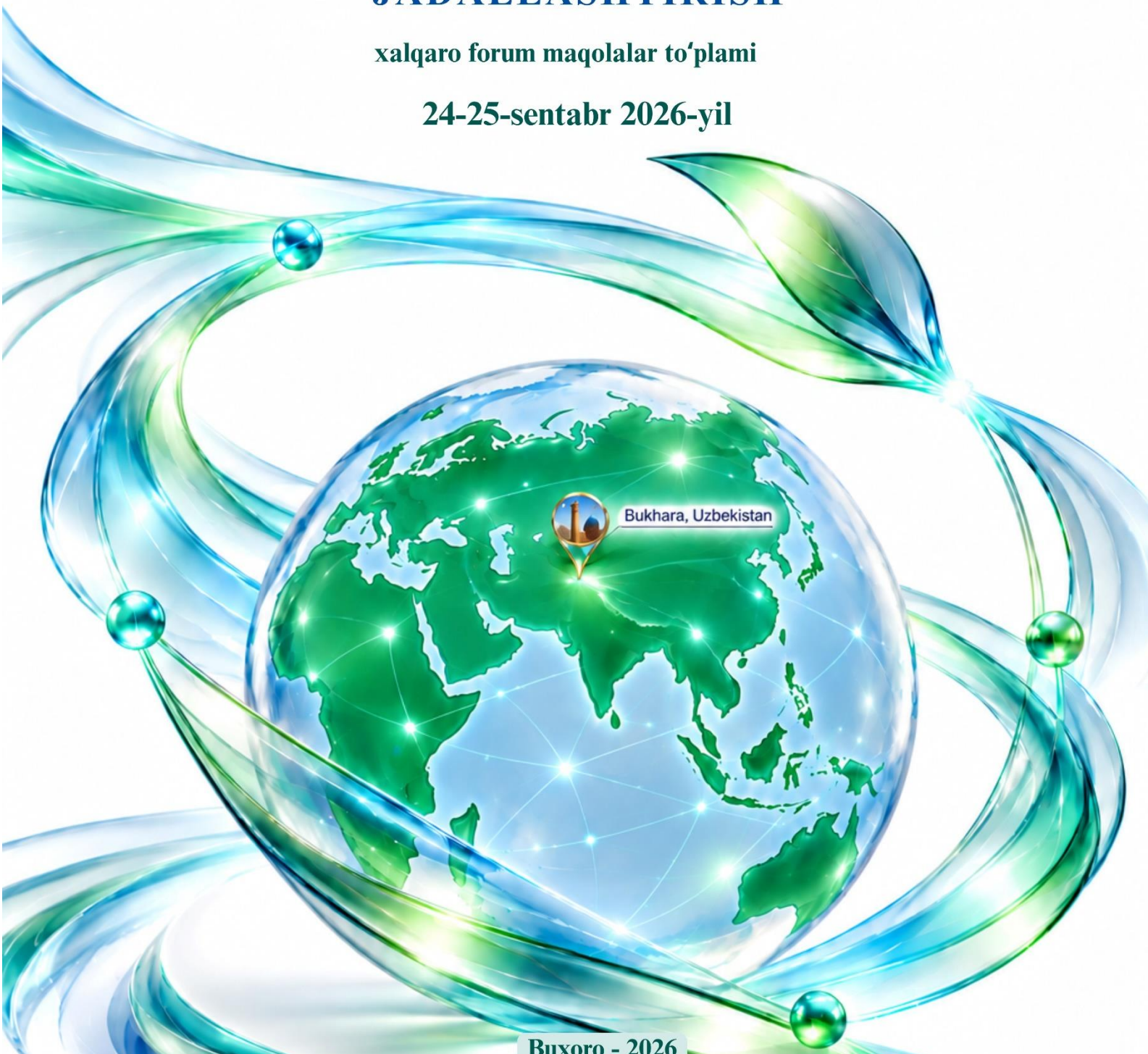
GLOBAL INTEGRATSIYALASHUV ORQALI SIRKULYAR BIOIQTISODIYOTNI SAMARADORLIGINI OSHIRISH VA BARQAROR RIVOJLANISHNI JADALLASHTIRISH

xalqaro forum maqolalar to'plami

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INDEKSATSIYA

HAMKORLAR

"Global integratsiyalashuv orqali sirkulyar bioiqtisodiyotni samaradorligini oshirish va barqaror rivojlanishni jadallashtirish" mavzusidagi
III Bioiqtisodiyot xalqaro forumi maqolalar to'plami.
BuxDU Buxoro 2026-yil.

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Mazkur to'plam ilmiy tadqiqotchilar, doktorantlar, magistrlar, talabalar, soha mutaxassislari, davlat va nodavlat tashkilotlari hamda tadbirkorlik subyektlari vakillari uchun mo'ljallangan.

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I-SEKSIYA-GLOBAL VA MINTAQAVIY BARQAROR RIVOJLANISHNING SIYOSATI, TAJRIBA VA STRATEGIYALARINI MUHOKAMA QILISH



BUXORO DAVLAT UNIVERSITETINING YASHIL IQTISODIYOTNI RIVOJLANTIRISHDAGI O‘RNI

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Annotatsiya

Maqolada Buxoro davlat universitetining yashil iqtisodiyotni rivojlantirishdagi o‘rni ta’lim, kampus amaliyoti va bilim transferi orqali o‘rganildi. Keys-tadqiqot doirasida xalqaro reytinglar hamda universitet ma’lumotlari qiyosiy va miqdoriy tahlil qilindi. Reytingdagi nisbiy pozitsiya, yo‘nalishlar bo‘yicha erishilgan natijalar va rivojlanish imkoniyatlari baholandi. Quyosh fotoelektr stansiyasining iqtisodiy ko‘rsatkichlari elektr energiyasining keltirilgan tannarxi va investitsiyaning qoplanish muddati asosida ko‘rib chiqildi. Tahlilda universitetning nisbiy reyting pozitsiyasi yaxshilangani qayd etildi, chiqindilarni boshqarish, toza transport va yashil startaplarni rivojlantirish ustuvorliklari belgilandi. Ta’lim, tadqiqot, kampus infratuzilmasi va hududiy hamkorlikni qayta aloqa orqali birlashtirgan bilimga asoslangan yashil model ishlab chiqildi. Model universitetning barqaror rivojlanish faoliyatini muvofiqlashtirish va hududiy iqtisodiyot bilan aloqalarini kengaytirish uchun taklif etildi.

Kalit so‘zlar: yashil iqtisodiyot, barqaror universitet, xalqaro reytinglar, quyosh energetikasi, bilim transferi, yashil kampus, aylanma iqtisodiyot, hududiy hamkorlik.

Аннотация

В статье была исследована роль Бухарского государственного университета в развитии зелёной экономики через образование, практику кампуса и трансфер знаний. В рамках исследования университета были применены сравнительный и количественный анализ международных рейтингов и университетских данных. Были оценены относительная рейтинговая позиция, результаты отдельных направлений и возможности дальнейшего развития. Экономические показатели солнечной электростанции были рассмотрены через приведённую стоимость электроэнергии и срок окупаемости инвестиций. Анализ выявил улучшение относительной рейтинговой позиции и обозначил приоритеты управления отходами, чистого транспорта и зелёных стартапов. Была разработана основанная на знаниях зелёная модель, связавшая образование, исследования, инфраструктуру кампуса и региональное сотрудничество через обратную связь. Модель была предложена для координации университетской деятельности в интересах устойчивого развития.

Ключевые слова: зелёная экономика, устойчивый университет, международные рейтинги, солнечная энергетика, трансфер знаний, зелёный кампус, циркулярная экономика, региональное сотрудничество.

Abstract

The article examined Bukhara State University’s contribution to the green economy through education, campus practices and knowledge transfer. The case study

applied comparative and quantitative analysis to international rankings and university data. Relative ranking positions, performance across categories and development opportunities were assessed. Solar power economics were examined through the levelised cost of electricity and investment payback period. The analysis identified an improved relative ranking position and priorities for waste management, clean transport and green startups. A knowledge-based green model connected education, research, campus infrastructure and regional cooperation through feedback. The model was proposed to coordinate university activities for sustainable development.

Keywords: green economy, sustainable university, international rankings, solar energy, knowledge transfer, green campus, circular economy, regional cooperation.

KIRISH

Yashil iqtisodiyot nazariyasi XXI asr boshida iqtisodiy o‘sish va tabiiy muhit sifati o‘rtasidagi munosabatni qayta talqin qilish ehtiyojidan kelib chiqqan. BMTning Atrof-muhit dasturi yashil iqtisodiyotni ekologik xavflar va resurslar tanqisligini sezilarli darajada kamaytirgan holda inson farovonligi hamda ijtimoiy tenglikni oshiradigan iqtisodiyot sifatida ta’riflab, uning asosiy manbalari tabiiy kapitalga, energiya va resurs samaradorligiga yo‘naltirilgan investitsiyalar ekanini ko‘rsatgan [23]. Iqtisodiy hamkorlik va taraqqiyot tashkiloti ushbu g‘oyani yashil o‘sish konsepsiyasi ko‘rinishida rivojlantirib, iqtisodiy o‘sish tabiiy aktivlarning farovonlik uchun zarur resurs va ekologik xizmatlarni taqdim etish qobiliyatini saqlagan holda ta’minlanishi lozimligini asoslagan hamda innovatsiyani bunday o‘sishning markaziy mexanizmi deb hisoblagan [13]. Ikki yondashuvni birlashtiruvchi umumiy g‘oya iqtisodiy natija va ekologik bosim o‘rtasidagi bog‘liqlikni zaiflashtirishdir, uning amalga oshishi esa texnologiya, bilim va malakali kadrlar bilan belgilanadi.

E. Barbier Rio+20 konferensiyasidan keyingi davr tahlilida yashil iqtisodiyotga o‘tish tabiiy kapitalni to‘g‘ri baholash, ekologik zararli subsidiyalardan voz kechish va toza texnologiyalarga investitsiyalarni rag‘batlantirishni talab etishini qayd etgan [2]. A. Luazo va hammualliflari yashil iqtisodiyotni aylanma iqtisodiyot, bioiqtisodiyot, sanoat ekologiyasi va ekologik innovatsiyalar kabi tushunchalarni o‘z ichiga oluvchi umumlashtiruvchi konsepsiya sifatida tizimlashtirgan [11]. J. Kirxxerr, D. Rayke va M. Xekkert aylanma iqtisodiyotning 114 ta ta’rifini qiyosiy o‘rganib, uni mikro, mezo va makro darajalarda kamaytirish, qayta foydalanish va qayta ishlash tamoyillariga asoslangan iqtisodiy tizim deb ta’riflagan [8]. M. Bugge, T. Xansen va A. Klitku bioiqtisodiyot bo‘yicha adabiyotlarni umumlashtirib, uning biotexnologik, bioresurs va bioekologik talqinlarini ajratgan hamda har uchalasida ilmiy bilim hal qiluvchi omil ekanini ko‘rsatgan [4]. Mazkur konsepsiyalarning barchasi uchun umumiy xususiyat bilim ishlab chiqaruvchi institutlarning yetakchi rolidir.

Bilim ishlab chiqaruvchi institutlarning iqtisodiy tizimdagi o‘rnini tushuntiruvchi nazariy asoslardan biri G. Itskovits va L. Leydesdorfning uch spiral modelidir. Ushbu modelga ko‘ra, innovatsion taraqqiyot universitet, sanoat va davlat o‘rtasidagi o‘zaro ta’sirlar natijasida vujudga keladi, universitet esa bilim yaratishdan tashqari uni tijoratlashtirishda ham faol ishtirok etadi [6]. G. Trencher va hammualliflari bu

yondashuvni barqarorlik kontekstida kengaytirib, universitetlarning an'anaviy uchinchi missiyadan keyingi yangi funksiyasi sifatida hududiy hamjamiyat, biznes va davlat organlari bilan birgalikda barqarorlik yechimlarini yaratishni asoslagan [19]. Universitet yashil iqtisodiyotda uch kanal orqali ishtirok etadi: yashil ko'nikmalarga ega inson kapitalini shakllantiradi, ekologik texnologiyalarni o'z kampusida sinovdan o'tkazadi va ilmiy natijalarni hududiy iqtisodiyotga uzatadi.

Inson kapitali nazariyasiga ko'ra, yashil iqtisodiyotga o'tish mehnat bozoriga yangi talablar qo'yadi. Qayta tiklanuvchi energetika, resurslarni tejovchi ishlab chiqarish, chiqindilarni qayta ishlash va ekologik muhandislik sohalari tizimli fikrlash, texnologik savodxonlik va fanlararo bilimga ega mutaxassislarni talab etadi. Bunday kompetensiyalar qisqa muddatli kurslar orqali emas, balki o'quv dasturlari, ilmiy tadqiqotlar va amaliy loyihalarni uyg'unlashtirgan uzoq muddatli ta'lim jarayonida shakllanadi. Universitet bu jarayonda nafaqat kadrlar tayyorlovchi, balki ekologik me'yor va qadriyatlarni jamiyatga yetkazuvchi institut sifatida ham namoyon bo'ladi. Qurg'oqchil iqlim sharoitida joylashgan, suv va energiya resurslaridan oqilona foydalanish hayotiy ahamiyatga ega bo'lgan hududlarda universitetning ushbu vazifasi yanada kengayadi, chunki ilmiy bilim hududiy iqtisodiyotning iqlim o'zgarishiga moslashuv salohiyatini bevosita belgilaydi. Universitetning yashil iqtisodiyotdagi o'rnini baholash inson kapitali, ilmiy-texnologik salohiyat va institutsional ta'sirni yaxlit tahlil qilishni taqozo etadi.

O'zbekistonda bu jarayon uchun mustahkam institutsional asos yaratilgan. 2019-2030-yillarda yashil iqtisodiyotga o'tish strategiyasi energiya samaradorligini oshirish, qayta tiklanuvchi manbalarni kengaytirish va ekologik barqaror infratuzilmani shakllantirishni davlat siyosatining ustuvor yo'nalishi sifatida belgilagan [29]. "Mamlakat taraqqiyotining 2030-yilgacha mo'ljallangan ustuvor yo'nalishlari doirasida islohotlarni izchil davom ettirish va yangi bosqichga olib chiqishning qo'shimcha chora-tadbirlari to'g'risida" Farmoni iqtisodiy o'sishni ekologik barqarorlik va inson kapitalini rivojlantirish bilan uyg'unlashtirishni ko'zda tutadi [28], oliy ta'lim tizimini 2030-yilgacha rivojlantirish konsepsiyasi esa universitetlarning ilmiy-innovatsion salohiyatini oshirish va xalqaro reytinglardagi o'rnini mustahkamlashni vazifa qilib qo'ygan [27]. Maqolaning maqsadi Buxoro davlat universiteti misolida oliy ta'lim muassasasining yashil iqtisodiyotni rivojlantirishdagi o'rnini nazariy jihatdan asoslash va xalqaro baholash natijalari asosida tavsiflashdan iborat. Maqsadga erishish uchun barqaror universitet nazariyasini umumlashtirish, reyting natijalarini nisbiy ko'rsatkichlar bilan baholash, kampus energetik loyihasining samaradorligini tahlil qilish va bilimga asoslangan yashil modelni ishlab chiqish vazifalari qo'yildi.

ADABIYOTLAR SHARHI

Barqaror universitet tushunchasi ilmiy adabiyotda universitetning ekologik, iqtisodiy va ijtimoiy ta'sirini yaxlit tizim sifatida boshqarish zarurati bilan bog'liq holda shakllangan. L. Velaskes va hammualliflari barqaror universitetni o'z faoliyati orqali jamiyatning barqaror turmush tarziga o'tishiga ko'maklashuvchi va ta'lim, tadqiqot, hamjamiyat bilan hamkorlik hamda kampus operatsiyalarida salbiy ta'sirni

kamaytiruvchi muassasa sifatida ta'riflagan, uni rivojlantirishni esa missiya, strategiya va monitoringdan iborat bosqichma-bosqich jarayon deb talqin qilgan [25]. X. Alshuvayxat va I. Abubakar kampus barqarorligiga integratsiyalashgan yondashuvni taklif etib, uni universitet ekologik menejment tizimi, jamoatchilik ishtiroki va ijtimoiy mas'uliyat hamda barqarorlik bo'yicha o'qitish va tadqiqotlardan iborat uch tarkibiy qism orqali tavsiflagan [1]. Ikki tadqiqotning umumiy xulosasi kampus operatsiyalari va akademik faoliyatni bir-biridan ajratib bo'lmasligidadir.

R. Lozano va hammualliflari oliy ta'limdagi barqarorlik deklaratsiyalarini tahlil qilib, universitet tizimining ta'lim, tadqiqot, kampus operatsiyalari, hamjamiyat bilan aloqa va baholash hamda hisobot berishdan iborat barcha bo'g'inlarini qamrab olgan yondashuvgina kutilgan natijani berishini asoslagan [12]. V. Leal Filyu va hammualliflari Barqaror rivojlanish maqsadlarining o'quv jarayoniga integratsiyasini xalqaro so'rov asosida o'rganib, bu jarayonda institutsional qo'llab-quvvatlash va o'qituvchilarning kasbiy tayyorgarligi hal qiluvchi ahamiyatga ega ekanini aniqlagan [10]. YUNESKO barqaror rivojlanish uchun ta'lim bo'yicha 2030-yilgacha yo'l xaritasida muassasaning butun faoliyatini qamrab oluvchi yondashuvni ustuvor yo'nalish sifatida belgilab, ta'lim muassasalari o'quvchilarga o'rgatayotgan barqarorlik qadriyatlarini o'z faoliyatida namoyon etishi lozimligini ta'kidlagan [24].

Kampusni tadqiqot va ta'lim maqsadlarida foydalaniladigan real sinov maydoni sifatida talqin qilish "tirik laboratoriya" konsepsiyasida o'z ifodasini topgan. J. Evans va hammualliflari universitet kampuslarini barqarorlik fanini ishlab chiqish platformasi sifatida ko'rib chiqib, tirik laboratoriyalar ilmiy bilimni amaliy muammolarni hal qilish bilan bog'lashini, texnologik yechimlarni haqiqiy foydalanish sharoitida sinashga va hamkorlar bilan birgalikda bilim yaratishga imkon berishini ko'rsatgan [7]. Ushbu yondashuv kampusdagi energetik, suv va chiqindi infratuzilmasini xarajat obyekti sifatida emas, balki ta'lim va innovatsiya resursi sifatida baholash uchun nazariy asos beradi. Mazkur talqin G. Trencher va hammualliflari [19] asoslagan birgalikda yaratish funksiyasini kampus darajasida aniqlashtiradi, chunki sinovdan o'tgan yechimlar hududiy hamkorlarga namunaviy loyiha sifatida uzatilishi mumkin.

Universitetlar barqarorligini o'lchash masalasi bo'yicha ham salmoqli tadqiqotlar mavjud. N. Suvarta va R. Sari UI GreenMetric reytingining birinchi yillaridagi natijalarini baholab, uning universitetlar o'rtasida ekologik tashabbuslarni rag'batlantirish va tajriba almashish vositasi sifatidagi samarasini ko'rsatgan [15]. A. Lauder va hammualliflari esa ushbu reyting metodologiyasini tanqidiy tahlil qilib, uning ko'rsatkichlarini takomillashtirish va turli iqlim hamda iqtisodiy sharoitlardagi universitetlarni solishtirish imkoniyatini kengaytirish yo'nalishlarini taklif etgan [9]. Times Higher Education tashkilotining barqarorlik ta'siri reytingi universitetlarni Barqaror rivojlanish maqsadlari bo'yicha alohida baholab, ularning jamiyatga ko'rsatayotgan ta'sirini xalqaro miqyosda qiyoslash imkonini beradi [18]. Adabiyotlar sharhi xalqaro baholash natijalari, kampus amaliyoti va hududiy yashil iqtisodiyot o'rtasidagi bog'liqlikni Markaziy Osiyo universiteti misolida yaxlit o'rganish zarurligini ko'rsatadi.

Ko‘rib chiqilgan tadqiqotlarni umumlashtirish universitetning yashil iqtisodiyotdagi o‘rnini tavsiflovchi uch nazariy yo‘nalishni ajratish imkonini beradi. Birinchi yo‘nalish barqaror universitetni boshqaruv obyekti sifatida o‘rganib, kampus operatsiyalari va akademik faoliyatning integratsiyasiga e’tibor qaratadi. Ikkinchi yo‘nalish universitetni innovatsion tizimning ishtirokchisi sifatida ko‘rib, bilim transferi va hamkorlikda yaratish mexanizmlarini tahlil qiladi. Uchinchi yo‘nalish xalqaro reytinglar va indikatorlar yordamida universitetlar barqarorligini o‘lchash masalalariga bag‘ishlangan. Mazkur yo‘nalishlar ko‘pincha alohida rivojlanib kelgan, holbuki universitetning yashil iqtisodiyotga real hissasini aniqlash uchun ularni yagona tahliliy doirada birlashtirish talab etiladi. Ushbu maqolada aynan shunday sintez amalga oshirilib, reyting indikatorlari universitet faoliyatining alohida kanallarini o‘lchash vositasi sifatida qo‘llanildi.

METODOLOGIYA

Tadqiqot sifat va miqdoriy usullarni uyg‘unlashtirgan holda keys-tadqiqot shaklida olib borildi. Axborot bazasini UI GreenMetric 2025 reytingida Buxoro davlat universitetining natijalari va reyting tarixi [20], reytingning 2025-yilgi metodik qo‘llanmasi [22], ishtirokchilar soni to‘g‘risidagi rasmiy ma’lumotlar [21], THE Impact Ratings 2026 natijalari [16] hamda universitetning energetika, ta’lim va kampus faoliyatiga oid ma’lumotlari tashkil etdi. Tahlil uch darajada amalga oshirildi: birinchi darajada universitetning xalqaro baholashdagi nisbiy o‘rni, ikkinchi darajada kampusdagi yashil infratuzilma loyihalarining iqtisodiy samaradorligi, uchinchi darajada bilim transferi kanallari o‘rganildi. Reytinglarda ishtirokchilar soni har yili o‘zgarib borishi sababli mutlaq o‘rin ko‘rsatkichi yillararo taqqoslash uchun yetarli emas, shuning uchun nisbiy pozitsiya ko‘rsatkichidan foydalanildi:

$$P_t = \frac{r_t}{N_t} \cdot 100 \quad (1)$$

bu yerda P_t - universitetning t yildagi nisbiy pozitsiyasi, foizda; r_t - universitetning t yildagi umumiy reytingdagi o‘rni; N_t - shu yili reytingda ishtirok etgan universitetlar soni. Ko‘rsatkich qiymati universitet reytingning yuqori necha foizida joylashganini bildiradi, $100 - P_t$ ifodasi esa universitet ortda qoldirgan muassasalar ulushini tavsiflaydi. Ko‘rsatkich qancha kichik bo‘lsa, universitetning xalqaro miqyosdagi o‘rni shuncha mustahkam hisoblanadi. Yo‘nalishlar bo‘yicha natijalar $S_k = b_k/B_k$ nisbati orqali baholandi, bu yerda b_k - k yo‘nalish bo‘yicha to‘plangan ball, B_k - metodik qo‘llanmada belgilangan maksimal ball [22]. Maksimal ball va erishilgan ball o‘rtasidagi farq har bir yo‘nalishning o‘sish zaxirasi sifatida talqin qilindi. THE Impact Ratings natijalari guruh chegaralari bo‘yicha (1) formulaga ko‘ra oraliq ko‘rinishida hisoblandi.

Kampus quyosh fotoelektr stansiyasining iqtisodiy samaradorligi elektr energiyasining keltirilgan tannarxi ko‘rsatkichi asosida baholandi. K. Branker, M. Patak va J. Pirs ushbu ko‘rsatkichni fotoelektr loyihalarini an’anaviy manbalar bilan taqqoslashning asosiy mezoni sifatida asoslagan [3]:

$$\text{LCOE} = \frac{\sum_{t=0}^{n} \frac{I_t + M_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+i)^t}} \quad (2)$$

bu yerda LCOE - elektr energiyasining keltirilgan tannarxi, AQSh dollari/kVt·soat; I_t - t yildagi investitsiya xarajatlari; M_t - t yildagi ekspluatatsiya va texnik xizmat xarajatlari; E_t - t yilda ishlab chiqarilgan elektr energiyasi; i - diskont stavkasi; n - stansiyaning xizmat muddati. Formula stansiyaning butun hayotiy sikli davomidagi diskontlangan xarajatlarini diskontlangan ishlab chiqarish hajmiga taqsimlab, bir birlik energiyaning to‘liq qiymatini aniqlaydi. Ko‘rsatkichning elektr energiyasi tarifidan past bo‘lishi loyihaning iqtisodiy jihatdan o‘zini oqlashini bildiradi. Qo‘shimcha ravishda investitsiyaning oddiy qoplanish muddati $T = I_0/A$ nisbati orqali tavsiflandi, bu yerda I_0 - boshlang‘ich investitsiya, A - yillik tejalgan xarajatlar. Hisob-kitoblar universitetning loyiha ma’lumotlariga asoslandi.

Tanlangan metodik yondashuvning afzalligi uning xalqaro miqyosda qabul qilingan, ochiq e’lon qilinadigan va har yili yangilanadigan indikatorlarga tayanishidadir. Bu universitet natijalarini boshqa muassasalar bilan taqqoslash, vaqt bo‘yicha dinamikasini kuzatish va boshqaruv qarorlarining samarasini baholash imkonini beradi. Reyting ko‘rsatkichlari universitetlar taqdim etgan ma’lumotlar va ularni tasdiqlovchi hujjatlar asosida shakllantirilishi hisobga olinib, tahlilda UI GreenMetric va THE Impact Ratings kabi metodologiyasi turlicha bo‘lgan ikki mustaqil tizim natijalari o‘zaro qiyoslandi. Ikki tizim natijalarining bir yo‘nalishda mos kelishi xulosalarning ishonchliligini oshiradi. Nisbiy pozitsiya, yo‘nalishlar bo‘yicha ulush va o‘sish zaxirasi ko‘rsatkichlarining birgalikda qo‘llanilishi esa universitetning erishilgan natijalarini ham, keyingi rivojlanish yo‘nalishlarini ham bir vaqtda aniqlashga xizmat qiladi.

TAHLIL VA NATIJALAR

Universitetning yashil iqtisodiyotdagi o‘rnini baholash xalqaro e’tirof dinamikasidan boshlandi. UI GreenMetric reytingi 2025-yilda 105 ta davlatdan 1 745 ta universitetni qamrab olgan bo‘lib, bu ko‘rsatkich oldingi yildagi 95 ta davlatdan 1 477 ta universitetga nisbatan sezilarli o‘sishni aks ettiradi [21]. Raqobat muhiti kengayib borayotgan sharoitda universitetning nisbiy pozitsiyasi (1) formula asosida hisoblandi (1-jadval).

1-jadval

Buxoro davlat universitetining UI GreenMetric reytingidagi o‘rni dinamikasi[1]

Yil	Jahon reytingidagi o‘rin	Ishtirokchi universitetlar soni	Nisbiy pozitsiya (P), foizda	Ortda qoldirilgan ulush, foizda
2022	553	1 050	52,7	47,3
2023	616	1 183	52,1	47,9
2024	447	1 477	30,3	69,7
2025	401	1 745	23,0	77,0

[1] Manba: UI GreenMetric reytingi tarixi va universitet ma’lumotlari [20]; 2024-2025-yillar ishtirokchilari soni UI GreenMetric rasmiy xabari bo‘yicha; nisbiy pozitsiya (1) formula asosida muallif tomonidan hisoblangan.

1-jadval ma'lumotlari universitetning reytingdagi o'rni izchil yaxshilanib borganini ko'rsatadi. To'rt yil davomida ishtirokchilar soni 1,66 barobar ko'paygan bo'lsa-da, universitet jahon reytingida 152 pog'ona yuqoriga ko'tarilgan, nisbiy pozitsiya esa 52,7 foizdan 23,0 foizga yaxshilangan. Nisbiy ko'rsatkichning afzalligi 2023-yil natijasida yaqqol ko'rinadi: mutlaq o'rin 553 dan 616 ga o'zgargan bo'lsa-da, ishtirokchilar sonining o'sishi hisobga olinganda nisbiy pozitsiya 52,7 foizdan 52,1 foizga yaxshilangan. Eng katta sifat o'zgarishi 2024-yilda qayd etilgan, bu davrda nisbiy pozitsiya 21,8 foiz punktga yaxshilanib, universitet reytingning yuqori uchdan bir qismiga kirgan. 2025-yilda universitet ishtirokchilarning 77 foizini ortda qoldirib, O'zbekiston universitetlari orasida 6-o'rinni egallagan. Ushbu natijalar kampusdagi ekologik tashabbuslarning tizimli va barqaror xususiyatga ega ekanini tasdiqlaydi. Natijaning mazmunini chuqurroq ochish uchun olti yo'nalish bo'yicha ko'rsatkichlar tahlil qilindi (2-jadval).

2-jadval

UI GreenMetric 2025 yo'nalishlari bo'yicha Buxoro davlat universiteti natijalari[1]

Yo'nalish	Vazn, foizda	Maksimal ball	To'plangan ball	Maksimal ballga nisbatan, foizda	O'zbekistondagi o'rin
Ta'lim va tadqiqot	18	1 800	1 412,5	78,5	12
Energiya va iqlim o'zgarishi	21	2 100	1 625,0	77,4	7
Joylashuv va infratuzilma	15	1 500	1 150,0	76,7	2
Transport	18	1 800	1 350,0	75,0	16
Suv resurslari	10	1 000	700,0	70,0	14
Chiqindilar	18	1 800	1 000,0	55,6	9
Jami	100	10 000	7 237,5	72,4	6

2-jadval universitet umumiy maksimal ballning 72,4 foizini to'plaganini va natijalar yo'nalishlar kesimida ancha muvozanatli ekanini ko'rsatadi. Eng yuqori ko'rsatkich ta'lim va tadqiqot yo'nalishida qayd etilgan, bu universitetning yashil iqtisodiyotga qo'shayotgan asosiy hissasi inson kapitali va ilmiy bilim ekanini tasdiqlaydi. Energiya va iqlim o'zgarishi yo'nalishi eng katta vaznga ega bo'lib, u umumiy ballning 22,5 foizini ta'minlagan. Joylashuv va infratuzilma bo'yicha universitet respublikada 2-o'rinni egallagan. O'sish zaxirasi tahlili muhim strategik xulosa beradi: maksimal ballgacha bo'lgan 2 762,5 ballik umumiy farqning 29,0 foizi chiqindilar yo'nalishiga to'g'ri keladi, energiya va iqlim o'zgarishi yo'nalishining ulushi 17,2 foizni, transport yo'nalishiniki 16,3 foizni tashkil etadi. Chiqindilarni boshqarish tizimini takomillashtirish universitetning reytingdagi o'rnini keyingi

[1] Manba: UI GreenMetric 2025 natijalari va universitet ma'lumotlari [20]; vazn va maksimal ballar metodik qo'llanma [22] bo'yicha; yo'nalishlar ballari ulush va maksimal ball asosida muallif tomonidan hisoblangan.

bosqichda yaxshilashning eng samarali yo‘nalishi hisoblanadi. Olingan natijalar THE Impact Ratings 2026 baholashi bilan qiyoslandi (3-jadval).

3-jadval

Buxoro davlat universitetining THE Impact Ratings 2026 natijalari[1]

Baholash yo‘nalishi	Universitet o‘rni	Ishtirokchilar soni	Nisbiy pozitsiya (P), foizda
Umumiy reyting	301-400	1 603	18,8-25,0
BRM 7. Arzon va toza energiya	24	892	2,7
BRM 2. Ochlikka barham berish	101-200	731	13,8-27,4
BRM 6. Toza suv va sanitariya	101-200	797	12,7-25,1
BRM 17. Maqsadlar yo‘lida hamkorlik	401-600	1 610	24,9-37,3

3-jadvaldan ko‘rinadiki, universitet THE Impact Ratings 2026 umumiy reytingida 1 603 ta muassasaning yuqori chorak qismiga kirgan. Eng yuqori natija Barqaror rivojlanishning 7-maqsadi bo‘yicha qayd etilgan: 892 ta universitet orasida [17] jahonda 24-o‘rin universitetni ushbu yo‘nalishda dunyodagi yetakchi 2,7 foiz muassasa qatoriga kiritadi. Ikki mustaqil reyting natijalarining o‘zaro mos kelishi e’tiborga molik, chunki UI GreenMetric reytingida ham energiya va iqlim o‘zgarishi yo‘nalishi yuqori ko‘rsatkichlardan biri bo‘lgan. Ochlikka barham berish va toza suv yo‘nalishlaridagi natijalar universitetning agrar-biologik tadqiqotlari va suv resurslarini tejash tajribasi xalqaro miqyosda e’tirof etilganini ko‘rsatadi. Hamkorlik yo‘nalishidagi natija esa xalqaro va hududiy sheriklik tarmog‘ini kengaytirish uchun qo‘shimcha imkoniyat mavjudligini bildiradi.

Ikki reyting natijalarini qiyoslash universitetning raqobat ustunliklari tarkibini aniqlashtirish imkonini beradi. UI GreenMetric asosan kampus infratuzilmasi va resurslarni boshqarish amaliyotini baholasa, THE Impact Ratings universitetning ta’lim, tadqiqot va jamiyat bilan hamkorlik orqali Barqaror rivojlanish maqsadlariga qo‘shayotgan hissasini o‘lchaydi. Har ikki tizimda energetika yo‘nalishining yetakchi bo‘lishi universitetning quyosh energetikasi sohasidagi faoliyati infratuzilmaviy loyiha doirasidan chiqib, ilmiy-ta’limiy va ijtimoiy ta’sirga ega yaxlit yo‘nalishga aylanganini ko‘rsatadi. Energetika yo‘nalishidagi ustunlikni mustahkamlash va uni boshqa yo‘nalishlarga kengaytirish universitet strategik rejalashtirishining asosiy vazifasi sifatida qaraladi. Mazkur ustunlikning amaliy asoslari kampus energetikasi misolida quyida batafsil ko‘rib chiqiladi.

Energetika yo‘nalishidagi yuqori baholashning asosiy amaliy asosi kampusdagi quyosh fotoelektr stansiyasidir. Universitetning o‘quv binolari va talabalar turar joylari tomlarida umumiy quvvati 1 210 kilovatt-pik bo‘lgan stansiya faoliyat ko‘rsatmoqda [5]. Universitet ma’lumotlariga ko‘ra, stansiya har biri 550 vatt quvvatga ega 2 201 ta monokristall panel va 21 ta invertordan tashkil topgan hamda umumiy elektr tarmog‘iga ulangan. Panellar soni va quvvati ko‘paytmasi 1 210,6 kilovattni tashkil etib, e’lon qilingan o‘rnatilgan quvvat bilan to‘liq mos keladi. Loyihaning

[1] Manba: universitet natijalari THE profili [16]; ishtirokchilar soni THE Impact Ratings 2026 jadvallari [17] bo‘yicha; nisbiy pozitsiya (1) formula asosida muallif tomonidan hisoblangan.

huquqiy asosi qayta tiklanuvchi energiya manbalaridan foydalanish to‘g‘risidagi qonun bilan ta’minlangan bo‘lib, u iste’molchilarga o‘z ehtiyojlari uchun qayta tiklanuvchi manbalardan elektr energiyasi ishlab chiqarish imkonini beradi [26]. Universitet hisob-kitoblariga ko‘ra, (2) formula bo‘yicha aniqlangan keltirilgan tannarx 0,048 AQSh dollari/kVt·soatni, investitsiyaning oddiy qoplanish muddati 9,92 yilni tashkil etadi. Qoplanish muddatining panellar xizmat muddatidan sezilarli darajada qisqa ekani yashil investitsiya ekologik samara bilan bir qatorda moliyaviy daromad ham keltirishini ko‘rsatadi. Stansiya Barqaror rivojlanishning 7- va 13-maqsadlariga bevosita xizmat qiladi.

Kampus energetikasining milliy iqlim siyosati bilan uzviy bog‘liqligi alohida ahamiyatga ega. O‘zbekiston yangilangan milliy belgilangan hissasida 2030-yilgacha yalpi ichki mahsulot birligiga to‘g‘ri keladigan issiqxona gazlari solishtirma chiqindilarini 2010-yil darajasiga nisbatan 35 foizga qisqartirish majburiyatini olgan [14]. Yashil iqtisodiyotga o‘tish islohotlari samaradorligini oshirish dasturi ushbu maqsad bilan bir qatorda 2030-yilgacha qayta tiklanuvchi energiya quvvatlarini 15 gigavattga yetkazish va ularning elektr energiyasi ishlab chiqarishdagi ulushini 30 foizdan oshirishni belgilagan [30]. Universitet stansiyasi milliy miqyosdagi yirik loyihalar bilan taqqoslaganda kichik bo‘lsa-da, uning ahamiyati namoyish effektida namoyon bo‘ladi: talabalar va hududiy tadbirkorlar taqsimlangan quyosh generatsiyasining texnik va iqtisodiy parametrlarini real ekspluatatsiya sharoitida o‘rganish imkoniga ega bo‘ladi. Kampus energetikasi LED yoritish, energiya tejovchi kompyuter va konditsionerlar, harakat sensorli ko‘cha chiroqlari hamda aqlli hisoblagichlar bilan to‘ldirilgan.

Ta’lim va tadqiqot yo‘nalishidagi yuqori baho universitet faoliyatining miqdoriy ko‘rsatkichlari bilan asoslanadi. Universitetning UI GreenMetric 2025 uchun taqdim etgan ma’lumotlariga ko‘ra, barqaror rivojlanishga oid 1 577 ta o‘quv kursi o‘qitiladi, barqarorlik mavzusida 530 ta ilmiy nashr chop etilgan, barqarorlik tadqiqotlariga 155 275 AQSh dollari yo‘naltirilgan [20]. Bitiruvchilarning 28,4 foizi yashil ish o‘rinlarida faoliyat yuritmoqda, barqarorlik sohasida Eco-Liveta, CornBioPlast, Eco-Arch va DustClean kabi oltita talabalar startapi tashkil etilgan. Ushbu ko‘rsatkichlar universitetning yashil iqtisodiyotga birinchi va asosiy kanal, ya’ni inson kapitali orqali ta’sir ko‘rsatayotganini tasdiqlaydi. Startaplarning bioplastik, ekologik arxitektura va havoni tozalash kabi yo‘nalishlarda shakllangani ilmiy g‘oyalarning tijoratlashtirilishi boshlanganidan dalolat beradi.

Inson kapitali kanalining hududiy iqtisodiy ahamiyati yashil kompetensiyalarga ega bitiruvchilarning mehnat bozoridagi o‘rni bilan belgilanadi. Buxoro viloyatida qayta tiklanuvchi energetika, qishloq xo‘jaligi mahsulotlarini qayta ishlash, turizm va qurilish sohalari jadal rivojlanayotgan bir sharoitda energiya tejash, suvdan oqilona foydalanish va chiqindilarni qayta ishlash bo‘yicha bilimga ega mutaxassislarga talab barqaror oshib bormoqda. Universitet o‘quv dasturlariga barqarorlik mavzularining keng integratsiyalashgani bitiruvchilarning ushbu talabga mos kelishini ta’minlaydi, ilmiy nashrlar va tadqiqot loyihalari esa hududiy korxonalar uchun texnologik yechimlar manbai bo‘lib xizmat qiladi. Shunday qilib, ta’lim va tadqiqot yo‘nalishidagi

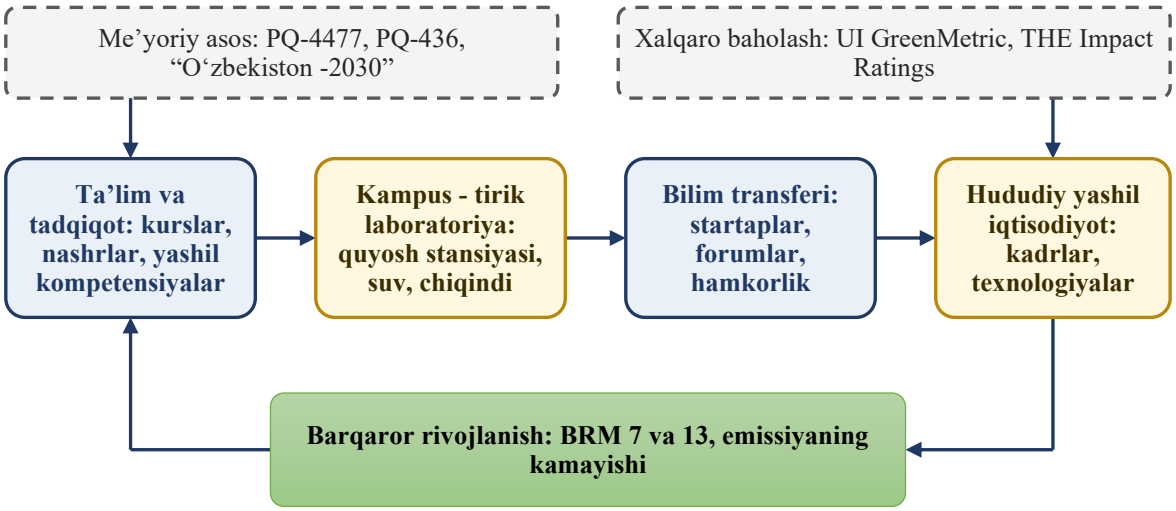
ko‘rsatkichlar universitet ichki faoliyatining natijasi bo‘lib qolmay, hududiy yashil iqtisodiyotning kadrlar va bilim bilan ta’minlanganlik darajasini ham aks ettiradi.

Kampus faoliyati aylanma iqtisodiyot tamoyillarining amaliy modeli sifatida tashkil etilgan. Universitet ma’lumotlariga ko‘ra, 8 tonna noorganik chiqindi qayta ishlangan, 8 tonna organik chiqindi kompostga aylantirilgan, kampus bo‘ylab chiqindilarni saralash tizimi joriy etilgan, kompostlash jarayonini fakultetlarning o‘zi boshqaradi. Talabalar orasida “Paperwise Warriors” va “5 oddiy qoida” tashabbuslari qog‘oz iste’molini kamaytirish va ekologik madaniyatni shakllantirishga xizmat qilmoqda. Qurg‘oqchil mintaqada joylashgan universitet uchun suv resurslarini boshqarish strategik ahamiyatga ega: IoT hisoblagichlar va SCADA monitoring tizimi o‘rnatilgan, kulrang suv qayta ishlanadi, yomg‘ir suvi yig‘iladi, jihozlarning 80 foizi suv tejovchi hisoblanadi. Ushbu amaliyot J. Evans va hammualliflari asoslagan tirik laboratoriya konsepsiyasiga to‘liq mos keladi [7].

Reyting ma’lumotlari keyingi rivojlanish bosqichining aniq yo‘nalishlarini ham belgilab beradi. Metodik qo‘llanmaga ko‘ra, kampusdagi qayta tiklanuvchi energiya manbalari soni va zaharli chiqindilarni qayta ishlash indikatorlarining har biri 300 ball, nol emissiyali transport ulushi 200 ball, barqarorlik startaplari soni 100 ball bilan baholanadi [22]. Universitet ushbu indikatorlar bo‘yicha mos ravishda 75, 75, 50 va 25 ball, ya’ni maksimal ballning chorak qismini to‘plagan, organik va noorganik chiqindilarni qayta ishlash indikatorlarida esa maksimal ballning yarmiga erishgan. Mazkur indikatorlar 2-jadvalda aniqlangan o‘sish zaxirasi bilan to‘liq mos keladi. Yangi kampus loyihasi ushbu yo‘nalishlarni kompleks rivojlantirish imkonini beradi: universitet ma’lumotlariga ko‘ra, 30 gektarlik hududning qariyb 47 foizi, ya’ni 140 ming kvadrat metri yashil maydonga ajratiladi, 52 500 kvadrat metr piyodalar yo‘laklari barpo etiladi, binolar tomlari esa quyosh stansiyasini kengaytirishga moslab loyihalangan.

Yangi kampusning yashil infratuzilmasi bir necha strategik samara beradi. Birinchi navbatda, keng yashil maydonlar issiq va qurg‘oqchil iqlim sharoitida mikroiqlimni yaxshilab, binolarni sovutish uchun energiya sarfini kamaytiradi va kampusning iqlim o‘zgarishiga moslashuv salohiyatini oshiradi. Keyingi samara piyodalar yo‘laklari tarmog‘i bilan bog‘liq bo‘lib, u avtotransportga bog‘liqlikni kamaytirib, transport yo‘nalishidagi ko‘rsatkichlarni yaxshilash uchun jismoniy asos yaratadi. Quyosh panellarini joylashtirishga moslangan tomlar esa qayta tiklanuvchi energiya ishlab chiqarishni kengaytirishni keyinchalik tom konstruksiyasini moslashtirish xarajatlarini kamaytirgan holda rejalashtirish imkonini beradi. Yangi kampus loyihasi reyting indikatorlari orqali aniqlangan o‘sish zaxiralarini loyihalash bosqichidayoq hisobga olgan kompleks yechim sifatida namoyon bo‘ladi va universitetning kelgusi yillardagi yashil rivojlanish trayektoriyasini belgilaydi.

Tahlil natijalari umumlashtirilib, universitetning bilimga asoslangan yashil modeli ishlab chiqildi (1-rasm).



1-rasm. Universitetning bilimga asoslangan yashil modeli[1]

Izoh: strelkalar ta'sir yo'nalishini, pastki qaytuvchi strelka hududiy natijalarning ta'lim va tadqiqot mazmuniga qayta ta'sirini bildiradi; BRM - Barqaror rivojlanish maqsadlari.

1-rasmda aks ettirilgan model universitetning yashil iqtisodiyotdagi o'rnini bir-birini to'ldiruvchi to'rt bo'g'inli zanjir sifatida tavsiflaydi. Birinchi bo'g'inda ta'lim va tadqiqot yashil kompetensiyalar va ilmiy g'oyalarni shakllantiradi. Ikkinchi bo'g'inda kampus tirik laboratoriya vazifasini bajaradi: quyosh stansiyasi, suv tejash va chiqindilarni saralash tizimlari ilmiy g'oyalarni real sharoitda sinovdan o'tkazadi. Uchinchi bo'g'in startaplar, forumlar va xalqaro hamkorlik orqali bilimni hududiy iqtisodiyotga uzatadi, to'rtinchi bo'g'inda esa yashil kadrlar va texnologiyalar hududiy iqtisodiyotning ekologik samaradorligini oshiradi. Modelning muhim xususiyati qayta aloqa mexanizmidir: hududiy amaliyotda yuzaga kelgan ehtiyojlar o'quv dasturlari va tadqiqot mavzularini yangilash uchun asos bo'ladi. Me'yoriy asos va xalqaro baholash tizimlari modelning tashqi muhitini tashkil etib, uning yo'nalishini belgilaydi va natijalarini o'lchash imkonini beradi.

XULOSA VA TAKLIFLAR

Tadqiqot natijasida oliy ta'lim muassasasining yashil iqtisodiyotni rivojlantirishdagi o'rni inson kapitalini shakllantirish, kampusni tirik laboratoriya sifatida tashkil etish va bilim transferi kanallari orqali amalga oshishi nazariy jihatdan asoslandi. Yashil iqtisodiyot, aylanma iqtisodiyot va bioiqtisodiyot konsepsiyalarining umumiy asosi bilim ekanligi universitetni yashil transformatsiyaning markaziy ishtirokchisiga aylantiradi. Buxoro davlat universitetining UI GreenMetric reytingidagi nisbiy pozitsiyasi 2022-2025-yillarda 52,7 foizdan 23,0 foizga yaxshilangani, THE Impact Ratings 2026 da arzon va toza energiya yo'nalishida jahonda 24-o'rinni egallagani universitet yashil faoliyatining tizimli va xalqaro miqyosda raqobatbardosh ekanini tasdiqladi. Kampus quyosh stansiyasi misolida yashil investitsiyalar iqtisodiy jihatdan o'zini oqlashi, 9,92 yillik qoplanish muddati

[1] Manba: G. Itskovits va L. Leydesdorf [6], J. Evans va hammualliflari [7] yondashuvlari hamda 1-3-jadvallar natijalari asosida muallif ishlanmasi.

esa bunday loyihalarni boshqa oliy ta'lim muassasalari va hududiy korxonalarda ham takrorlash mumkinligini ko‘rsatdi.

Yo‘nalishlar bo‘yicha o‘sish zaxirasi tahlili keyingi bosqichning strategik ustuvorliklarini aniqlash imkonini berdi. Chiqindilarni boshqarish, kampusdagi qayta tiklanuvchi manbalarni diversifikatsiyalash, nol emissiyali transport va barqarorlik startaplari universitetning xalqaro reytinglardagi o‘rnini yanada mustahkamlashning asosiy yo‘nalishlari hisoblanadi. Olingan natijalar asosida quyidagi takliflar ishlab chiqildi.

1. Kampusda chiqindilarni saralash va kompostlash tizimini zaharli chiqindilarni xavfsiz qayta ishlash bo‘yicha ixtisoslashgan hamkorlar bilan shartnomaviy mexanizm orqali to‘ldirish maqsadga muvofiq.

2. Yangi kampus tomlaridagi quyosh stansiyasini kengaytirish bilan bir qatorda biomassa va quyosh-issiqlik qurilmalarini joriy etib, kampusdagi qayta tiklanuvchi energiya manbalari turini ko‘paytirish lozim.

3. Universitet hududida elektr transport va velosiped infratuzilmasini rivojlantirish nol emissiyali harakatlanish ulushini oshiradi.

4. Universitet huzurida yashil startaplar akseleratori tashkil etilib, bioiqtisodiyot forumi natijalarini tijoratlashtirish uchun hududiy tadbirkorlar va investorlar bilan muntazam hamkorlik yo‘lga qo‘yilishi zarur.

5. Kampus quyosh stansiyasi, suv va chiqindi tizimlari ma'lumotlarini ochiq monitoring platformasi orqali e'lon qilish hamda ularni o‘quv jarayonida amaliy mashg‘ulotlar uchun foydalanish tirik laboratoriya salohiyatini to‘liq ishga soladi.

Ushbu takliflarning amalga oshirilishi universitetning xalqaro reytinglardagi o‘rnini mustahkamlash bilan birga Buxoro viloyatining yashil iqtisodiyotga o‘tish jarayoniga ilmiy-amaliy hissasini yanada kengaytiradi.

Taklif etilgan bilimga asoslangan yashil model O‘zbekistonning yashil iqtisodiyotga o‘tish strategiyasi va “Mamlakat taraqqiyotining 2030-yilgacha mo‘ljallangan ustuvor yo‘nalishlari doirasida islohotlarni izchil davom ettirish va yangi bosqichga olib chiqishning qo‘shimcha chora-tadbirlari to‘g‘risida” Farmonida [28] belgilangan maqsadlarga erishishda oliy ta'lim tizimining imkoniyatlarini to‘liqroq ishga solish uchun metodik asos bo‘lib xizmat qiladi. Model boshqa hududiy universitetlar tomonidan ham qo‘llanilishi mumkin, chunki uning tarkibiy qismlari xalqaro baholash tizimlarining ochiq indikatorlari bilan o‘lchanadi. Buxoro davlat universiteti tajribasi xalqaro reyting natijalarini tashqi e'tirof vositasi sifatida emas, balki strategik boshqaruv uchun diagnostik axborot manbai sifatida qo‘llash samarali ekanini ko‘rsatdi. Reyting indikatorlari asosida aniqlangan o‘sish zaxiralarining yangi kampus loyihasi va kampus amaliyotiga izchil tatbiq etilishi universitetning yashil transformatsiyasini boshqariladigan va o‘lchanadigan jarayonga aylantiradi. Keyingi tadqiqotlarda universitetning yashil faoliyati va hududiy iqtisodiyotning ekologik samaradorlik ko‘rsatkichlari o‘rtasidagi bog‘liqlikni ekonometrik usullar yordamida baholash hamda O‘zbekiston universitetlarining yashil faoliyati bo‘yicha qiyosiy tadqiqot o‘tkazish rejalashtirilgan.

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CHAKANA SAVDONING BARQAROR RIVOJLANISHINI TA'MINLASHDA NARXNI SHAKLLANTIRISH STRATEGIYALARI

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Annotatsiya

Maqolada talabning narx elastikligi, dinamik narxlash, iste'molchilarning mo'ljal narxlari va aksiya narxlari nazariyalarini birlashtirgan kompleks yondashuv taklif etilgan. Empirik tahlilda O'zbekiston Respublikasi Prezidenti huzuridagi Statistika agentligining 2024-2026-yillar uchun ommaviy mavjud ma'lumotlari, xususan, Toshkentdagi chakana savdo aylanmasi bo'yicha oylik ma'lumotlar va tovarlar va xizmatlar narx ko'rsatkichlari qo'llanildi. Narxlash muhitidagi o'zgarishlar va savdo dinamikasi o'rtasidagi bog'liqlikni o'rganish uchun mavsumiy va vaqtinchalik komponentlarni o'z ichiga olgan regressiya modeli tuzildi. Toshkentda chakana savdo aylanmasi 2024-yildagi 105,3 trillion so'mdan 2025-yilda 130,8 trillion so'mga oshdi. Modelda narx indeksining joriy va kechiktirilgan o'zgarishi koeffitsiyentlari manfiy bo'lsa-da, ular 5 foizlik darajada statistik ahamiyatga ega emas. Natijada bazaviy narx, elastiklik, raqobatchilar narxlari, ssenariylar va narx sinovidan iborat besh bosqichli narxlash modeli taklif etildi hamda chegirma faqat yalpi foydani saqlab qolgan holdagina iqtisodiy jihatdan oqlanishi asoslandi.

Kalit so'zlar: narxlash, savdo hajmi, narx elastikligi, dinamik narxlash, narx aksiyalari, yalpi foyda, chakana savdo.

Аннотация

В статье предлагается комплексный подход, объединяющий теории ценовой эластичности спроса, динамического ценообразования, референтных цен потребителей и промо-цен. В эмпирическом анализе используются общедоступные данные Агентства статистики при Президенте Республики Узбекистан за 2024-2026 годы, в частности ежемесячные данные о розничном товарообороте Ташкента и индексы цен на товары и услуги. Для изучения связи между изменениями ценовой среды и динамикой продаж построена регрессионная модель с сезонными и временными компонентами. Розничный товарооборот Ташкента вырос со 105,3 трлн сумов в 2024 году до 130,8 трлн сумов в 2025 году. Коэффициенты текущего и лагового изменения индекса цен отрицательны, однако не являются статистически значимыми на 5%-ном уровне. В результате предложена пятиэтапная модель ценообразования, включающая

базовую цену, эластичность, цены конкурентов, сценарии и ценовой тест, а также обосновано, что скидка экономически оправдана лишь при сохранении валовой прибыли.

Ключевые слова: ценообразование, объём продаж, ценовая эластичность, динамическое ценообразование, ценовые промоакции, валовая прибыль, розничная торговля.

Abstract

The article proposes a comprehensive approach integrating theories of price elasticity of demand, dynamic pricing, consumer reference prices, and promotional pricing. The empirical analysis utilizes publicly available data from the Statistics Agency under the President of the Republic of Uzbekistan for the 2024-2026 period - specifically, monthly data on retail trade turnover and price indices for goods and services in Tashkent. A regression model incorporating seasonal and temporal components was developed to examine the relationship between changes in the pricing environment and sales dynamics. Retail trade turnover in Tashkent grew from 105.3 trillion soums in 2024 to 130.8 trillion soums in 2025. The coefficients of current and lagged price index changes are negative but not statistically significant at the 5% level. As a result, a five-stage pricing model comprising base price, elasticity, competitor prices, scenarios and price testing is proposed, and it is shown that a discount is economically justified only when gross profit is preserved.

Keywords: pricing, sales volume, price elasticity, dynamic pricing, price promotions, gross profit, retail trade.

KIRISH

Narx marketing va tijorat siyosatining bir nechta vositalaridan biri bo‘lib, u bir vaqtning o‘zida talab, daromad va marjaga bevosita ta’sir qiladi. Chakana savdo kompaniyasi uchun narx belgilashdagi xato ikki tomonlama ta’sirga ega bo‘lishi mumkin. Haddan tashqari yuqori narx sotib olish ehtimolini kamaytiradi va talabni o‘rnini bosuvchi mahsulotlar yoki raqobatchilarga yo‘naltiradi. Haddan tashqari past narx sotib olish ehtimolini oshiradi, ammo yalpi foydani kamaytirishi, mijozlarda doimiy chegirmalarga nisbatan kutishlarni yaratishi va brendning qabul qilingan qiymatini pasaytirishi mumkin. Shuning uchun zamonaviy narxlashning maqsadi shunchaki minimal yoki maksimal narxni mexanik izlash emas, balki birlik savdo hajmining oshishi narxning pasayishini qoplaydigan va barqaror iqtisodiy natijani ta’minlaydigan narx darajasi va tuzilishini aniqlashdir [1]; [11].

Ushbu masalaning dolzarbligi, ayniqsa, O‘zbekiston chakana savdo bozorida yaqqol ko‘rinib turibdi. O‘zbekiston Respublikasi Prezidenti huzuridagi Statistika agentligi ma’lumotlariga ko‘ra, 2025-yilda mamlakatning chakana savdo aylanmasi 482,4 trillion so‘mni tashkil etdi, bu o‘tgan yilga nisbatan 11,2% ga ko‘pdir. Toshkentda chakana savdo aylanmasining umumiy hajmi 2024-yilda taxminan 105,3 trillion so‘mga, 2025-yilda esa 130,8 trillion so‘mga yetdi [12]. Natijada, narxlash bo‘yicha qarorlar kengayib borayotgan bozor, inflyatsiya, raqobatning kuchayishi va iste’mol modellarining o‘zgarishi sharoitida qabul qilinadi.

Shu bilan birga, sezilarli inflyatsiya komponenti saqlanib qolmoqda. O‘zbekistonda yillik iste’mol narxlari indeksi 2025-yilda 108,8% ni, oziq-ovqat mahsulotlari indeksi esa 105,1% ni tashkil etdi [14]. Toshkentda oylik narx indeksi ham o‘sishni, ham pasayishni ko‘rsatdi. Bunday sharoitda bir xil nominal narx turli davrlarda turli real narx pozitsiyasini ifodalashi mumkin [13].

Ushbu maqolaning maqsadi yalpi marjani nazorat qilishni saqlab qolish bilan birga savdo hajmini oshirishga qaratilgan narxlash yondashuvini ishlab chiqish va asoslashdir. Ushbu maqsadga erishish uchun tadqiqot narxlash yondashuvlarini tizimlashtirish, elastiklik rolini baholash, Toshkentda narxlash muhiti va chakana savdo aylanmasi o‘rtasidagi bog‘liqlikni tahlil qilish, amaliy narxlash qarorlari modelini yaratish va kompaniyalar uchun tavsiyalar ishlab chiqish masalalarini ko‘rib chiqadi.

Ilmiy yangilik ommaviy statistikaning makro darajadagi tahlilini boshqaruv narxlash qarorlari modeli va SKU darajasidagi elastiklikni baholashga mikro darajadagi yondashuv bilan birlashtirishda yotadi. Amaliy ahamiyati taklif qilingan algoritmni supermarketlar, onlayn bozorlar va ixtisoslashgan chakana savdo do‘konlaridan olingan ma’lumotlarga moslashtirish qobiliyatidan kelib chiqadi.

ADABIYOTLAR SHARHI

Iqtisodiy nazariya an’anaviy ravishda talab miqdorini talab funksiyasi orqali narx bilan bog‘laydi. Ceteris paribus, narxning oshishi talab miqdorining kamayishiga olib keladi, narxning pasayishi esa oshishiga olib keladi. Biroq, boshqaruv qarorlarini qabul qilish uchun bog‘liqlik yo‘nalishini bilish yetarli emas; uning kuchini, xususan, talabning narx elastikligini aniqlash kerak [10]; [11]:

$$E_p = \frac{\%\Delta Q}{\%\Delta P} \quad (1)$$

bu yerda E_p - talabning narx elastikligi, $\%\Delta Q$ - talab miqdorining foizli o‘zgarishi, $\%\Delta P$ - narxning foizli o‘zgarishi. Agar elastiklikning mutlaq qiymati birdan oshsa, talab elastik deb hisoblanadi. Ushbu ssenariyda narxning 1% ga pasayishi savdo hajmining 1% dan ortiq oshishiga olib kelishi mumkin.

Chakana savdo aksiyalari bo‘yicha tadqiqotlar shuni ko‘rsatadiki, chegirmalarga savdo munosabati sezilarli darajada farq qiladi. Bemmaor va Mouchoux reklama elastikligining sezilarli darajalarini aniqladilar va chegirma uchun reklama qo‘llab-quvvatlashi bu ta’sirni yanada kuchaytirishini ko‘rsatdilar [1]. Bolton reklama elastikligi bozorlarda farq qilishini va brend xususiyatlari, bozor ulushi va marketing faoliyatiga bog‘liqligini aniqladi [2]. Natijada, narxlarning bir xil foizga pasayishi turli mahsulotlar uchun bir xil natija bermaydi.

Dinamik narxlash tadqiqotning muhim sohasini ifodalaydi. Statik narxlardan farqli o‘laroq, dinamik narxlar talab, vaqt, joylashuv, mahsulot xususiyatlari va boshqa omillarga qarab o‘zgaradi. Zamonaviy adabiyotlarda dinamik narxlar narxlarni o‘zgaruvchan bozor sharoitlariga moslashtirish uchun ma’lumotlardan foydalanish usuli sifatida qaraladi. Onlayn chakana savdo ma’lumotlaridan foydalangan holda, Fisher, Gallino va Li raqobatbardosh dinamik narxlar maqsadli marjani saqlab qolish bilan birga daromadni oshirishi mumkinligini ko‘rsatdilar [3].

Yana bir tadqiqot to‘plami reklama aksiyalarining dinamik ta’siriga qaratilgan. O‘tmishdagi chegirmalar keyingi iste’molchilarning reaksiyalariga ta’sir qiladi. Haddan tashqari chegirmalar pastroq mo‘ljal narxni belgilaydi, bu esa xaridorlarni odatiy narxda xarid qilishdan voz kechishga majbur qilishi mumkin. Shuning uchun reklama samaradorligi nafaqat chegirmaning chuqurligi, balki uning chastotasi, davomiyligi va vaqti bilan ham belgilanadi [4; 8; 9].

Kross-elastiklik ham muhimdir; bir toifadagi reklama boshqa toifadagi savdoga ta’sir qilishi mumkin. Supermarket uchun bu reklama aksiyasini faqat bitta SKU savdosiga asoslangan holda baholash yetarli emasligini anglatadi. Agar mahsulot narxining pasayishi umumiy savat qiymatini oshirsa va qo‘shimcha mahsulotlar savdosini oshirsa, oqlanishi mumkin [6; 7].

So‘nggi tadqiqotlar reklama elastikligi milliy brendlar va xususiy yorliqli mahsulotlar o‘rtasida farq qilishini tasdiqlaydi. 30 ta mahsulot toifasidagi 60 000 ta UPC bo‘yicha qariyb 700 million kuzatuvlarning tahlili shuni ko‘rsatadiki, reklama effekti ham brend turiga, ham narx darajasiga bog‘liq. Natijada, “past narxlar savdo hajmining oshishiga olib keladi” degan qoida haddan tashqari soddalashtirilgan [5].

Bu masala, ayniqsa, chakana savdo tarmoqlari va raqamli kanallarning o‘sishi, iste’molchilarning o‘zgaruvchan afzalliklari va inflyatsiya bosimi tufayli O‘zbekiston uchun dolzarbdir. Mahalliy tadqiqotlar allaqachon dinamik narxlarni va chegirmalarning ta’sirini o‘rganayotgan bo‘lsa-da [15; 16], narx siyosatini foydali savdo hajmining o‘sishiga erishish maqsadi bilan empirik ravishda bog‘lash zarurati saqlanib qolmoqda.

METODOLOGIYA

Tadqiqot ikki bosqichdan iborat. Birinchi bosqichda O‘zbekiston Respublikasi Prezidenti huzuridagi Statistika agentligining rasmiy ma’lumotlari tahlil qilinadi. Toshkentdagi oylik chakana savdo aylanmasi ko‘rsatkichlari va shahardagi barcha tovarlar va xizmatlar narxlari indeksi qo‘llaniladi [12; 13]. Tahlil 2024-yil yanvaridan 2026-yil iyuligacha bo‘lgan davrni, jumladan, 31 ta oylik kuzatuvni qamrab oladi. Savdo aylanmasi ma’lumotlari yil boshidan beri jami yig‘indi sifatida e’lon qilinganligi sababli, oylik qiymatlar avvalgi jami ko‘rsatkichni joriy ko‘rsatkichdan ayirish orqali olingan.

Ikkinchi bosqich amaliy narxlash modelini ishlab chiqishni o‘z ichiga oladi. Ommaviy foydalanish mumkin bo‘lgan ma’lumotlarning muhim cheklovi shundaki, savdo aylanmasi nominal jami ko‘rsatkich bo‘lib, narx indeksi esa keng tovarlar savatining o‘rtacha dinamikasini aks ettiradi. Natijada, empirik koeffitsiyentlarni ma’lum bir SKUning sof mikroiqtisodiy elastikligi sifatida talqin qilib bo‘lmaydi; ular makro darajada munosabatlarning yo‘nalishi va barqarorligini sinab ko‘rish va batafsilroq tahlil zarurligini asoslash uchun xizmat qiladi. Ushbu bog‘liqlikni o‘rganish uchun quyidagi model qo‘llaniladi:

$$g_t = \alpha + \beta_0 p_t + \beta_1 p_{t-1} + \gamma t + \Sigma \delta_m D_m + \varepsilon_t \quad (2)$$

bu yerda g_t - oylik chakana savdo aylanmasining o‘zgarish tezligi; p_t - narx indeksining oylik o‘zgarishi; p_{t-1} - bir davrdagi kechiktirilgan o‘zgarish; t - trend; D_m - mavsumiy fiktiv (dummy) o‘zgaruvchilar; ε_t - tasodifiy xato. β_0 va β_1 koeffitsiyentlari

narx o‘zgarishining savdo dinamikasiga mos ravishda joriy va kechiktirilgan ta’sirini ifodalaydi: ularning manfiy qiymati narxlar o‘sishi savdo o‘sish sur’atini sekinlashtirishini bildiradi.

Boshqaruv qarorlarini qabul qilish uchun optimallashtirish funksiyasi taklif qilinadi:

$$P* = argmax[Q(P) \times (P - C) - K(P)] \quad (3)$$

bu yerda P* - optimal narx, Q(P) - talab prognozi, C - o‘zgaruvchan xarajatlar va K(P) - narxlash qarori bilan bog‘liq qo‘shimcha xarajatlar. Demak, optimal narx eng yuqori savdo hajmini emas, balki qo‘shimcha xarajatlar hisobga olingandagi eng katta yalpi natijani beradigan narxdir.

Narx elastikligini empirik baholash uchun logarifmik talab modelidan foydalaniladi:

$$lnQ = \alpha + \beta lnP + \theta X + \varepsilon \quad (4)$$

Ushbu modelda β koeffitsiyenti narx elastikligi sifatida talqin qilinadi, X esa narxdan tashqari omillarni (mavsumiylik, aksiyalar va boshqalar) ifodalaydi. Masalan, β = -1,5 bo‘lsa, narxning 1% ga pasayishi sotuv hajmini taxminan 1,5% ga oshiradi. Chegirmani baholashda yalpi foydaning o‘zgarishini hisoblash kerak:

$$\Delta GP = (P_1 - C)Q_1 - (P_0 - C)Q_0 \quad (5)$$

bu yerda P_0, Q_0 - chegirmagacha bo‘lgan narx va sotuv hajmi, P_1, Q_1 - chegirmadan keyingi narx va sotuv hajmi. Agar yalpi foydaning o‘sishi salbiy bo‘lmasa yoki o‘lchanadigan strategik ta’sir marjaning qisqa muddatli pasayishini qoplasa, chegirma iqtisodiy jihatdan oqlangan deb hisoblanishi kerak [7].

Tadqiqot gipotezalari:

H1. Qisqa muddatda narxlarning o‘sish sur’atining oshishi chakana savdo hajmining o‘sish sur’atining pasayishi bilan bog‘liq, boshqa barcha narsalar teng.

H2. Narx effekti vaqt oralig‘ini o‘z ichiga oladi: oldingi davrdagi narxlarning o‘zgarishi kutilgan natijalarni va mo‘ljal narxni o‘zgartirish orqali joriy davrdagi savdoga ta’sir qilishi mumkin.

H3. Mavsumiylik narx va savdo o‘rtasidagi kuzatilgan bog‘liqlikni sezilarli darajada o‘zgartiradi.

H4. Elastiklik, raqobat va mahsulotning savatdagi roliga asoslangan segmentlangan narxlar bir xil ustamadan ko‘ra samaraliroqdir.

H5. Narxni pasaytirish faqat qo‘shimcha savdo hajmi birlik uchun marjaning pasayishini qoplagan taqdirdagina tavsiya etiladi.

TAHLIL VA NATIJALAR

Rasmiy ma’lumotlarga ko‘ra, Toshkentdagi jami chakana savdo aylanmasi 2024-yilda 105,34 trillion so‘mga, 2025-yilda esa 130,79 trillion so‘mga yetdi. Nominal o‘sish taxminan 24,2% ni tashkil etdi. 2026-yil yanvaridan iyulgacha aylanma 82,23 trillion so‘mga yetdi, 2025-yilning shu davrida bu ko‘rsatkich 74,77 trillion so‘mga nisbatan taxminan 10,0% ga oshgan [12].

Nominal aylanmaning o‘sishi avtomatik ravishda savdo hajmining mutanosib o‘sishini anglatmaydi; o‘zgarishning bir qismi narxlarning o‘zgarishi bilan bog‘liq. Natijada, narxlash KPI sifatida faqat daromadga tayanish noto‘g‘ri xulosalarga olib

kelishi mumkin, chunki kompaniya daromadning o‘sishi haqida xabar berishi mumkin, sotilgan birliklar soni esa aslida kamayadi.

2025-yilda O‘zbekistonda yillik iste’mol narxlari indeksi 108,8% ni tashkil etdi, oziq-ovqat narxlari o‘rtacha 5,1% ga oshdi [14]. Toshkentda 2025-yil davomida umumiy indeksning oylik ko‘rsatkichlari 99,56 dan 101,35 gacha bo‘lgan [13]. Bu narxlash muhiti dinamik ekanligini va tijorat qarorlariga davriy tuzatishlar kiritishni talab qilishini ko‘rsatadi.

O‘sish sur’atlarining o‘zgarishidan so‘ng 30 ta kuzatuvga asoslangan modelda (2-formula) narx indeksidagi joriy o‘zgarish koeffitsiyenti -4,94 ni, kechiktirilgan o‘zgarish koeffitsiyenti esa -22,84 ni tashkil etdi. Tegishli p-qiymatlar mos ravishda 0,716 va 0,113 ni tashkil etdi. Shunday qilib, munosabatlar yo‘nalishi H1 va H2 gipotezalariga mos kelsa-da, statistik ahamiyat 5% chegarasidan past. Bu natija ma’lum bir narxning pasayishi natijasida yuzaga kelgan sababiy ta’sirning isboti deb hisoblanishi mumkin emas; aksincha, bu umumlashtirilgan ma’lumotlar bunday ta’sirni aniq aniqlash uchun yetarli emasligini ko‘rsatadi. Kuchliroq salbiy kechiktirilgan koeffitsiyent xaridor narx o‘zgarishiga darhol munosabat bildirmaydigan vaziyatni aks ettirishi mumkin. Narxlarning oshishi natijasida ba’zi iste’molchilar o‘rnini bosuvchi mahsulotlarga o‘tishlari, savat hajmini kamaytirishlari yoki sotib olishni keyinga qoldirishlari mumkin. Xuddi shunday, narx pasaygandan keyin odatlarni o‘zgartirish ham vaqt talab qilishi mumkin [8].

Chegirmaning iqtisodiy asoslarini ko‘rib chiqaylik. Agar o‘zgaruvchan xarajati 70 000 so‘m bo‘lgan mahsulot 1000 dona hajmda 100 000 so‘mdan sotilsa, yalpi foyda 30 million so‘mni tashkil qiladi. Narx 10% ga tushirilgandan so‘ng, narx 90 000 ga teng bo‘ladi va marja 20 000 ga tushadi. Yalpi foydani saqlab qolish uchun 1500 dona sotilishi kerak - bu 50% ga o‘sish. Natijada, 10% chegirma avtomatik ravishda foydali bo‘lmaydi.

Agar dastlabki marja yuqori bo‘lsa, talab qilinadigan hajm o‘sishi pastroq bo‘ladi; agar marja past bo‘lsa, zarur o‘sishga iqtisodiy jihatdan erishib bo‘lmasligi mumkin. Shuning uchun, chegirma taklif qilish to‘g‘risidagi qaror elastiklikni baholashga asoslangan bo‘lishi kerak. -1,5 elastiklik bilan, narxning 5% ga pasayishi nazariy jihatdan miqdorni taxminan 7,5% ga oshiradi; -4,5 elastiklik bilan o‘sish taxminan 22,5% ni tashkil qiladi. Xuddi shu narxni sozlash juda xilma-xil moliyaviy natijalarni beradi [10].

Raqobatchilarning narxlarini belgilash ham juda muhim. Agar narxni pasaytirish bitta sotuvchi tomonidan amalga oshirilsa, savdo o‘sishining bir qismi shunchaki mijozlar brendlarini almashtirishi natijasida yuzaga kelishi mumkin. Agar raqobatchilar narxlarini bir vaqtning o‘zida tushirsalar, bozorning umumiy hajmi deyarli o‘zgarmasligi mumkin. Shunday qilib, amaliy dinamik narxlash strategiyalari nafaqat o‘z savdo tarixini, balki raqobatchilarning narxlarini ham o‘z ichiga olishi kerak [3].

Va nihoyat, narxlash savat darajasida baholanishi kerak. Trafikni jalb qiluvchi mahsulot narxini pasaytirish, agar u qo‘shimcha mahsulotlar savdosini ko‘paytirsa,

oqlanishi mumkin. Bu, ayniqsa, FMCG sektorida muhimdir, bu yerda sotib olish to‘g‘risidagi qarorlar individual SKUlarga emas, balki umumiy savatga asoslangan [6].

Savdo hajmining o‘sishini ta’minlash uchun narxlash modeli

Nazariya va empirik tahlil asosida besh bosqichli model taklif qilingan. Birinchi bosqich o‘zgaruvchan xarajatlar, maqsadli marja va minimal maqbul rentabellik darajasidan foydalangan holda bazaviy narxni aniqlashni o‘z ichiga oladi. Eng muhimi, bu bazaviy narx avtomatik ravishda haqiqiy sotish narxiga aylanmasligi kerak.

Ikkinchi bosqich - narx elastikligini baholash. Har bir muhim SKU uchun elastiklik quyidagicha hisoblanadi:

$$E_i = \frac{\Delta Q_i / Q_i}{\Delta P_i / P_i} \quad (6)$$

bu yerda $\Delta Q_i/Q_i$ - i-mahsulot (SKU) sotuv hajmining nisbiy o‘zgarishi, $\Delta P_i/P_i$ - uning narxining nisbiy o‘zgarishi. Agar ma’lumotlar yetarli bo‘lmasa, buning o‘rniga kategoriya yoki segment elastikligi qo‘llaniladi; bu kamdan-kam sotiladigan mahsulotlar uchun beqaror taxminlardan qochadi.

Uchinchi bosqich tashqi omillarni o‘z ichiga oladi: raqobatchilar narxlari, mahsulot mavjudligi, mavsumiylik, inventarizatsiya darajasi, saqlash muddati, reklama faoliyati, reklama joylashtirish, haftaning kuni va bayramlar. Muayyan kategoriyalar uchun ob-havo sharoitlari va mahalliy voqealar ham hisobga olinishi mumkin.

To‘rtinchi bosqich ssenariy modellashtirishni o‘z ichiga oladi. Menejer joriy narxni 3%, 5%, 7% va 10% pasayishlar, shuningdek, narxlarning oshishi bilan taqqoslaydi. Prognoz qilingan savdo hajmi, daromad va yalpi foyda har bir ssenariy uchun hisoblanadi. Beshinchi bosqich - bu nazorat qilinadigan narx sinovi. Narx cheklangan do‘konlar yoki mahsulotlar guruhi uchun sozlanadi, taqqoslanadigan nazorat guruhi esa asl narx darajasini saqlab qoladi. Keyin qo‘shimcha effekt taqqoslanadi. Ushbu dizayn narxlarning ta’sirini mavsumiylik va kengroq bozor tendensiyalaridan samarali ravishda ajratib turadi [3].

Har bir mahsulot uchun narxning pastki chegarasi va narx chegarasini belgilash tavsiya etiladi. Ushbu chegaralar doirasida algoritm maqsadli metrikani maksimal darajada oshiradigan narxni tanlaydi. Agar trafikni jalb qiladigan mahsulotlar umumiy savat qiymatini oshirsa, ular uchun pastroq marjalarga ruxsat beriladi, yuqori marjali mahsulotlar uchun esa rentabellikni himoya qilish ustuvor hisoblanadi.

Aksiyalar chastotasiga alohida e’tibor qaratish kerak. Agar mahsulot juda tez-tez chegirma bilan sotilsa, mijozlar chegirmali narxni standart narx sifatida qabul qila boshlaydilar. Shuning uchun tizim nafaqat narxlar tarixini, balki o‘tmishdagi aksiyalarning chastotasi va chuqurligini ham kuzatishi kerak [8; 9]. Raqamli tijoratda algoritm har kuni yoki undan ham tez-tez yangilanishi mumkin; ammo, dinamik narxlar o‘zboshimchalik bilan narx o‘zgarishi taassurotini yaratmaslik uchun narx o‘zgarishi tezligiga cheklovlar va shaffoflik qoidalarini o‘z ichiga olishi kerak.

Amaliy hisoblash misoli

Aytaylik, mahsulot 50 000 so‘mga sotilmoqda, o‘zgaruvchan xarajatlar 35 000 so‘m va o‘rtacha savdo hajmi oyiga 2000 dona. Daromad 100 million so‘mni, yalpi foyda esa 30 million so‘mni tashkil qiladi.

Agar narx 5% ga tushirilsa, yangi narx 47 500 so‘mga, bir birlik uchun marja esa 12 500 so‘mga teng bo‘ladi. Yalpi foydani saqlab qolish uchun 2400 dona sotilishi kerak - bu 20% ga o‘sish. Agar elastiklik -1,5 bo‘lsa, kutilgan hajm o‘sishi taxminan 7,5% ni tashkil qiladi; shuning uchun chegirma kamaytirilgan marjani qoplamaydi. Agar elastiklik -4,5 bo‘lsa, kutilgan o‘sish taxminan 22,5% ni tashkil qiladi, bu esa chegirmani potensial jihatdan oqlanishiga olib keladi.

Bundan kelib chiqib, menejerning asosiy savoli “Narxni tushira olamizmi?” emas, balki “Qo‘shimcha foyda olish uchun narx o‘zgarishi uchun hajm qanchaga oshishi kerak?” bo‘lishi kerak. Bu savol marketing siyosatini moliyaviy natijalar bilan bevosita bog‘laydi.

Natijalarni muhokama qilish

Topilmalar “savdo hajmini oshirish uchun narxni pasaytirish” oddiy qoidasiga nisbatan ehtiyotkorlik zarurligini tasdiqlaydi. Toshkent uchun umumiy darajada koeffitsiyentlarning salbiy belgisi narx sezgirligi bilan mos keladi; ammo, statistik noaniqlik makro darajadagi ma’lumotlar ma’lum bir mahsulot uchun optimal narxni aniqlash uchun yetarli emasligini ko‘rsatadi.

Bu cheklov o‘z-o‘zidan muhim topilma hisoblanadi. Narx mikroiqtisodiy o‘zgaruvchidir, shaharning savdo hajmi esa umumiy ko‘rsatkichdir. Aralashuvchi omillarga uy xo‘jaliklari daromadi, bandlik, ta’minot, mahsulot assortimenti, chakana savdo nuqtalari soni, raqobat, import, valyuta kurslari, mavsumiylik va iste’molchilarning afzalliklari kiradi. Shuning uchun, makroiqtisodiy munosabatlar individual mahsulot elastikligini baholashning o‘rnini bosa olmaydi.

Ikkinchi xulosa vaqt effekti bilan bog‘liq. Kuchliroq salbiy kechikish koeffitsiyenti xatti-harakatlarning asta-sekin o‘zgarishini aks ettirishi mumkin. Narxlarning oshishi natijasida iste’molchi darhol do‘konlarini yoki brendlarini o‘zgartirmaydi; ular buni faqat bir nechta xaridlarni amalga oshirgandan keyin amalga oshirishlari mumkin. Natijada, kechikishlarni hisobga olmagan qisqa muddatli tahlil bu ta’sirni kam baholashi mumkin [8].

Uchinchi xulosa marjaga tegishli. Savdo hajmini oshirish, agar u rentabellik hisobiga bo‘lsa, o‘z-o‘zidan maqsad emas. Savdo o‘sishi va foydali savdo o‘sishi o‘rtasida farq bo‘lishi kerak; ikkinchisi narx siyosatining asosiy maqsadi bo‘lishi kerak.

To‘rtinchi xulosa raqamlashtirishga tegishli. POS ma’lumotlarini, inventarizatsiya darajasini, raqobatchilar narxlarini va xaridorlarning xatti-harakatlarini integratsiya qilish dinamik narxlarni nazariy konsepsiyadan odatiy boshqaruv jarayoniga aylantirish imkonini beradi [3; 15].

Beshinchi xulosa axloqqa tegishli. Narxlarni shaxsiylashtirish aniq qoidalar bilan tartibga solinishi va bir xil xarid sharoitlarida asossiz tafovutlarni yaratmaslik kerak. Narx siyosatida shaffoflik va bashorat qilish brend ishonchini shakllantirishning ajralmas qismiga aylanadi.

XULOSA VA TAKLIFLAR

Savdo hajmini oshirishga qaratilgan narxni belgilash oddiy, mexanik narxlarni pasaytirish o‘rniga optimallashtirish vazifasi sifatida ko‘rib chiqilishi kerak.

Toshkentdan olingan ommaviy ma'lumotlarning empirik tahlili narx tendensiyalari va chakana savdo aylanmasi o'rtasidagi bog'liqlikni ko'rsatadi; ammo, umumlashtirilgan ko'rsatkichlar SKU darajasidagi talabni baholashning o'rnini bosa olmaydi. O'zbekistonning chakana savdo sektori uchun eng istiqbolli yo'l elastiklik, raqobatchilar narxlari, mavsumiylik, inventarizatsiya darajasi va mahsulotning xarid savatchasidagi roliga asoslangan segmentlangan narxlarga o'tishdir. Asosiy tamoyil shundaki, narxning pasayishi nafaqat sotilgan birliklarning ko'payishi, balki natijada qo'shimcha iqtisodiy natija bilan ham baholanishi kerak.

Tadqiqot natijalari asosida quyidagi xulosa va tavsiyalar ishlab chiqildi:

1. Narx talabga bevosita ta'sir qiladi; ammo, bu ta'sirning kuchi mahsulotlar, toifalar, brendlar va kanallar bo'yicha farq qiladi. Yagona ustama optimal narxlash uchun universal usul bo'lib xizmat qila olmaydi.

2. Toshkentda chakana savdo aylanmasi 2024-yildagi 105,3 trillion so'mdan 2025-yilda 130,8 trillion so'mgacha oshdi; 2026-yil yanvar-iyul oylarida 2025-yilning shu davriga nisbatan o'sish taxminan 10% ni tashkil etdi. Nominal o'sishni jismoniy hajmning o'sishi sifatida to'liq talqin qilib bo'lmaydi.

3. Agregatsiyalangan modelda joriy va kechiktirilgan narx o'zgarishlari mavsumiylik va tendensiyalarni hisobga olgan holda sotuv dinamikasi bilan salbiy korrelyatsiyani ko'rsatadi; ammo, statistik noaniqlik kuchli sabab-oqibat xulosalarini chiqarishga to'sqinlik qiladi.

4. Agar hajmning oshishi marjadagi yo'qotishni qoplasa yoki xarid savatchasi va mijozlarning umrbod qiymatiga o'lchanadigan qo'shimcha ta'sir ko'rsatsa, narxning pasayishi iqtisodiy jihatdan oqlanadi.

5. O'zbekistondagi chakana savdo kompaniyalariga "bazaviy narx - elastiklik - raqobatchilar - ssenariylar - narx sinovi" tizimini joriy etish tavsiya etiladi.

6. FMCG uchun mahsulotlarni trafik drayverlari, yuqori elastiklikli mahsulotlar, past elastiklikli mahsulotlar va yuqori marjali mahsulotlarga ajratish, har bir guruhga turli qoidalarni qo'llash tavsiya etiladi.

7. Reklama chastotasini kuzatib borish kerak, chunki haddan tashqari chegirmalar mo'ljal narxni pasaytirishi va kelajakdagi reklama aksiyalarining samaradorligini pasaytirishi mumkin.

8. Narxlash KPI ko'rsatkichlari hajm, daromad, yalpi foyda, qo'shimcha marja, o'rtacha chek qiymati, takroriy xaridlar va qo'shimcha mahsulotlarga ta'sirini qamrab olishi kerak.

9. Tadqiqotning keyingi bosqichi Toshkentdagi bir yoki bir nechta chakana savdo tarmoqlaridan olingan ma'lumotlarga asoslangan SKU darajasidagi tahlilni o'z ichiga olishi kerak. Minimal ma'lumotlar to'plami SKU, sana, narx, miqdor, reklama bayrog'i, aksiyalar darajasi, toifa, do'kon va raqobatchi narxini o'z ichiga olishi kerak.

10. Keng qamrovli sabab-oqibat tahlili panel modellari va dala tajribalaridan, masalan, "farqlar ichidagi farq" (difference-in-differences) yoki tasodifiy narx sinovlaridan foydalanishni talab qiladi.

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YASHIL IQTISODIYOT TAMOYILLARI ASOSIDA MINTAQALARNING BARQAROR RIVOJLANISH STRATEGIYALARINI SHAKLLANTIRISH MEXANIZMLARI

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Annotatsiya

Maqolada yashil iqtisodiyot tamoyillari asosida mintaqalarning barqaror rivojlanish strategiyalarini shakllantirish mexanizmlari nazariy va amaliy jihatdan o‘rganildi. Tadqiqot jarayonida tizimli yondashuv, kontent-tahlil va indeks usullari qo‘llanildi. Muallif UNEP va OECD konsepsiyalarini, iqtisodiy o‘sishni resurs sarfi va ekologik bosimdan ajratish nazariyasini hamda strategik hududiy rejalashtirish yondashuvlarini umumlashtirib, yashil strategiyani o‘zini-o‘zi tuzatuvchi boshqaruv sikli sifatida talqin etdi. O‘zbekistonning yashil iqtisodiyotga o‘tish bo‘yicha 2019-2030-yillarga mo‘ljallangan strategiyasi, 2022-yilgi chora-tadbirlar va “O‘zbekiston - 2030” strategiyasidagi maqsadli ko‘rsatkichlar qiyosiy tahlil qilindi. IRENA ma’lumotlari asosida qayta tiklanuvchi energiya quvvatlari dinamikasi va strategik maqsadga erishish darajasi hisoblandi. Hisob-kitoblarga ko‘ra, 2025-yilda strategik maqsadga erishish darajasi 35,1 foizni tashkil etdi, gidroenergetikadan tashqari manbalar ulushi esa 75,7 foizga yetdi. Natijada tamoyillar, salohiyat tahlili, maqsadli indikatorlar, yashil investitsiyalar, amalga oshirish va monitoringni birlashtirgan mexanizm modeli ishlab chiqildi hamda mintaqaviy yashil strategiyalarni takomillashtirish bo‘yicha takliflar asoslab berildi.

Kalit so‘zlar: yashil iqtisodiyot, yashil o‘sish, barqaror rivojlanish, mintaqaviy strategiya, dekapling, qayta tiklanuvchi energiya, yashil investitsiyalar, monitoring indikatorlari.

Аннотация

В статье с теоретической и практической стороны исследованы механизмы формирования стратегий устойчивого развития регионов на основе принципов зелёной экономики. В исследовании применены системный подход, контент-анализ и индексный метод. Автор обобщил концепции ЮНЕП и ОЭСР, теорию отделения экономического роста от ресурсопотребления и экологической нагрузки, а также подходы стратегического территориального планирования и интерпретировал зелёную стратегию как самокорректирующийся управленческий цикл. Проведён сравнительный анализ целевых показателей Стратегии перехода Узбекистана к зелёной экономике на 2019-2030 годы, мер 2022 года и Стратегии «Узбекистан - 2030». На основе данных IRENA рассчитаны динамика мощностей возобновляемой энергетики и степень достижения стратегической цели. Согласно расчётам, в 2025 году степень достижения стратегической цели составила 35,1%, а доля источников, помимо гидроэнергетики, достигла 75,7%. В результате разработана модель механизма, объединяющая принципы, анализ потенциала, целевые индикаторы, зелёные

инвестиции, реализацию и мониторинг, а также обоснованы предложения по совершенствованию региональных зелёных стратегий.

Ключевые слова: зелёная экономика, зелёный рост, устойчивое развитие, региональная стратегия, декаплинг, возобновляемая энергетика, зелёные инвестиции, индикаторы мониторинга.

Abstract

The article examined the mechanisms for forming sustainable development strategies of regions based on green economy principles. The author synthesised the UNEP and OECD concepts, the theory of decoupling economic growth from resource use and environmental pressure, and approaches of strategic spatial planning, and interpreted a green strategy as a self-correcting management cycle. The targets of Uzbekistan's Strategy for the Transition to a Green Economy for 2019-2030, the 2022 implementation measures and the "Uzbekistan - 2030" Strategy were compared. Using IRENA data, the dynamics of renewable energy capacity and the degree of attainment of the strategic target were calculated. According to the calculations, in 2025 the degree of attainment of the strategic target reached 35.1%, while the share of non-hydro sources reached 75.7%. As a result, a mechanism model integrating principles, potential assessment, target indicators, green investment, implementation and monitoring was developed, and proposals for improving regional green strategies were substantiated.

Keywords: green economy, green growth, sustainable development, regional strategy, decoupling, renewable energy, green investment, monitoring indicators.

KIRISH

Barqaror rivojlanish nazariyasi iqtisodiy o‘sish, ijtimoiy farovonlik va tabiiy kapitalni saqlash o‘rtasidagi muvozanatni ta’minlash zaruratidan kelib chiqqan bo‘lib, XX asrning so‘nggi choragida iqtisodiy fikrning mustaqil yo‘nalishiga aylandi. Dastlab u ko‘proq me’yoriy g‘oya sifatida talqin qilingan bo‘lsa, keyingi o‘n yilliklarda boshqaruv amaliyotiga tatbiq etiladigan aniq vositalarni talab qila boshladi. Ana shunday vositalardan biri sifatida yashil iqtisodiyot konsepsiyasi shakllandi. BMTning Atrof-muhit dasturi (UNEP) yashil iqtisodiyotni ekologik xavflar va resurs tanqisligini sezilarli darajada kamaytirgan holda inson farovonligi hamda ijtimoiy tenglikni oshiruvchi iqtisodiyot sifatida ta’riflab, unga o‘tishni investitsiyalarni tabiiy kapitalni tiklovchi, energiya va resurs samaradorligini oshiruvchi tarmoqlarga qayta yo‘naltirish jarayoni deb baholagan [17]. Mazkur ta’rifning nazariy ahamiyati shundaki, u ekologik cheklovlarni iqtisodiy o‘sishga to‘siq sifatida emas, balki yangi o‘sish manbalarini shakllantiruvchi omil sifatida ko‘rib chiqadi.

Iqtisodiy hamkorlik va taraqqiyot tashkiloti (OECD) tomonidan ilgari surilgan yashil o‘sish konsepsiyasi mazkur g‘oyani makroiqtisodiy siyosat tiliga o‘girdi. Unga ko‘ra, yashil o‘sish tabiiy aktivlar farovonlik uchun zarur bo‘lgan resurs va ekotizim xizmatlarini taqdim etishda davom etishini kafolatlagan holda iqtisodiy o‘sish va rivojlanishni rag‘batlantirishni anglatadi [11]. OECD yondashuvida innovatsiyalar, narx signallari, investitsion muhit va institutsional sifat o‘sishning yashil trayektoriyasini belgilovchi asosiy kanallar sifatida ajratiladi. Natijada yashil

iqtisodiyot faqat ekologik siyosat bilan chegaralanmay, tarkibiy o‘zgarishlar, texnologik yangilanish va raqobatbardoshlikni oshirish vazifalarini qamrab oluvchi kompleks kategoriyaga aylanadi. Konsepsiyaning kengayishi uning mintaqaviy darajada qo‘llanilishiga ham yo‘l ochdi, zero hududlar tabiiy resurslar tarkibi, iqtisodiy ixtisoslashuvi va ekologik yuklamasi bo‘yicha bir-biridan sezilarli farq qiladi.

Nazariy adabiyotda yashil iqtisodiyot bir qator yaqin tushunchalar, jumladan aylanma iqtisodiyot, biologik iqtisodiyot, past uglerodli iqtisodiyot va ekologik modernizatsiya bilan uzviy bog‘liq holda ko‘rib chiqiladi. E. Luazo va hammualliflari bu tushunchalarni tizimlashtirib, ularning barchasini iqtisodiy faoliyatni ekologik chegaralar doirasida qayta tashkil etishga qaratilgan, biroq ta’sir obyekti va qo‘llanish ko‘lami bilan farqlanadigan konsepsiyalar oilasi sifatida tasniflagan [9]. Ushbu tasnif mintaqaviy strategiya uchun muhim metodologik xulosani beradi: hududiy darajada yashil iqtisodiyot yagona dastur emas, balki energetika, sanoat, qishloq xo‘jaligi, suv va chiqindilar boshqaruvi kabi sohalardagi yo‘nalishlarni muvofiqlashtiruvchi integratsion ramka vazifasini bajaradi. Mintaqaning barqaror rivojlanish strategiyasi aynan shu muvofiqlashtirish vazifasini maqsadlar, resurslar va mas’uliyat taqsimoti orqali amalga oshiradi.

Strategiya shakllantirish mexanizmi deganda maqolada maqsadlarni belgilash, resurslarni jalb etish, chora-tadbirlarni amalga oshirish va natijalarni baholashni o‘zaro bog‘lovchi institutsional, iqtisodiy va axborot vositalari majmui tushuniladi. Yashil iqtisodiyot tamoyillari bu mexanizmga uchta talabni qo‘yadi: iqtisodiy o‘sishni resurs sarfi va ifloslanishdan ajratish, tabiiy kapitalni investitsiya obyekti sifatida hisobga olish hamda natijalarni o‘lchanadigan ko‘rsatkichlar orqali muntazam kuzatib borish. O‘zbekiston sharoitida bu talablar yashil iqtisodiyotga o‘tish strategiyasi va “O‘zbekiston - 2030” strategiyasida milliy darajada mustahkamlangan bo‘lib, ularni mintaqalar kesimida izchil amalga oshirish ilmiy asoslangan uslubiy yondashuvni talab etadi.

Maqolaning maqsadi yashil iqtisodiyot tamoyillari asosida mintaqalarning barqaror rivojlanish strategiyalarini shakllantirish mexanizmini nazariy jihatdan asoslash va uni takomillashtirish yo‘nalishlarini ishlab chiqishdan iborat. Maqsadga erishish uchun quyidagi vazifalar belgilandi: yashil iqtisodiyot va yashil o‘sish konsepsiyalarining mintaqaviy strategiya uchun ahamiyatini ochib berish; strategik jarayon samaradorligini baholashga imkon beruvchi o‘lchov vositalarini tanlash; O‘zbekistonning yashil transformatsiyaga oid strategik hujjatlaridagi maqsadli ko‘rsatkichlar evolyutsiyasini tahlil qilish; qayta tiklanuvchi energetika misolida strategik maqsadga erishish darajasini baholash hamda mintaqaviy yashil strategiyani shakllantirish mexanizmining konseptual modelini taklif etish.

ADABIYOTLAR SHARHI

Yashil iqtisodiyot konsepsiyasining ilmiy muhokamasida uning barqaror rivojlanish g‘oyasiga munosabati markaziy o‘rin egallaydi. E. Barbier “Rio+20” konferensiyasidan keyingi davrda yashil iqtisodiyotni tabiiy kapitalning kam baholanishini bartaraf etuvchi va iqtisodiy qarorlarda ekologik tanqislikni hisobga olishga undovchi amaliy dastur sifatida talqin qilgan hamda uning muvaffaqiyati narx

islohotlari va innovatsiyalarni rag‘batlantirishga bog‘liqligini ko‘rsatgan [2]. O. Bina yashil iqtisodiyot va barqaror rivojlanish o‘rtasidagi munosabatni tahlil qilib, birinchisi ikkinchisining amaliy vositasi bo‘lib xizmat qilishi uchun ijtimoiy tenglik va uzoq muddatli ekologik maqsadlar strategik hujjatlarda aniq ifodalanishi lozimligini qayd etgan [3]. A. Merino-Saum va hammualliflari yashil iqtisodiyotning 140 ta ta’rifini miqdoriy tahlil qilib, ularda eng ko‘p takrorlanadigan elementlar sifatida resurs samaradorligi, past uglerodlilik va ijtimoiy inklyuzivlikni aniqlagan [10].

Yashil strategiyalarni baholashning nazariy asosi iqtisodiy o‘sishni ekologik bosimdan ajratish, ya’ni dekapling tushunchasiga tayanadi. UNEP qoshidagi Xalqaro resurslar paneli resurs dekaplingi va ta’sir dekaplingini farqlab, birinchisini yalpi mahsulot birligiga to‘g‘ri keladigan resurs sarfining kamayishi, ikkinchisini esa ekologik ta’sirning iqtisodiy faollikdan tezroq pasayishi sifatida ta’riflagan [16]. P. Tapio dekapling darajasini elastiklik koeffitsiyenti orqali o‘lchash usulini taklif etib, kuchli, zaif va salbiy dekapling holatlarini ajratuvchi tipologiyani ishlab chiqqan [15]. X. Haberl va hammualliflari 835 ta empirik tadqiqotni tizimli ko‘rib chiqib, nisbiy dekapling keng tarqalganini, mutlaq dekapling esa asosan energetika tarkibi tubdan yangilangan holatlarda qayd etilishini ko‘rsatgan [5]. J. Xikel va G. Kallis dekapling sur’atlari ekologik maqsadlarga erishish uchun yetarli bo‘lishi kerakligini ta’kidlab, strategiyalarda mutlaq ko‘rsatkichlarni belgilash zarurligiga e’tibor qaratgan [6].

Yashil o‘zgarishlarning iqtisodiy samaradorligi masalasida M. Porter va K. van der Linde gipotezasi muhim nazariy asos bo‘lib xizmat qiladi. Ularning fikricha, puxta ishlab chiqilgan ekologik talablar korxonalarni resurslardan unumliroq foydalanishga yo‘naltiruvchi innovatsiyalarni rag‘batlantiradi va natijada ekologik me’yorlarga rioya qilish xarajatlarini qisman yoki to‘liq qoplaydigan raqobat ustunligini yaratadi [14]. M. Kapasso va hammualliflari yashil o‘sishga oid ilmiy natijalarni umumlashtirib, texnologik innovatsiyalar, sanoat siyosati va hududiy institutlar o‘zaro uyg‘unlashgan holatlardagina yashil o‘sish barqaror tus olishini asoslagan [4]. Bu xulosa mintaqaviy darajadagi strategik boshqaruvning hal qiluvchi rolini ko‘rsatadi, chunki aynan hududlarda texnologiyalar, investorlar, mahalliy hokimiyat va aholi manfaatlari bevosita kesishadi.

Mintaqaviy strategiyani shakllantirish nazariyasida L. Albrexts yondashuvi alohida o‘rin tutadi. U strategik hududiy rejalashtirishni uzoq muddatli istiqbolni belgilash, ustuvor yo‘nalishlarni tanlash, manfaatdor tomonlarni jalb etish va amalga oshirish jarayonini muntazam qayta ko‘rib chiqishni o‘z ichiga olgan uzluksiz jarayon sifatida talqin etgan [1]. OECD shaharlar va hududlarda yashil o‘sishni ta’minlash tajribasini umumlashtirib, mahalliy hokimiyatlar energetika, transport, qurilish va chiqindilar boshqaruvida bevosita vakolatlarga ega bo‘lgani uchun yashil siyosatning eng ta’sirchan ijrochilari ekanini ko‘rsatgan [13]. Adabiyotlar tahlili yashil iqtisodiyot nazariyasi, dekapling o‘lchovlari va strategik rejalashtirish yondashuvlari alohida-alohida chuqur ishlanganini, biroq ularni mintaqaviy strategiyani shakllantirishning yagona mexanizmiga birlashtiruvchi modellar yetarli emasligini ko‘rsatadi. Maqolaning ilmiy yangiligi ushbu bo‘shliqni to‘ldirishga qaratilgan.

METODOLOGIYA

Tadqiqotning metodologik asosini tizimli yondashuv tashkil etdi: mintaqaning barqaror rivojlanish strategiyasi maqsadlar, resurslar, amalga oshirish vositalari va qayta aloqa kanallari o‘zaro ta’sirda bo‘lgan boshqaruv tizimi sifatida ko‘rib chiqildi. Nazariy qismda tarixiy-mantiqiy, qiyosiy va umumlashtirish usullari qo‘llanildi. Amaliy qismda normativ-huquqiy hujjatlarning kontent-tahlili hamda strategik maqsadga erishish darajasini baholashga qaratilgan indeks usuli qo‘llanildi. Ko‘rsatkichlarni tanlashda OECD yashil o‘sish indikatorlari tizimiga tayanildi. Ushbu tizim ishlab chiqarishning ekologik va resurs samaradorligi, tabiiy aktivlar bazasi, hayot sifatining ekologik o‘lchami hamda iqtisodiy imkoniyatlar va siyosiy javob choralari guruhlarini qamrab oladi [12]. Mintaqaviy strategiyada har bir guruhdan kamida bitta ko‘rsatkich tanlanishi maqsadlar tizimining to‘liqligini ta’minlaydi.

Iqtisodiy o‘sish va ekologik bosim o‘rtasidagi munosabatni baholash uchun P. Tapio taklif etgan dekapling elastikligi ko‘rsatkichidan foydalanish tavsiya etildi:

$$e_t = \frac{\Delta E_t}{E_{t-1}} \cdot \frac{Y_{t-1}}{\Delta Y_t} \qquad (1)$$

bu yerda e_t - t davrdagi dekapling elastikligi; ΔE_t - ekologik bosim ko‘rsatkichining (energiya iste’moli, issiqxona gazlari chiqindilari yoki suv sarfi) davr mobaynidagi o‘zgarishi; E_{t-1} - shu ko‘rsatkichning oldingi davrdagi qiymati; ΔY_t - yalpi hududiy mahsulotning real o‘zgarishi; Y_{t-1} - oldingi davrdagi yalpi hududiy mahsulot. Iqtisodiy o‘sish sharoitida $e_t < 0$ bo‘lsa, kuchli dekapling, $0 \le e_t < 0{,}8$ bo‘lsa, zaif dekapling qayd etiladi. Formula mintaqaviy strategiyaning monitoring blokida yillik baholash vositasi sifatida qo‘llanilib, har bir hudud uchun o‘sishning resurs sig‘imi qay darajada qisqarayotganini aniqlash imkonini beradi.

Strategik maqsadlarga erishish darajasini o‘lchash uchun maqsadga yaqinlashish indeksi qo‘llanildi:

$$P_t = \frac{X_t - X_0}{X^* - X_0} \times 100 \qquad (2)$$

bu yerda P_t - t yilda strategik maqsadga erishish darajasi, foizda; X_t - ko‘rsatkichning t yildagi haqiqiy qiymati; X_0 - strategik davr boshidagi bazaviy qiymat; X^* - strategiyada belgilangan maqsadli qiymat. Indeks bazaviy holat va maqsad o‘rtasidagi masofaning qancha qismi bosib o‘tilganini ko‘rsatadi hamda turli o‘lchov birliklaridagi ko‘rsatkichlarni yagona shkalada taqqoslash imkonini beradi. Amaliy hisob-kitob uchun Xalqaro qayta tiklanuvchi energiya agentligi (IRENA) ning 2016-2025-yillarga oid o‘rnatilgan quvvatlar statistikasi [8] va lex.uz milliy bazasida e’lon qilingan strategik hujjatlar asosiy axborot manbasi bo‘lib xizmat qildi.

TAHLIL VA NATIJALAR

O‘zbekistonda yashil iqtisodiyotga o‘tishning institutsional asosi bosqichma-bosqich shakllanib, har bir keyingi hujjat maqsadlar tizimini aniqlashtirish va kengaytirish yo‘lidan bordi. 2019-yilda qabul qilingan yashil iqtisodiyotga o‘tish strategiyasi energiya samaradorligini oshirish, energiya iste’molini diversifikatsiya qilish, iqlim o‘zgarishiga moslashish va moliyaviy mexanizmlarni joriy etishni ustuvor

yo‘nalishlar sifatida belgilab, 2030-yilga qadar issiqxona gazlarining yalpi ichki mahsulot birligiga nisbatan solishtirma chiqindilarini 2010-yil darajasidan 10 foizga qisqartirishni nazarda tutgan [20]. 2022-yilgi chora-tadbirlar ushbu vazifalarni miqdoriy jihatdan aniqlashtirib, qayta tiklanuvchi manbalar quvvatini 15 GVt ga oshirish va energiya sig‘imini 30 foizga kamaytirishni belgiladi [19]. “O‘zbekiston - 2030” strategiyasi qayta tiklanuvchi energiya quvvatlarini 25 ming MVt ga, ularning jami iste’moldagi ulushini 40 foizga yetkazishni ko‘zda tutdi [18]. Asosiy maqsadli ko‘rsatkichlar 1-jadvalda umumlashtirildi.

1-jadval

O‘zbekistonning yashil transformatsiyaga oid strategik hujjatlaridagi 2030-yilgacha bo‘lgan maqsadli ko‘rsatkichlar[1]

Ko‘rsatkich	PQ-4477 (2019)	PQ-436 (2022)	PF-158 (2023)
YaIM birligiga issiqxona gazlari chiqindilarini 2010-yilga nisbatan qisqartirish	10 foiz	35 foiz	30 foiz
Qayta tiklanuvchi energiya quvvati	belgilanmagan	15 GVt	25 ming MVt
Qayta tiklanuvchi energiya ulushi	elektr energiyasi ishlab chiqarishning 25 foizidan ortiq	elektr energiyasi ishlab chiqarishning 30 foizidan ortiq	jami iste’molning 40 foizi
Sanoatda energiya samaradorligini oshirish	kamida 20 foiz	kamida 20 foiz	energoaudit tizimini joriy etish
Suvni tejovchi sug‘orish texnologiyalari	1 mln gektargacha	1 mln gektargacha	-
Shaharlardagi yashil maydonlar	-	30 foizdan ortiq	-

1-jadval ma’lumotlari milliy yashil strategiyaning uchta muhim xususiyatini ko‘rsatadi. Birinchidan, maqsadlar tizimi sifat jihatidan boyib bordi: 2019-yilgi strategiyada asosiy urg‘u yo‘nalishlar va nisbiy ko‘rsatkichlarga berilgan bo‘lsa, keyingi hujjatlarda mutlaq quvvat hajmlari, energiya sig‘imi va yashil maydonlar kabi aniq o‘lchanadigan maqsadlar paydo bo‘ldi. Ikkinchidan, qayta tiklanuvchi energetika bo‘yicha maqsadlar izchil oshirildi, bu erishilgan amaliy natijalar strategik rejalashtirishga qayta aloqa sifatida ta’sir ko‘rsatganidan dalolat beradi. Uchinchidan, iqlim bo‘yicha maqsad yalpi ichki mahsulot birligiga nisbatan belgilangan, ya’ni u nisbiy dekapling mantiqiga asoslangan bo‘lib, iqtisodiy o‘sishni cheklamasdan uning uglerod sig‘imini kamaytirishni ko‘zda tutadi. Mintaqaviy strategiyalar uchun bu xususiyatlar muhim metodologik ko‘rsatma bo‘lib xizmat qiladi: hududiy maqsadlar milliy ko‘rsatkichlar bilan bir xil o‘lchov birliklarida ifodalanganda ularning hissasini jamlash va baholash imkoniyati paydo bo‘ladi.

Energetika sohasi yashil transformatsiyaning yetakchi yo‘nalishi sifatida tanlanganining asosli sabablari mavjud. Xalqaro energetika agentligi ma’lumotlariga ko‘ra, 2019-yilda O‘zbekistonda elektr energiyasi ishlab chiqarishning 85 foizi tabiiy

[1] Manba: PQ-4477 [20], PQ-436 [19] va PF-158 [18] hujjatlari asosida muallif tomonidan tuzilgan.

gaz hissasiga to‘g‘ri kelgan, mamlakat esa quyosh energiyasining yuqori salohiyatiga ega [7]. Bunday tarkib energiya tizimini diversifikatsiya qilish orqali tabiiy gaz resurslarini tejash va ularni yuqori qo‘shilgan qiymatli qayta ishlashga yo‘naltirish uchun keng imkoniyat yaratadi. Qayta tiklanuvchi energetika bo‘yicha maqsadlarga erishish dinamikasi IRENA statistikasi va (2) formula asosida baholandi. Bazaviy yil sifatida yashil iqtisodiyotga o‘tish strategiyasi qabul qilingan 2019-yil, maqsadli qiymat sifatida “O‘zbekiston - 2030” strategiyasidagi 25 ming MVt ko‘rsatkichi olindi. Hisob-kitob natijalari 2-jadvalda keltirilgan.

2-jadval

O‘zbekistonda qayta tiklanuvchi energiya quvvatlari dinamikasi va strategik maqsadga erishish darajasi, MVt[1]

Yil	Jami qayta tiklanuvchi quvvat	Gidroenergetika	Quyosh, shamol va boshqa manbalar	Ulushi, foizda	Maqsadga erishish darajasi (P), foizda
2019	1912	1908	4	0,2	0,0
2020	2025	2021	4	0,2	0,5
2021	2056	2052	4	0,2	0,6
2022	2429	2225	204	8,4	2,2
2023	3250	2382	868	26,7	5,8
2024	6079	2391	3688	60,7	18,0
2025	10027	2441	7586	75,7	35,1

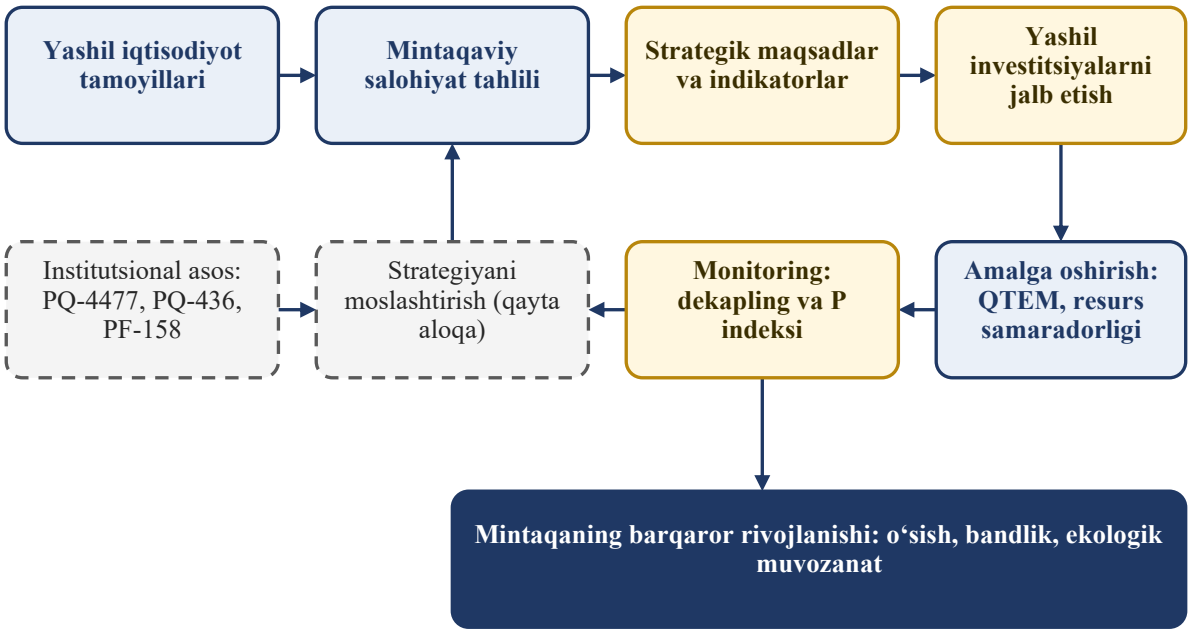
2-jadval qayta tiklanuvchi energetikada sifat jihatidan yangi bosqich boshlanganini yaqqol ko‘rsatadi. 2019-2021-yillarda jami quvvat deyarli to‘liq gidroenergetikaga tayangan bo‘lsa, 2022-yildan boshlab quyosh va shamol elektr stansiyalarining keng ko‘lamda ishga tushirilishi natijasida gidroenergetikadan tashqari manbalar ulushi 2025-yilda 75,7 foizga yetdi. Jami qayta tiklanuvchi quvvat 2022-2025-yillarda 4,1 barobar oshib, 10027 MVt ni tashkil etdi. Maqsadga yaqinlashish indeksi 2025-yilda 35,1 foizni tashkil etgan bo‘lib, bu strategik davrning dastlabki yillarida bazaviy holat va maqsad o‘rtasidagi masofaning uchdan biridan ko‘prog‘i bosib o‘tilganini bildiradi. Indeksning 2023-2025-yillardagi tezlashuvchi dinamikasi yirik investitsiya loyihalarining ishga tushish davri boshlanganini aks ettiradi va 2030-yilgi maqsadga erishish uchun mustahkam asos yaratilganini ko‘rsatadi.

Olingan natijalar mintaqaviy strategiyalar uchun muhim xulosaga olib keladi. Quyosh va shamol stansiyalari tabiiy salohiyati yuqori, bo‘sh yer maydonlari mavjud bo‘lgan hududlarda joylashadi, demak milliy energetika maqsadlariga erishish ko‘p jihatdan mintaqalarning investitsion jozibadorligi, yer ajratish tartibi va tarmoq infratuzilmasiga bog‘liq. Bunday sharoitda mintaqaviy strategiya milliy maqsadlarning hududiy ulushini aniq belgilashi, loyihalar uchun yer va tarmoqqa ulanish imkoniyatlarini oldindan rejalashtirishi hamda yangi quvvatlardan hududiy iqtisodiyot

[1] Manba: IRENA ma’lumotlari [8] asosida muallif tomonidan hisoblangan; maqsadli qiymat PF-158 [18] bo‘yicha olingan.

uchun qo‘shimcha samara olish yo‘llarini ko‘zda tutishi lozim. OECD tajribasi mahalliy darajada qabul qilinadigan qarorlar, jumladan yer resurslaridan foydalanish va infratuzilmani rejalashtirish, yashil investitsiyalarning samaradorligini sezilarli darajada belgilashini tasdiqlaydi [13]. Mintaqaviy strategiya shu tariqa milliy maqsadlarni hududiy loyihalar portfeliga aylantiruvchi bo‘g‘in vazifasini bajaradi.

Nazariy tahlil va amaliy natijalar asosida yashil iqtisodiyot tamoyillari asosida mintaqaviy barqaror rivojlanish strategiyasini shakllantirish mexanizmining konseptual modeli ishlab chiqildi (1-rasm). Model strategik jarayonni chiziqli ketma-ketlik sifatida emas, balki monitoring natijalari salohiyat tahlili va maqsadlarni qayta ko‘rib chiqishga qaytariladigan yopiq boshqaruv sikli sifatida tasvirlaydi. Mexanizmning institutsional asosini milliy strategik hujjatlar tashkil etadi, ular hududiy maqsadlar uchun yo‘nalish va me’yoriy chegaralarni belgilaydi.



1-rasm. Mintaqaviy yashil strategiyani shakllantirish mexanizmi modeli[1]

Izoh: QTEM - qayta tiklanuvchi energiya manbalari; monitoring blokida dekapling elastikligi (1) va maqsadga yaqinlashish indeksi (2) qo‘llaniladi; uzuq chiziqli bloklar qo‘llab-quvvatlovchi elementlarni bildiradi.

1-rasmda aks ettirilgan mexanizm oltita funksional bosqichni birlashtiradi. Yashil iqtisodiyot tamoyillari strategiyaning qadriyat va mezonlar tizimini belgilaydi, mintaqaviy salohiyat tahlili hududning tabiiy resurslari, energiya tizimi va tarmoq tarkibini baholaydi. Strategik maqsadlar va indikatorlar bosqichida milliy ko‘rsatkichlarning hududiy ulushi OECD indikatorlari mantiqida ifodalanadi, yashil investitsiyalarni jalb etish bosqichi davlat va xususiy sheriklik, xalqaro moliya institutlari hamda yashil moliyaviy vositalar orqali resurslarni safarbar qiladi. Amalga oshirish bosqichida qayta tiklanuvchi energetika, resurs samaradorligi va suvni tejash loyihalari ijro etiladi. Monitoring bosqichi (1) va (2) formulalar yordamida natijalarni baholab, olingan ma’lumotlarni strategiyani moslashtirish blokiga uzatadi, u esa

[1] Manba: UNEP [17], L. Albrexts [1] va P. Tapio [15] yondashuvlari asosida muallif ishlanmasi.

navbatdagi siklda salohiyat tahlilini yangilaydi. Modelning afzalligi uning o‘zini-o‘zi tuzatish xususiyatida bo‘lib, 1-jadvalda qayd etilgan maqsadlarning izchil oshirilishi ham xuddi shunday qayta aloqa mantiqini milliy darajada namoyon etadi.

Taklif etilgan modelni hududlar kesimida qo‘llash ularning iqtisodiy ixtisoslashuviga qarab ustuvor bloklarni farqlash imkonini beradi. Sanoati rivojlangan hududlarda asosiy e’tibor resurs samaradorligi va energiya sig‘imini kamaytirishga qaratilib, monitoringda energiya iste’moli bo‘yicha dekapling elastikligi yetakchi ko‘rsatkichga aylanadi. Agrar hududlarda suvni tejovchi sug‘orish texnologiyalari va qishloq xo‘jaligi chiqindilaridan foydalanish ustuvor bo‘lib, suv sarfining yalpi hududiy mahsulotga nisbati asosiy nazorat ko‘rsatkichi sifatida olinadi. Quyosh va shamol salohiyati yuqori hududlarda qayta tiklanuvchi energetika loyihalari strategiyaning tayanch yo‘nalishini tashkil etadi va maqsadga yaqinlashish indeksi hududiy ulush bo‘yicha hisoblanadi. Bunday farqlash M. Kapasso va hammualliflari [4] ta’kidlagan texnologiyalar, siyosat va hududiy institutlar uyg‘unligini amalda ta’minlaydi hamda milliy maqsadlarga har bir mintaqa o‘z qiyosiy ustunliklari orqali hissa qo‘shishiga sharoit yaratadi.

XULOSA VA TAKLIFLAR

O‘tkazilgan tadqiqot yashil iqtisodiyot tamoyillari mintaqaviy barqaror rivojlanish strategiyasining mazmuni va tuzilishini tubdan boyitishini ko‘rsatdi. UNEP va OECD konsepsiyalari strategiyaning qadriyat asosini, dekapling nazariyasi uning o‘lchov vositalarini, strategik hududiy rejalashtirish nazariyasi esa jarayonning tashkiliy mantiqini belgilaydi. Ushbu uch nazariy qatlamni birlashtirish mintaqaviy strategiyani hujjat sifatida emas, balki doimiy ravishda o‘zini tuzatib boruvchi boshqaruv sikli sifatida talqin etish imkonini berdi. O‘zbekistonning strategik hujjatlari tahlili maqsadlar tizimining izchil takomillashib, nisbiy ko‘rsatkichlardan aniq mutlaq maqsadlarga o‘tganini ko‘rsatdi. Qayta tiklanuvchi energetika bo‘yicha hisob-kitoblar 2025-yilda strategik maqsadga erishish darajasi 35,1 foizni tashkil etganini hamda gidroenergetikadan tashqari manbalar jami qayta tiklanuvchi quvvatning to‘rtdan uch qismidan ortig‘ini egallaganini aniqladi.

Mintaqalarning yashil strategiyalarini shakllantirish mexanizmini takomillashtirish uchun quyidagi takliflar ilgari suriladi. Birinchidan, milliy strategik maqsadlarni hududlar kesimida taqsimlash va har bir mintaqa uchun qayta tiklanuvchi energetika, energiya sig‘imi hamda suv sarfi bo‘yicha hududiy maqsadli ko‘rsatkichlarni belgilash maqsadga muvofiq. Ikkinchidan, mintaqaviy statistika tizimiga OECD yashil o‘sish indikatorlariga moslashtirilgan hududiy ko‘rsatkichlar to‘plamini joriy etish va ular asosida har yili dekapling elastikligini hisoblash lozim. Uchinchidan, hududiy investitsiya dasturlarida yashil loyihalar uchun yer uchastkalari va tarmoqqa ulanish imkoniyatlarini oldindan belgilovchi “yashil investitsiya xaritalari”ni shakllantirish tavsiya etiladi. To‘rtinchidan, maqsadga yaqinlashish indeksini hududiy hokimliklar faoliyatini baholash tizimiga kiritish strategik maqsadlarga erishishda mas’uliyatni oshiradi. Beshinchidan, monitoring natijalarini ochiq e’lon qilish va ular asosida mintaqaviy strategiyalarni har uch yilda qayta ko‘rib

chiqish amaliyotini joriy etish mexanizmning qayta aloqa funksiyasini to‘liq ishga tushiradi.

Taklif etilgan choralar “O‘zbekiston - 2030” strategiyasida belgilangan yashil iqtisodiyotni rivojlantirish vazifalari bilan to‘liq uyg‘un bo‘lib, mintaqalarning o‘z tabiiy va iqtisodiy salohiyatiga tayangan holda barqaror rivojlanishini ta’minlashga xizmat qiladi. Keyingi tadqiqotlarda yalpi hududiy mahsulot va energiya iste’moli bo‘yicha hududiy ma’lumotlar asosida mintaqalarning dekapling holatini empirik baholash hamda modelni muayyan hududlar misolida sinovdan o‘tkazish rejalashtirilmoqda.

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FINANCIAL RESOURCES OF HIGHER EDUCATION INSTITUTIONS IN THE TRANSITION TO A GREEN ECONOMY AND THEIR ECONOMIC SUBSTANCE

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Abstract

This paper examines the economic substance of the financial resources of higher education institutions (HEIs) in the context of Uzbekistan's transition to a green economy. It draws a clear distinction between three concepts that are often used interchangeably - financial sources, financial resources, and financial funds - and classifies HEI financial resources into six groups: state-commissioned places (state grants), tuition-contract fees, grants, sponsorship, research projects, and own revenues. For each group, the paper identifies its role in financing the green transformation and the risks it carries. As a contribution to the literature, the paper proposes classifying a set of innovative, repayable and performance-linked financing channels - green bonds, green revolving funds, energy service contracts, international climate grants, "1+1" partnerships with innovation-support funds, crowdfunding, public-private partnerships, and a green-oriented adaptation of the targeted teaching-laboratory fund and HEI-enterprise partnership model proposed by Turobova, Giyazova and Qodirov (2018) - as a distinct "seventh group of resources." The paper also develops indicators for assessing the diversification of financial sources and innovative financing capacity, and offers recommendations for financing the "green" HEI.

Keywords: higher education, financial resources, financial autonomy, tuition contract, state grant, green economy, diversification, sustainable financing.

Annotatsiya

Maqolada O‘zbekistonning yashil iqtisodiyotga o‘tishi sharoitida oliy ta’lim muassasalari (OTM) moliyaviy resurslarining iqtisodiy mohiyati tadqiq etilgan. Ko‘pincha bir ma’noda qo‘llanadigan uchta tushuncha - moliyaviy manbalar, moliyaviy resurslar va moliyaviy mablag‘lar - aniq farqlab berilgan hamda OTM moliyaviy resurslari olti guruhga tasniflangan: davlat buyurtmasi (davlat granti), to‘lov-kontrakt mablag‘lari, grantlar, homiylik, ilmiy loyihalar va o‘z daromadlari. Har bir guruhning yashil transformatsiyani moliyalashtirishdagi roli va unga xos xatarlar aniqlangan. Adabiyotlarga hissa sifatida innovatsion, qaytariladigan va natijaga bog‘langan moliyalashtirish kanallarini - yashil obligatsiyalar, yashil aylanma fondlar, energiya servis shartnomalari, xalqaro iqlim grantlari, innovatsiyalarni qo‘llab-quvvatlash fondlari bilan "1+1" hamkorlik, kraudfanding, davlat-xususiy sheriklik hamda Turobova, Giyazova va Qodirov (2018) taklif etgan maqsadli o‘quv-laboratoriya fondi va OTM - korxona hamkorligi modelining yashil yo‘nalishga moslashtirilgan shaklini - alohida "yettinchi resurslar guruhi" sifatida tasniflash taklif etilgan. Shuningdek, moliyaviy manbalar diversifikatsiyasi va innovatsion moliyalashtirish salohiyatini baholash ko‘rsatkichlari ishlab chiqilgan hamda "yashil" OTMni moliyalashtirish bo‘yicha tavsiyalar berilgan.

Kalit so‘zlar: oliy ta’lim, moliyaviy resurslar, moliyaviy mustaqillik, to‘lov-kontrakt, davlat granti, yashil iqtisodiyot, diversifikatsiya, barqaror moliyalashtirish.

Аннотация

В статье исследуется экономическая сущность финансовых ресурсов высших образовательных учреждений (вузов) в условиях перехода Узбекистана к зелёной экономике. Проведено чёткое разграничение трёх понятий, которые часто используются как синонимы, - финансовые источники, финансовые ресурсы и финансовые средства, - и финансовые ресурсы вузов классифицированы в шесть групп: государственный заказ (государственный грант), плата по контракту, гранты, спонсорство, научные проекты и собственные доходы. Для каждой группы определены её роль в финансировании зелёной трансформации и присущие ей риски. В качестве вклада в литературу предложено выделить в отдельную «седьмую группу ресурсов» совокупность инновационных, возвратных и ориентированных на результат каналов финансирования - зелёные облигации, зелёные возобновляемые фонды, энергосервисные контракты, международные климатические гранты, партнёрство «1+1» с фондами поддержки инноваций, краудфандинг, государственно-частное партнёрство, а также адаптированную к зелёным направлениям модель целевого фонда учебных лабораторий и партнёрства «вуз - предприятие», предложенную Туробовой, Гиязовой и Кодировым (2018). Разработаны также показатели оценки диверсификации финансовых источников и потенциала инновационного финансирования, даны рекомендации по финансированию «зелёного» вуза.

Ключевые слова: высшее образование, финансовые ресурсы, финансовая автономия, плата по контракту, государственный грант, зелёная экономика, диверсификация, устойчивое финансирование.

INTRODUCTION

Uzbekistan's strategy for transitioning to a green economy for 2019-2030, approved by Presidential Resolution No. PQ-4477 of 4 October 2019, names improving energy efficiency, expanding the use of renewable energy, adapting to climate change, and developing the financial and non-financial mechanisms needed to support the green economy as priority directions [19]; [23]. The strategy also calls for integrating green-economy principles into education and science, including updating the curricula of higher and specialized secondary education in relevant fields [39]. Higher education institutions therefore carry a double responsibility: they train the specialists the green transition needs, while at the same time being economic actors that themselves require “green” infrastructure - energy-efficient buildings, solar installations, modern laboratories.

This responsibility has fallen on a system that has been expanding rapidly. In the 2024/2025 academic year, Uzbekistan had 222 operating HEIs, 99 of them private; student numbers rose from 571,500 in 2020/2021 to 1,432,800. Over the same period the number of academic staff grew from 32,100 to 49,600, so the number of students

per teacher rose from 17.8 to 28.9 [26]. This has intensified the financial pressure on infrastructure and quality.

Financial autonomy has also been extended in stages. From 1 January 2022, HEIs granted financial autonomy dissolved their boards of trustees and replaced them with supervisory boards in which at least 70% of members are drawn from the ministry, employers, the public and sponsors [20]; [32]. Against this backdrop, the composition of HEI financial resources, the balance between different sources, and the scope for using them to support the green transition have become a pressing research question.

The purpose of the study is to clarify the economic substance of HEI financial resources and to develop recommendations for improving how they are formed and used in the context of the transition to a green economy.

Objectives: (1) to distinguish the core concepts; (2) to classify the resources and establish the economic substance of each group; (3) to assess the opportunities and risks each presents from the standpoint of the green transition; (4) to offer practical recommendations.

LITERATURE REVIEW

The topic sits at the intersection of four strands of research: the theory of higher education finance, the financial management of HEIs in Uzbekistan, research on the green economy, and green finance. Each strand has been studied in its own right, but the overlap between them has received far less attention.

The first strand - the theoretical foundations of higher education finance - analyzes financing models through the lens of resource dependence theory and performance-based funding. Resource dependence theory has been applied to Uzbekistan's HEIs by Kholmuminov, Kholmuminov and Wright (2019) [35]. The advantages and risks of performance-based funding have been examined by Dougherty and Natow (2015), Kivistö and Suprun (2024), and Matveeva (2025) [3; 10; 11]. HEI financial sustainability is addressed in an OECD report [14], and university autonomy in the European University Association's scorecard [15].

The second strand - the financial resources of Uzbekistan's HEIs - has attracted considerable attention from domestic authors in recent years:

- a study assessing the capacity of financially autonomous state HEIs for self-financing was published in the journal Nashrlar (2024) [29];
- the management of financial-resource formation has been analyzed using Tashkent State University of Economics, the Tashkent Institute of Finance, and the state universities of Andijan, Bukhara, Namangan and Qarshi, covering financial and academic autonomy, budget sources, tuition-contract revenue, and the balance of income and expenditure [28];
- a 2026 article identifies the centralization of financial management, the incomplete rollout of performance-based funding, and the need for greater transparency as the principal problems facing HEIs, and recommends developing endowment funds and strengthening financial autonomy [33];

- Bayuetdinov and Medetbayeva (2025), using Uzbekistan's state universities as their case, identify limited financial sources, imprecise forecasting and weak financial oversight as the core problems, and propose diversifying sources [30];

- a 2026 paper on alternative financing sources argues that HEIs' heavy reliance on tuition-contract revenue heightens financial risk, and reviews the potential of research projects, grants, consulting, start-ups, endowment funds and public-private partnerships [31];

- a 2025 article compares financing models - neoliberal, social-democratic, mixed, corporate, endowment and public-private partnership - drawing on international experience [34];

- a study of the role of the state budget concludes that the budget remains the leading source of financing and that alternative sources are needed [36];

- Abdualimova and co-authors (2026) propose a composite index for assessing the shift from financial autonomy to performance-based funding and pilot it across six HEIs - one of the few studies to examine sustainable-development finance at the level of the individual institution [26].

The third strand - the green economy and higher education - owes much to researchers at Bukhara State University. H.R. Turobova and M. M. Qodirova jointly produced the textbook Green Economy (Bukhara, 2025, 96 pp.), which argues for integrating green-economy principles into education and science [39]. Two further papers by Turobova cover related ground: bioeconomy [38], and the priority given to the circular economy and the Sustainable Development Goals in Uzbekistan's national strategic programmes [37].

The work most directly relevant to the present study is the 2018 article by H.R. Turobova, N.B. Giyazova and A.A. Qodirov, which raises the question of how to finance teaching laboratories for training economists and how such financing might be improved [40]. The authors found that, at the time, teaching laboratories existed only in the exact and natural sciences - none had been established for economics, finance or accounting. At Bukhara State University, for instance, there were laboratories in physics (5), soil science and geography (2), chemistry (2), occupational safety (6), ecology (1) and biology (2), but not a single one in economics. The authors cite the Ministry of Finance's Fund for the Development of the Material and Technical Base of Higher Education Institutions, which spent 312 billion soum nationally in 2015 and 355.6 billion soum in 2016, and note that 1,921.5 million soum was earmarked for modernizing Bukhara State University's teaching-laboratory base between 2017 and 2021.

The scientific novelty and proposal of that study was to establish a targeted “teaching-laboratory fund” financed from four sources: (I) state budget funds (the Material and Technical Base Fund); (II) contributions from students or their parents (an additional payment equal to 1-2% of the contract fee); (III) sponsorship; and (IV) state or foreign grants. The authors also proposed an “educational institution - production enterprise” partnership model, under which an enterprise sets aside a room on its premises as a teaching laboratory, students gain hands-on experience in small

groups, and the enterprise pays the salary of the specialist who heads the laboratory - a way of drawing in financial and staffing resources at no additional cost to the HEI.

Abroad, a study based on panel data for 30 Chinese provinces over 2003-2021 assessed the impact of higher-education resources, including budgetary resources, on green economic growth [17]. The degree to which sustainable development has been integrated into universities in Central Asia, the South Caucasus and the European Union has also been compared [2].

The fourth strand - green finance and "green university" financing - includes a study covering the RCEP region for 2000-2020, which found that a one-percentage-point increase in the share of the population with higher education raised sustainable energy development by 0.19% in the short run and 0.29% in the long run, with green finance contributing 0.43% and 0.38% respectively [12]. Research on "green campuses" identifies high upfront investment and financial constraints as the main barriers, and points to green bonds and sustainability-linked loans as possible solutions [1]. Mechanisms for financing "green universities" in emerging economies were examined separately in a 2026 study [4], and a recent edited volume on the role of universities in the green transition stresses the importance of financial incentives and governance readiness [8].

Research gap. Taken together, the literature reviewed shows that: (1) the financial resources of Uzbekistan's HEIs and their diversification have been well studied; (2) the link between the green-economy strategy and education has been addressed from a curricular standpoint; (3) green finance instruments have been studied in the context of HEIs abroad; and (4) Turobova, Giyazova and Qodirov (2018) [40] proposed a targeted financing fund and an HEI-enterprise partnership model in the specific context of teaching economics. What has not yet been done systematically is to classify the six traditional types of HEI financial resource together from the standpoint of the green transition, to link their economic substance to their green-investment potential, to adapt the targeted-fund model proposed by Turobova and co-authors to green (energy and ecology) directions, and to propose corresponding quantitative indicators - a diversification index, a green-investment-intensity indicator, and an innovative-financing-capacity indicator. This paper aims to fill that gap.

METHODOLOGY

The study draws on analysis of legal and regulatory documents, systematic and comparative analysis, and classification. Two indicators proposed by the author are used to assess the diversification of financial sources:

- Source concentration index: $HHI = \Sigma si^2$, where si is the share of source i in total revenue (from 0 to 1). The smaller the index, the higher the diversification; 1/HHI gives the "effective number of sources."

- Green investment intensity: G = funds directed to green projects / total HEI expenditure.

The information base of the study comprises the legal acts regulating the financing and financial autonomy of state HEIs and the green-economy strategy of Uzbekistan [19-25], official statistical and open data on the higher education system summarized

in recent studies [26; 32], and domestic and international research on higher education finance, green universities and green finance instruments [1; 3; 12; 14; 17; 35; 40]. The analysis proceeds in three steps. First, the concepts of financial sources, resources and funds are separated by their content and level of analysis. Second, the six traditional sources of HEI financing are classified by origin, purpose, predictability and competitiveness, and each is assessed in terms of its role in the green transition and its main risk; the same sources are then categorized by five green-economy criteria. Third, innovative financing channels are identified and described by implementation mechanism, conditions and risks, and an additional indicator of innovative financing capacity is proposed. The indicators are designed so that they can be calculated from an HEI's annual financial reports.

ANALYSIS AND RESULTS

Interpreting the Concepts

In the economic literature, the terms "financial sources," "financial resources" and "financial funds" are frequently used interchangeably. For analytical precision, this paper distinguishes between them as set out in Table 1.

Table 1

Distinguishing the Core Concepts[1]

Concept	Meaning	What it represents
Financial sources	Where money comes from and from whom	Origin: the state budget, applicants and their parents, donors, business, the HEI's own activities
Financial resources	The pool of funds accumulated from these sources and held by the HEI for designated use	An economic category: the HEI's development potential and financial capacity
Financial funds	The actual money in accounts and in cash on a given date, including balances and flows	An operational category: the level of accounting and treasury execution

In short: a source is "where it comes from," a resource is "what has been formed and is ready to be used," and a fund is "what is currently on the books." Resources are therefore broader than sources, since they also include internal accumulations; a fund is the operational, monetary expression of a resource.

Classification of HEI Financial Resources

The classification can be organized around four criteria: origin (budgetary or extra-budgetary), purpose (earmarked or unrestricted), predictability (stable or variable), and competitiveness (formula-based or competitive). On this basis, Table 2 sets out the six main sources available to HEIs.

Table 2 shows that the six sources differ not only in origin but also in their suitability for green projects. The state commission is the most stable but also the most budget-dependent source; tuition-contract fees and own revenues are the most flexible sources and can be partly earmarked for green development; grants, sponsorship and research projects are the sources most directly suited to financing green equipment,

[1] Source: compiled by the author.

laboratories and research, but they are periodic and depend on external parties. The economic substance of each source is considered in more detail below

Table 2

Classification and Economic Substance of HEI Financial Resources[1]

Source	Economic substance	Role in the green transition	Main risk
State-commissioned places (state grant)	Covers the cost of training specialists from the budget on a normative basis; earmarked, stable	Funds core teaching and academic-staff costs; creates scope for expanding the state's commission for green-related fields	Dependence on the budget cycle; weaker incentive to innovate
Tuition-contract fees	Private payment charged for the service on a cost basis; unrestricted, demand-sensitive	The principal extra-budgetary source for building a development fund	Ability to pay, inequality, over-reliance on contract revenue
Grants	Competitive, earmarked financing from international and domestic donors	The best-suited source for green projects, equipment and curricula	Periodicity; dependence on donor conditions
Sponsorship	Voluntary, non-repayable or earmarked donations from individuals and legal entities	Green campus facilities, scholarships, laboratories	Uncertainty; influence of sponsor interests
Research projects	Research income from state science programmes and commissioned contracts	Finances research on green technology, energy and ecology; commercialization	Uncertain outcomes; demands specialist staff
Own revenues	Income from continuing education, consulting, leasing, technology parks, start-ups and other services	A flexible and stable internal source; reinvesting the savings from energy efficiency	Risk of drifting from the core mission

State-commissioned places. In financially autonomous HEIs, the cost of training specialists under the state commission (state grant) is financed from the state budget under the procedure approved by Cabinet of Ministers Resolution No. 419 of 1 August 2022, and formalized through a contract between the commissioning body and the HEI [22]. The admissions system and the procedure for allocating the state commission were further refined by Presidential Decree No. PF-81 of 24 May 2024 [24]. Economically, this is normative financing based on the principle of "number of students × average cost," which HEIs use to cover teaching expenses.

Tuition contracts. Within the scope of financial autonomy, HEIs set their own tuition-contract fees, including differentiated fees [27; 32]. This gives an HEI room to manage its revenue, but rising fees can reduce access for prospective students. From the standpoint of the green transition, it would make sense to earmark part of contract revenue for a dedicated "green development fund."

Grants. The form of grants available to students is also evolving. Under Cabinet of Ministers Resolution No. 149 of 10 March 2025, students may receive one of two types of grant: one that covers tuition fully from the state budget, and one that is covered partly from the funds of financially autonomous universities [25]. Student grants can therefore be both a source of HEI financial resources and an item of

[1] Source: compiled by the author.

expenditure. Beyond this, research and development grants - funded by international organizations and donors - carry particular weight for green projects.

Sponsorship. The presence of sponsor representatives on supervisory boards creates a channel for drawing them into an HEI's strategy [32]. Pooling sponsorship funds in a dedicated fund - for energy-saving projects, for instance - improves transparency.

Research projects and own revenues. Research builds the "knowledge base" of the green economy while also serving as a source of financial resources. Own revenues are an HEI's most flexible and stable source; as they grow, dependence on the budget falls [31].

Categorizing Financial Resources from the Standpoint of the Green Economy

The classification in Table 2 is based on where resources originate - the state commission, contracts, grants, and so on - and applies universally to any HEI activity. But under the transition to a green economy, each of these six sources also needs to be assessed against a further set of criteria - purpose-orientation, environmental effect, time horizon, repayability, and level of management - because these are what determine how far a given resource actually serves the green transformation. Table 3 sets out a multi-dimensional (matrix) classification of HEI financial resources built on these criteria.

Table 3

Categorization of HEI Financial Resources from the Green-Economy Perspective[1]

Classification criterion	Categories	Explanation and examples
1. By purpose-orientation	Green (earmarked) resources Neutral (general-purpose) resources	Green resources must be spent solely on ecological/energy projects (e.g. a GCF or GEF grant, a green bond). Neutral resources (the state commission, tuition contracts, own revenues) are directed to general needs, though part may be allocated to green projects.
2. By nature of environmental effect	Direct effect Indirect effect	Direct: a grant for solar panels or an energy audit, where the effect is immediately measurable. Indirect: spending on training specialists or research, where the effect emerges over the long run through human capital.
3. By financing horizon	Short-term (up to 1 year) Medium-term (1-3 years) Long-term (over 3 years)	Short-term: a grant for current energy costs. Medium-term: laboratory modernization (e.g. Bukhara State University's 1,921.5 million soum programme for 2017-2021). Long-term: a green bond, a PPP, campus infrastructure.
4. By repayability	Non-repayable resources Repayable (revolving) resources	Non-repayable: a grant, sponsorship, the state commission - given once and not repaid. Repayable: a green revolving fund, an ESCO contract, a bond - savings or repayments finance new projects.
5. By level of management	Centralized (state-managed) Decentralized (HEI-managed)	Centralized: the state budget, the Ministry of Finance's Material and Technical Base fund. Decentralized: an HEI's own revenues, sponsorship, targeted internal funds (e.g. a "teaching-laboratory fund").

[1] Source: compiled by the author.

These five criteria are not mutually exclusive - their intersection defines the "green profile" of any given resource. A green bond, for example, can be characterized as purpose-oriented (1) + direct-effect (2) + long-term (3) + repayable (4) + decentralized (5); the state commission, by contrast, is neutral + indirect-effect + +long-term + non-repayable + centralized. This kind of multi-dimensional categorization gives HEI leadership a practical tool for deciding which source suits which green project: unrestricted, non-repayable resources (own revenues, sponsorship) fit short-term, rapid ecological measures, while long-term, repayable resources (green bonds, revolving funds, PPPs) are better suited to major infrastructure projects.

Distinctive Features of Financial Resources under the Green Transition

Green campuses require large upfront investment, with returns accruing only over the long run through energy savings. Research on the "green university" model stresses that it requires integrating energy efficiency, renewable energy, sustainable infrastructure, waste management and environmental education into an institution's development strategy - which in turn calls for long-term planning and new financing mechanisms [4].

An example from Uzbekistani practice: a pilot analysis based on open data from Bukhara State University records a roughly 2-billion-soum solar power installation and campus-wide LED and inverter upgrades [26]. This shows that HEIs can finance green investments from their own resources, but such cases are not yet systematic and have not been confirmed by audited financial data.

There are also risks attached to the exercise of financial autonomy. As the authors of the pilot analysis point out, Tashkent hosts 98 HEIs and 37.6% of all students (539,400), so financing tied to rankings, without an equalization mechanism, could reinforce the dominance of the capital's institutions [26]. The student loan system is under similar pressure: the World Bank has approved a USD 250 million loan under the EduImkon programme, intended to provide study loans to roughly 600,000 young people [18].

A Procedure for Diversifying Financial Sources

To apply the proposed indicators in practice, an HEI can follow this sequence:

11. group annual revenue by the six sources and calculate each share (si);
12. calculate the HHI and the "effective number of sources" (1/HHI): even where all six sources are present, diversification will in practice be low if most revenue is concentrated in a single source, such as contracts;
13. assess green investment intensity (G) and its breakdown by source, to establish which source is financing green projects and to what extent;
14. track the trend over time and compare across groups of HEIs (capital-city, regional, sector-specific).

Scientific Novelty: Innovative Channels for Mobilizing Financial Resources

The novelty of this study lies in bringing together, for the first time in a single framework, a set of innovative channels through which HEIs can mobilize financial

resources for the green transition beyond the traditional six sources - identifying for each its implementation mechanism, its conditions, and its risks (Table 4).

Table 4

Innovative Channels for Mobilizing Financial Resources for HEIs[1]

Innovative instrument	Implementation mechanism	Conditions and risks for Uzbekistan's HEIs
Green bonds	An HEI or a consortium issues a bond earmarked for a specific purpose (energy saving, a solar power plant, a "green" building), serviced from tuition-contract and development-fund revenue. Worldwide, HEIs have raised USD 15 billion through green bonds [6]	Uzbekistan has not yet developed a legal framework allowing state HEIs to issue bonds; piloting the approach through a consortium of major universities would be a sensible first step
Green revolving fund	A one-off capital allocation is made to energy-efficiency projects; the savings are returned to the fund and used to finance the next round of projects, turning it into a self-replenishing source [13]	Requires initial capital (from own revenue, sponsorship or a grant); demands transparent management and precise accounting of savings
Energy service contracts (ESCO/EPC)	An external energy service company carries out modernization at its own expense and recovers its costs from the energy savings generated in subsequent years, letting the HEI benefit from green modernization without upfront investment	Institutional experience in contracting and in monitoring realized energy savings is limited; an audit and monitoring system is needed
International climate grants (GCF, GEF, etc.)	Large, competitively awarded grants (the Green Climate Fund, the Global Environment Facility) finance renewable-energy and climate-adaptation projects [5; 7]	Complex application and reporting requirements; needs project-management capacity and an English-proficient team
Innovation-support funds and "1+1" partnerships	A share of the profits of enterprises with more than 50% state ownership is directed to innovation funds; HEIs commercialize green technologies in partnership with industry on a "1+1" basis and set up spin-off companies in technology parks [21]	Requires aligning HEIs' research capacity with business needs and building intellectual-property management systems
Crowdfunding and alumni platforms	Digital platforms mobilize many small donations from donors and alumni, which can evolve into an endowment fund over time	Requires trusted digital infrastructure, transparent reporting, and a system for maintaining long-term ties with alumni
Public-private partnerships (PPPs)	Campus infrastructure (dormitories, laboratories, energy facilities) is built in partnership with a private investor and leased or paid for under a long-term contract	Requires clearly defined mechanisms for sharing legal and financial risk and a settled long-term tariff policy
Targeted teaching-laboratory fund and HEI-enterprise partnership	Following the 2018 proposal by Turobova, Giyazova and Qodirov: a targeted fund financed from four sources (the state budget/Material and Technical Base fund, a 1-2% student/parent contribution, sponsorship, grants); an enterprise sets aside a laboratory room on its premises and pays the salary of the specialist who heads it [40]	Applied to green fields (energy audits, environmental laboratories), it gives an HEI a practical research base at no cost; requires a long-term contract with the enterprise and ongoing monitoring

[1] Source: compiled by the author based on [5; 6; 7; 13; 21; 40].

What these instruments have in common is that, unlike the traditional six sources, all of them rest on repayable or performance-linked financing: funds are not provided once, but are replenished repeatedly through savings or commercialization. This is the defining feature that sets them apart from the six traditional sources described above (Table 2), and is the basis for proposing that they be classified separately as a "seventh - innovative - group of resources."

To assess the financial potential of these innovative instruments, a third indicator can be added to those introduced in the Methodology section:

Innovative financing capacity: I = (green bonds + funds mobilized through ESCO + grants + crowdfunding + PPP share) / total HEI development expenditure. The higher the value of I, the less an HEI's green transformation depends on the budget and tuition-contract revenue.

Major international studies point in the same direction: among the range of financing channels available - green bonds, sustainability-linked loans, revolving funds - revolving funds tend to be the most stable, since they are less exposed to external market conditions and are managed within the HEI itself [9; 16].

CONCLUSION AND SUGGESTIONS

1. "Financial source," "financial resource" and "financial fund" are related but distinct concepts: a source denotes origin, a resource denotes the economic capacity that has been formed, and a fund denotes the actual money on the books.

2. The six groups of HEI resources differ in their purpose-orientation, stability and flexibility. The state commission provides stability; tuition contracts and own revenues provide flexibility; grants, sponsorship and research projects create additional scope for development and for green projects.

3. The state budget remains the leading source [36], so the green transition should not be confined to the budget alone - extra-budgetary sources, both internal and external, need to be expanded.

4. Unlike the traditional six sources, innovative instruments such as green bonds, green revolving funds, energy service contracts, international climate grants, "1+1" partnerships with innovation funds, crowdfunding and public-private partnerships rest on repayable and performance-linked financing, and have the potential to reduce an HEI's dependence on the budget and on contract revenue.

Based on these conclusions, the following recommendations are proposed:

1. Establish a dedicated "green development fund" in every financially autonomous HEI, financed from contract revenue, own revenues and sponsorship;

2. Adapt the four-source targeted fund and "HEI-enterprise" partnership model proposed by Turobova, Giyazova and Qodirov (2018) [40] to the establishment of energy-audit and environmental laboratories;

3. Redirect the savings generated by energy efficiency back into this fund, on the revolving-fund principle;

4. Examine separately the legal scope for state HEIs to use instruments such as green bonds, sustainability-linked loans and energy service contracts;

5. Disclose annual financial reports together with the HHI and G indicators;

6. Preserve equalization grants for regional HEIs once ranking-based financing begins in 2027 [26].

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BARQAROR RIVOJLANISHNING GLOBAL VA MILLIY MAQSADLARIGA ERISHISHDA BIOIQTISODIYOTNING ROLI VA AMALIY AHAMIYATI

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Annotatsiya

Maqolada Birlashgan Millatlar Tashkilotining 2030-yilgacha bo'lgan Barqaror rivojlanish maqsadlari (BRM) hamda O'zbekistonning milliy BRMlariga erishishda bioiqtisodiyotning o'rni va amaliy ahamiyati tadqiq etilgan. Bioiqtisodiyot tushunchasining nazariy evolyutsiyasi hamda uning "yashil" va sirkulyar iqtisodiyot bilan o'zaro nisbati tizimlashtirilgan. Global karbonat angidrid (CO_2) chiqindilari, Yevropa Ittifoqi bioiqtisodiyotining makroiqtisodiy ko'rsatkichlari, shuningdek, O'zbekistonda qishloq xo'jaligi, qayta tiklanuvchi energetika va maishiy chiqindilar bilan bog'liq 2024-2025-yillar ma'lumotlari qiyosiy tahlil qilingan. Bioiqtisodiyotning beshta tarmog'i va to'qqizta BRM o'rtasidagi bog'liqlik matritsasi asosida sohaning eng kuchli ta'siri BRM-13 (iqlim o'zgarishiga qarshi kurash), BRM-8 (munosib mehnat va iqtisodiy o'sish) va BRM-12 (mas'uliyatli iste'mol va ishlab chiqarish) maqsadlariga to'g'ri kelishi aniqlangan. Tadqiqot natijalariga ko'ra, O'zbekistonda bioiqtisodiyotni rivojlantirishning huquqiy-institutsional asoslari shakllangan bo'lsa-da, sohaga oid alohida milliy strategiya, statistik o'lchov tizimi va organik chiqindilarni qayta ishlash infratuzilmasi yetarli emas. Milliy bioiqtisodiyot strategiyasini ishlab chiqish, bioiqtisodiyotni statistik hisobga olish, dehqon va fermer xo'jaliklarida biogaz texnologiyalarini keng joriy etish hamda hududiy bioiqtisodiy klasterlarni tashkil etishga oid taklif va tavsiyalar ishlab chiqilgan.

Kalit so'zlar: bioiqtisodiyot, barqaror rivojlanish maqsadlari, sirkulyar iqtisodiyot, "yashil" iqtisodiyot, biomassa, qayta tiklanuvchi energiya, chiqindilarni qayta ishlash, O'zbekiston.

Аннотация

В статье исследованы роль и практическое значение биоэкономики в достижении Целей устойчивого развития (ЦУР) Организации Объединённых Наций до 2030 года и национальных ЦУР Узбекистана. Систематизированы теоретическая эволюция понятия биоэкономики и её соотношение с «зелёной» и циркулярной экономикой. Проведён сравнительный анализ глобальных выбросов диоксида углерода (CO_2), макроэкономических показателей биоэкономики Европейского союза, а также данных за 2024-2025 годы по сельскому хозяйству, возобновляемой энергетике и бытовым отходам в Узбекистане. На основе матрицы взаимосвязей между пятью отраслями биоэкономики и девятью ЦУР установлено, что наиболее сильное влияние биоэкономики приходится на ЦУР 13 (борьба с изменением климата), ЦУР 8

(достойная работа и экономический рост) и ЦУР 12 (ответственное потребление и производство). Результаты показывают, что, несмотря на сформированные правовые и институциональные основы, в Узбекистане пока недостаточно развиты отдельная национальная стратегия биоэкономики, система её статистического измерения и инфраструктура переработки органических отходов. Разработаны предложения по подготовке национальной стратегии биоэкономики, статистическому учёту биоэкономики, широкому внедрению биогазовых технологий в дехканских и фермерских хозяйствах и созданию региональных биоэкономических кластеров.

Ключевые слова: биоэкономика, цели устойчивого развития, циркулярная экономика, «зелёная» экономика, биомасса, возобновляемая энергия, переработка отходов, Узбекистан.

Abstract

The article examines the role and practical significance of the bioeconomy in achieving the United Nations 2030 Sustainable Development Goals (SDGs) and the national SDGs of Uzbekistan. The theoretical evolution of the bioeconomy concept and its relationship with the green and circular economy are systematised. Global carbon dioxide (CO_2) emissions, macroeconomic indicators of the European Union bioeconomy, and 2024-2025 data on agriculture, renewable energy and municipal waste in Uzbekistan are analysed comparatively. An interlinkage matrix between five bioeconomy sectors and nine SDGs shows that the strongest contribution of the bioeconomy relates to SDG 13 (climate action), SDG 8 (decent work and economic growth) and SDG 12 (responsible consumption and production). The results indicate that although the legal and institutional foundations for bioeconomy development have been established in Uzbekistan, a dedicated national strategy, a statistical measurement system and infrastructure for processing organic waste remain insufficient. Recommendations are proposed on developing a national bioeconomy strategy, introducing statistical accounting of the bioeconomy, scaling up biogas technologies in smallholder (dehkan) and commercial farms, and establishing regional bioeconomy clusters.

Keywords: bioeconomy, sustainable development goals, circular economy, green economy, biomass, renewable energy, waste recycling, Uzbekistan.

KIRISH

XXI asrda insoniyat oldida turgan eng keskin muammolar - iqlim o‘zgarishi, biologik xilma-xillikning qisqarishi, tuproq degradatsiyasi, suv tanqisligi, oziq-ovqat xavfsizligi va tabiiy resurslarning tugab borishi - an’anaviy “qazib olish - ishlab chiqarish - tashlab yuborish” tamoyiliga asoslangan chiziqli iqtisodiyot modelining chegaralarini yaqqol namoyon etmoqda. Shu sababli qazilma resurslarni qazib olishni imkon qadar kamaytirish, ularni tejash, biologik xilma-xillikni asrash, qayta tiklanadigan xomashyo, biomahsulotlar va ularning chiqindilaridan samarali foydalanishni yo‘lga qo‘yish orqali barqaror rivojlanishni ta’minlash hozirgi davrning eng muhim ilmiy-amaliy vazifalaridan biriga aylandi. Dunyoning ilg‘or mamlakatlari

ushbu vazifani hal etishda “yashil” iqtisodiyot va uning tarkibiy unsurlari, xususan, bioiqtisodiyot taraqqiyotiga tobora ko‘proq tayanmoqda.

O‘zbekistonda ham “yashil” iqtisodiyotga o‘tish davlat siyosatining ustuvor yo‘nalishlaridan biri sifatida belgilangan. Mamlakatimiz Prezidenti Sh.M. Mirziyoyev Oliy Majlis va O‘zbekiston xalqiga Murojaatnomasida hududlarimizning aksariyatida tuproq tarkibi buzilib, unumdor yerlar qisqarib borayotgani, cho‘llanish, suv yetishmasligi va qurg‘oqchilik jiddiy ekologik muammolarga aylanganini ta’kidlab, tabiatni asrab-avaylash har bir mahalla aholisining madaniyati va amaliy harakatiga aylanishi, “yashil” energiyaga tezroq o‘tish hamda bu borada qonunchilikda aniq mexanizmlarni belgilash zarurligini qayd etgan [43].

Qayta tiklanadigan biologik resurs - biomassani ishlab chiqarish, tayyorlash, qayta ishlash va shu sohada xizmat ko‘rsatishga asoslangan bioiqtisodiyot global miqyosda eng istiqbolli yo‘nalishlardan biri sifatida e’tirof etilmoqda, mazkur sohaga yo‘naltirilayotgan investitsion loyihalar soni esa ortib bormoqda. Bioiqtisodiyot biomassadan yuqori qo‘shilgan qiymat yaratish orqali qazilma xomashyodan olinadigan mahsulotlar o‘rnini bosuvchi mahsulotlar ishlab chiqarishga va shu asosda tabiiy resurslarni qazib olishni kamaytirishga xizmat qiladi. BMTning Oziq-ovqat va qishloq xo‘jaligi tashkiloti (FAO) ma’lumotlariga ko‘ra, bugungi kunda 27 ta mamlakat va 3 ta mintaqa alohida bioiqtisodiyot strategiyasini rasman qabul qilgan, yana 14 ta mamlakat uni ishlab chiqish jarayonida [10].

Mamlakatimizda bioiqtisodiyotga mansub tarmoqlar - dehqonchilik, chorvachilik, ipakchilik, qorako‘lchilik, bog‘dorchilik va oziq-ovqat sanoati - tarixan uzoq davr mobaynida rivojlanib kelayotganiga qaramay, “bioiqtisodiyot” atamasi o‘zbek ilmiy muomalasida hali kam qo‘llanilmoqda. O‘zbekistonlik olimlar tomonidan barqaror rivojlanishga oid ko‘plab tadqiqotlar amalga oshirilgan bo‘lsa-da, bioiqtisodiyotni BRMlarga erishishning mustaqil yo‘nalishi sifatida tizimli tadqiq etish yetarli darajada emas. Holbuki, mamlakatda bioiqtisodiyotni rivojlantirishning katta ishlab chiqarish va ilmiy salohiyati mavjud. Bu hol mazkur mavzuning dolzarbligini belgilaydi.

Tadqiqotning maqsadi - bioiqtisodiyotning global va milliy BRMlarga erishishdagi rolini baholash hamda O‘zbekistonda uni rivojlantirish bo‘yicha ilmiy asoslangan taklif va tavsiyalar ishlab chiqishdan iborat. Maqsadga erishish uchun quyidagi vazifalar belgilandi: bioiqtisodiyot tushunchasining nazariy asoslari va uning BRM bilan bog‘liqligini tizimlashtirish; global ekologik bosim va bioiqtisodiyotni rivojlantirish bo‘yicha xalqaro tajribani qiyosiy tahlil qilish; O‘zbekistonda bioiqtisodiyot rivojining huquqiy-institutsional va resurs asoslarini baholash; bioiqtisodiyot tarmoqlarining BRMlarga ta’sirini matritsa usulida baholash; amaliy taklif va tavsiyalar ishlab chiqish.

ADABIYOTLAR SHARHI

“Bioiqtisodiyot” g‘oyasining ilmiy ildizlari N. Georgescu-Roegenning iqtisodiy jarayonni termodinamika qonunlari, xususan, entropiya qonuni nuqtai nazaridan talqin etgan konsepsiyasiga borib taqaladi [12]. Unga ko‘ra, iqtisodiy o‘sish biosferaning cheklangan moddiy-energetik imkoniyatlari doirasida sodir bo‘ladi va bu chegaralarni

e'tiborsiz qoldirish uzoq muddatda iqtisodiy tizimning o'zini xavf ostiga qo'yadi. Zamonaviy siyosiy ma'noda esa bioiqtisodiyot tushunchasi Iqtisodiy hamkorlik va taraqqiyot tashkilotining "2030-yilgacha bioiqtisodiyot: siyosat kun tartibini loyihalash" nomli ma'ruzasidan so'ng keng tarqaldi [20]. Mazkur hujjatda biotexnologiyalar, ilmiy-innovatsion tadqiqotlar, qayta ishlash sanoati, bioasosli mahsulotlar bozori va ta'lim tizimi bioiqtisodiyotning asosiy drayverlari sifatida ko'rsatilib, davlat, xususiy sektor va nodavlat tashkilotlarining uyg'un harakati hamda sohada investitsion faollikni oshirish zarurligi asoslangan.

Yevropa Ittifoqi bioiqtisodiyotni quruqlik va dengizdagi qayta tiklanuvchi biologik resurslardan oziq-ovqat, yem, bioasosli mahsulotlar va energiya ishlab chiqarishni qamrab oluvchi tizim sifatida talqin etib, 2012-yilda birinchi, 2018-yilda esa yangilangan bioiqtisodiyot strategiyasini qabul qildi [8]. 2025-yilda raqobatbardoshlik va barqarorlikni uyg'unlashtirishga qaratilgan yangi strategik hujjat e'lon qilindi [9]. Ilmiy adabiyotlarda bioiqtisodiyot biologik innovatsion va texnologik bilim hamda jarayonlarni qo'llaydigan barcha sanoat va iqtisodiy sohalarni qamrab oluvchi tizim sifatida qaraladi [2].

M. Bugge, T. Hansen va A. Klitkou [3] ilmiy manbalarni tahlil qilib, bioiqtisodiyotga oid uchta ideal-tipik qarashni ajratib ko'rsatgan: biotexnologik qarash (ilm-fan yutuqlari va biotexnologiyalarni tijoratlashtirishga urg'u), bioresurs qarashi (biomassani qayta ishlash va yangi qiymat zanjirlarini yaratish) hamda bioekologik qarash (ekotizimlar barqarorligi, biologik xilma-xillik va mahalliy resurslarga tayanish). R. Birner [2] bioiqtisodiyot konsepsiyalarining "birinchi avlodi" asosan qazilma xomashyoni biomassa bilan almashtirishga, "ikkinchi avlodi" esa barqarorlik mezonlari va ijtimoiy natijalarga e'tibor qaratishini ta'kidlaydi. D. D'Amato va hammualliflari [5] "yashil", sirkulyar va bioiqtisodiyot konsepsiyalarini qiyosiy tahlil qilib, ularning bir-birini to'ldiruvchi, biroq barqarorlikka turlicha yondashuvlar ekanini ko'rsatgan: sirkulyar iqtisodiyot resurs samaradorligiga, bioiqtisodiyot qayta tiklanuvchi biologik resurslarga, "yashil" iqtisodiyot esa ekologik va ijtimoiy natijalarning umumiy muvozanatiga urg'u beradi.

Bioiqtisodiyot va BRM o'rtasidagi bog'liqlik masalasida T. Heimann [15] bioiqtisodiyot BRMlarning ko'pchiligiga ijobiy ta'sir ko'rsatishi mumkinligini, ammo yer va suv resurslari uchun raqobat, oziq-ovqat va energetik ekinlar o'rtasidagi ziddiyat kabi o'zaro qarama-qarshi ta'sirlar (trade-off) mavjudligini asoslagan. T. Ronzon va A. Sanjuán [22] Yevropa Ittifoqi misolida bioiqtisodiyot bilan bog'liq BRM ko'rsatkichlari o'rtasidagi sinergiya va ziddiyatlarni empirik baholab, siyosatlar muvofiqligini ta'minlash zarurligini ko'rsatgan. FAO bioiqtisodiyotni o'zining 2022-2031-yillarga mo'ljallangan strategik asosidagi ustuvor dasturiy yo'nalishlardan biri sifatida belgilab, mamlakatlar uchun bioiqtisodiyot strategiyasi va siyosatini ishlab chiqish metodologiyasini taklif etgan [14].

Mintaqalarni barqaror rivojlantirish mexanizmlarining xorijiy va milliy amaliyotlari R. Kostiukevych va boshqalar [16], V. Danyliuk va boshqalar [6], V.V. Dyadik va boshqalar [7], S. Filatov va V. Filatova [11], V.V. Stroyev va

boshqalar [25], M.A. Bazyleva [29] hamda V.I. Belov [30] tadqiqotlarida qiyosiy tahlil asosida o‘rganilgan va ularning o‘ziga xos jihatlari ochib berilgan.

O‘zbekistonlik iqtisodchi olimlardan T.M. Axmedov [28], U.A. Madraximov [42], F.T. Egamberdiyev va boshqalar [33], O.O. Olimjonov [44], A.T. Umarov [47], B. Ro‘zmetov [32], A.B. Nizomov [31], D.Sh. Yavmutov [49] va B.B. Valiyev [48] tomonidan respublika hududlarining ijtimoiy-iqtisodiy kompleks rivojlanishi, investitsiyalash samaradorligi, hududlarda ekologik barqarorlikni ta’minlash hamda “yashil” iqtisodiyotga o‘tish sharoitida mintaqa iqtisodiyotini barqaror rivojlantirish masalalari tadqiq etilgan.

Bioiqtisodiyotga oid tadqiqotlar esa mamlakatimizda endigina shakllanmoqda. Erasmus+ dasturining BioEcUz loyihasi (619294-EPP-1-2020-1-LV-EPPKA2-CBHE-JP) doirasida hamkorlar konsorsiumi tomonidan tayyorlangan “Bioiqtisodiyot tizimi va sohadagi asosiy manfaatdor tomonlarning batafsil tahlili” hisoboti [1] bioiqtisodiyot sohasidagi ta’lim ekotizimi, O‘zbekistondagi bioiqtisodiyot va unga aloqador tarmoqlar hamda sohaga oid milliy strategiya, siyosat va rivojlanish dasturlarini tahlil qilgan dastlabki tizimli tadqiqotlardan biri hisoblanadi. Adabiyotlar tahlili shuni ko‘rsatadiki, milliy ilmiy manbalarda bioiqtisodiyot va BRM o‘rtasidagi bog‘liqlikni miqdoriy va sifat jihatdan baholashga bag‘ishlangan tadqiqotlar deyarli uchramaydi. Mazkur maqola ushbu ilmiy bo‘shliqni qisman to‘ldirishga qaratilgan.

METODOLOGIYA

Tadqiqotda tizimli yondashuv asosida quyidagi usullar qo‘llanildi. Birinchidan, bioiqtisodiyot nazariyasi va uning BRM bilan bog‘liqligiga oid xorijiy va mahalliy ilmiy manbalar tizimli sharhlandi. Ikkinchidan, normativ-huquqiy va boshqa hujjatlar hujjatli tahlil usulida o‘rganildi.

Uchinchidan, Global Carbon Project, Statbase, Yevropa Komissiyasi Qo‘shma tadqiqot markazi (JRC), BMT Barqaror rivojlanish yechimlari tarmog‘i (SDSN), O‘zbekiston Respublikasi Milliy statistika qo‘mitasi hamda rasmiy axborot manbalari ma’lumotlari qiyosiy-statistik tahlil qilindi. To‘rtinchidan, bioiqtisodiyotning BRMlarga ta’sirini baholash uchun T. Heimann [15] hamda T. Ronzon va A. Sanjuan [22] yondashuvlariga tayangan holda sifat ko‘rsatkichli bog‘liqlik matritsasi tuzildi: bioiqtisodiyotning beshta tarmog‘ining to‘qqizta BRMga ta’siri “2-bevosita ta’sir”, “1-bilvosita ta’sir”, “0-sezilarli ta’sir yo‘q” shkalasida ekspert baholash usulida aniqlandi. Beshinchidan, qayta tiklanuvchi energetika loyihasining iqtisodiy samaradorligi soddalashtirilgan (diskontlanmagan) qoplanish muddati usulida hisoblandi; bunda rasmiy va ochiq axborot manbalari ma’lumotlaridan foydalanildi. Tahlil natijalarini sintez qilish, ilmiy abstraksiya va ekstrapolyatsiya usullari asosida bioiqtisodiyotni rivojlantirishning strategik yo‘nalishlari belgilandi.

TAHLIL VA NATIJALAR

Dunyo aholisining o‘sishi, ayrim mamlakatlarda o‘rtacha daromadlarning yuqoriligi va iste’molchilar tabaqalashuvining keskinlashuvi global tovar va xizmatlar bozorida talabning miqdor va sifat jihatdan jadal o‘sishiga asos soldi. Talabning o‘sishi, o‘z navbatida, tovar taklifini, pirovardida esa xomashyo, materiallar va boshqa

ishlab chiqarish omillariga bo‘lgan talabni ham oshirdi. Ishlab chiqarishga yanada ko‘proq resurslarni jalb etish bilan birga intensiv-innovatsion va unumdorligi yuqori texnologiyalarning qo‘llanishi insonning tabiatga ta’sirini yanada kuchaytirdi. Bozor iqtisodiyoti dunyoda yetakchi xo‘jalik yuritish shakliga aylangan bo‘lsa-da, uning ojiz jihatlaridan biri sifatida e’tirof etilgan atrof-muhitni muhofaza qilish muammosi - iqlim o‘zgarishi, cho‘llanish, tuproq degradatsiyasi, suv tanqisligi, zararli gaz va moddalarning atrof-muhitga chiqarilishi, korxona va uy xo‘jaliklari chiqindilarining to‘planishi - keskinlashib, insoniyatga tahdid solmoqda.

Global Carbon Project ma’lumotlariga ko‘ra, 2025-yilda qazilma yoqilg‘ilardan chiqarilgan CO_2 hajmi 1,1 foizga oshib, 38,1 mlrd tonna bilan tarixiy maksimumga yetgan, yerdan foydalanishning o‘zgarishi bilan bog‘liq chiqindilar esa 4,1 mlrd tonnani tashkil etgan [13]. Statbase ma’lumotlar bazasiga ko‘ra, 2025-yilda jahon bo‘yicha CO_2 chiqindilari 41,04 mlrd tonnani tashkil etib, 0,83 foizga o‘sgan [24]. Ko‘rsatkichlardagi farq hisob-kitob metodologiyalarining turlichaligi bilan izohlanadi, biroq ikkala manba ham chiqindilarning o‘sish tendensiyasi saqlanib qolayotganini tasdiqlaydi (1-jadval).

1-jadval

Dunyoning ayrim mamlakatlarida 2025-yilda CO_2 chiqindilari hajmi, ularning jahon miqyosidagi ulushi va o‘rni[1]

Jahondagi o‘rni	Mamlakat	CO_2 chiqindilari, mlrd t	Jahon hajmidagi ulushi, foizda
1	Xitoy	12,53	30,53
2	AQSh	5,25	12,79
3	Hindiston	3,20	7,79
4	Rossiya	2,21	5,38
5	Eron	1,04	2,53
6	Yaponiya	1,00	2,43
7	Indoneziya	0,96	2,34
39	O‘zbekiston Respublikasi	0,15	0,36
-	Jahon bo‘yicha jami	41,04	100,0

1-jadvalda Xitoy va AQSh birgalikda jahon CO_2 chiqindilarining 43,3 foizini, yetakchi yettita mamlakat esa 63,8 foizini beradi. O‘zbekiston 0,15 mlrd tonna (0,36 foiz) bilan 39-o‘rinda turadi. Mutlaq ulush kichik bo‘lsa-da, milliy iqtisodiyotda tabiiy gazga asoslangan energetikaning ustunligi hamda iqtisodiyotning energiya sig‘imi yuqoriligi sababli mazkur ko‘rsatkich mamlakat uchun ijobiy natija emas va dekarbonizatsiya vazifalarini dolzarb qilib qo‘yadi.

Korxonalar va uy xo‘jaliklari faoliyati natijasida CO_2 bilan bir qatorda turli chiqindilar ham atrof-muhitga tashlanmoqda, ularni utilizatsiya qilish va qayta ishlash katta xarajatlarni talab etmoqda. Chiqindilarni ko‘mish oqibatida sayyoramizda minglab gektar yer maydonlari foydalanishdan chiqmoqda, bunday maqsadlarda foydalanilayotgan maydonlar esa kengayib bormoqda. Ayrim hollarda chiqindilarning

[1] Manba: Statbase [24] ma’lumotlari asosida muallif tomonidan tuzilgan.

suv havzalariga oqizilishi suv manbalarining ifloslanishiga sabab bo‘lib, shusiz ham mavjud suv tanqisligi muammosini yanada keskinlashtirmoqda.

Mazkur global muammolarga javoban 2015-yil sentabrida BMT Bosh Assambleyasi 70/1-son rezolyutsiyasi bilan “Dunyomizni o‘zgartirish: 2030-yilgacha bo‘lgan davrda barqaror rivojlanish sohasidagi kun tartibi”ni qabul qildi [26]. BMTga a’zo barcha davlatlar ma’qullagan ushbu hujjat 17 ta o‘zaro bog‘liq maqsad va 169 ta vazifani qamrab olib, qashshoqlik va ochlikni tugatish, sog‘liqni saqlash, sifatli ta’lim, gender tengligi, toza suv, arzon va toza energiya, munosib mehnat, mas’uliyatli iste’mol va ishlab chiqarish, iqlim o‘zgarishiga qarshi kurash hamda quruqlikdagi ekotizimlarni saqlash kabi yo‘nalishlarni o‘z ichiga oladi. Bioiqtisodiyot ushbu maqsadlarning bir vaqtning o‘zida bir nechtasiga ta’sir ko‘rsatuvchi kesishuvchi (kross-sektoral) soha hisoblanadi.

Rivojlangan mamlakatlarda bioiqtisodiyot iqtisodiy o‘sish, bandlik va innovatsiyalarning muhim manbaiga aylangan. Yevropa Ittifoqi misolida bioiqtisodiyotning asosiy makroiqtisodiy ko‘rsatkichlari 2-jadvalda keltirilgan (2-jadval).

2-jadval

Yevropa Ittifoqi (EU-27) bioiqtisodiyotining asosiy ko‘rsatkichlari[1]

Ko‘rsatkich	2017-yil	2023-yil	O‘zgarish, foizda
Bandlar soni, mln kishi	17,5	17,1	-2,3
Umumiy bandlikdagi ulushi, foizda	8,9	7,9	-1
Qo‘shilgan qiymat, mlrd yevro	614	863	40,6
YaIMdagi ulushi, foizda	4,7	5,0	0,3
Bir bandga to‘g‘ri keladigan qo‘shilgan qiymat, ming yevro	35,1	50,5	43,9

2-jadvaldan ko‘rinadiki, 2017-2023-yillarda Yevropa Ittifoqi bioiqtisodiyotida band bo‘lganlar soni biroz kamaygan holda qo‘shilgan qiymat 40,6 foizga oshgan, natijada bitta bandga to‘g‘ri keladigan qo‘shilgan qiymat 43,9 foizga o‘sgan [19; 21]. Bu holat sohaning ekstensiv (qishloq xo‘jaligida bandlikka tayangan) modeldan intensiv, bilim va texnologiyaga asoslangan modelga o‘tayotganidan dalolat beradi. 2023-yilda bioasosli sanoat 583 mlrd yevro qo‘shilgan qiymat yaratgan bo‘lib, uning qariyb yarmi oziq-ovqat, ichimliklar va agro-qayta ishlash tarmoqlariga to‘g‘ri kelgan. Xizmatlar sohasini ham hisobga olganda, bioiqtisodiyot bilan bog‘liq tarmoqlar 1,9-2,7 trln yevro qo‘shilgan qiymat (YaIMning 11-16 foizi) yaratgan va 42-60 mln kishini ish bilan ta’minlagan [19]. Yevropa Komissiyasi baholariga ko‘ra, bioiqtisodiyot sanoatida yaratilgan har bir ish o‘rni qo‘shimcha ravishda 2,9 ta bilvosita ish o‘rni yaratilishiga olib keladi [9]. Ushbu tajriba bioiqtisodiyotning BRM-8 (munosib mehnat va iqtisodiy o‘sish) va BRM-9 (sanoat, innovatsiya va infratuzilma) maqsadlariga qo‘shayotgan hissasini yaqqol ko‘rsatadi.

[1] Manba: [19; 21] ma’lumotlari asosida muallif hisob-kitoblari.

Mamlakatimizda BMTning 70/1-son rezolyutsiyasidagi BRMlarni amalga oshirish bo‘yicha izchil ishlar olib borilmoqda. Xususan, 2017-2021-yillarda O‘zbekiston Respublikasini rivojlantirishning beshta ustuvor yo‘nalishi bo‘yicha Harakatlar strategiyasi [34], Vazirlar Mahkamasining “2030-yilgacha bo‘lgan davrda barqaror rivojlanish sohasidagi milliy maqsad va vazifalarni amalga oshirish chora-tadbirlari to‘g‘risida”gi 2018-yil 20-oktabrdagi 841-son qarori [40], 2019-2030-yillarda “yashil” iqtisodiyotga o‘tish strategiyasi (PQ-4477) [39], 2019-2028-yillarda qattiq maishiy chiqindilar bilan bog‘liq ishlarni amalga oshirish strategiyasi (PQ-4291) [38], 2022-2026-yillarga mo‘ljallangan Yangi O‘zbekistonning taraqqiyot strategiyasi [35] hamda “O‘zbekiston-2030” strategiyasi [36] qabul qilingan. 2025-yil 24-martda chiqindilarni qayta ishlash sohasini yanada takomillashtirish va kompleks tizimlashtirish chora-tadbirlariga oid Prezident farmoni qabul qilindi [37]. Mazkur dasturiy hujjatlarda mamlakat uchun nisbatan yangi bo‘lgan bioiqtisodiyot tarmoqlari va “yashil” texnologiyalarni keng joriy etish, qayta tiklanuvchi energetika loyihalarini amalga oshirish ko‘zda tutilgan.

Ta’kidlash joizki, qishloq xo‘jaligi yalpi qo‘shilgan qiymatning 17,3 foizini va bandlarning qariyb to‘rtdan bir qismini ta’minlab, bioiqtisodiyotning asosiy tayanchi bo‘lib qolmoqda [45]; [46]. Uning ulushining kamayishi esa sanoat va xizmatlar sohasining jadal o‘sishi bilan bog‘liq bo‘lib, qayta ishlash va bioasosli mahsulotlar ishlab chiqarishga o‘tish zaruratini ko‘rsatadi. Qishloq xo‘jaligi mahsulotining 62,3 foizi kichik dehqon va tomorqa xo‘jaliklarida yetishtirilishi biogaz, kompost va boshqa kichik hajmli bioiqtisodiy texnologiyalarni markazlashmagan tarzda joriy etish uchun keng imkoniyat yaratadi [46]. Mamlakatimizda yiliga 14,8 mln tonna maishiy chiqindi hosil bo‘lgani holda uning atigi 6,1 foizi qayta ishlanmoqda [41]. Bu organik chiqindilarni qayta ishlash va sirkulyar bioiqtisodiyotni rivojlantirishning ulkan, hozircha foydalanilmayotgan zaxirasi mavjudligini anglatadi.

Bioiqtisodiyot tarmoqlarining keng rivoji ekologik toza mahsulot ishlab chiqarishni; chiqindilarni xavfsiz qayta ishlash va zararsizlantirishni; aholining oziq-ovqat ta’minoti va xavfsizligini yaxshilashni; biologik xilma-xillikni asrashni; yangi ish o‘rinlari yaratish orqali ishsizlikni kamaytirish va kambag‘allikni qisqartirishni ta’minlaydi.

Tahlillar O‘zbekistonda bioiqtisodiyot rivojiga to‘sqinlik qilayotgan quyidagi asosiy omillarni aniqlash imkonini berdi:

- bioiqtisodiyotga bag‘ishlangan alohida milliy strategiya va tarmoqlararo muvofiqlashtiruvchi organning mavjud emasligi;
- bioiqtisodiyotning YaIM va bandlikdagi hissasini o‘lchash imkonini beruvchi statistik metodologiyaning yo‘qligi;
- organik chiqindilarni manbada saralash va qayta ishlash infratuzilmasining sustligi, chiqindi siyosatida asosan yoqish orqali energiya olishga urg‘u berilishi;
- suv resurslari tanqisligi sharoitida biomassa ishlab chiqarishni kengaytirish imkoniyatlarining cheklanganligi;
- biotexnologiya sohasida ilmiy-tadqiqot va tajriba-konstruktorlik ishlariga ajratilayotgan mablag‘larning hamda malakali kadrlarning yetishmasligi va boshqalar.

XULOSA VA TAKLIFLAR

O‘tkazilgan tadqiqot quyidagi xulosalarga kelish imkonini berdi. Birinchidan, global miqyosda CO_2 chiqindilarining o‘sishda davom etayotgani chiziqli iqtisodiyot modelining barqaror emasligini tasdiqlaydi va qayta tiklanuvchi biologik resurslarga asoslangan bioiqtisodiyotga o‘tishni obyektiv zaruratga aylantiradi. Ikkinchidan, Yevropa Ittifoqi tajribasi bioiqtisodiyot YaIMning 5 foizini va bandlikning qariyb 8 foizini ta’minlab, mehnat unumdorligining yuqori sur’atlarda o‘sishiga xizmat qilayotganini ko‘rsatadi. Uchinchidan, bioiqtisodiyot BRMlarning bir nechtasiga bir vaqtda ta’sir ko‘rsatuvchi tarmoqlararo soha bo‘lib, uning eng katta hissasi iqlim, bandlik va mas’uliyatli iste’mol maqsadlariga to‘g‘ri keladi. To‘rtinchidan, O‘zbekistonda BRM va “yashil” iqtisodiyotga oid mustahkam huquqiy asos yaratilgan bo‘lsa-da, bioiqtisodiyot alohida strategik yo‘nalish sifatida hali shakllanmagan.

Tadqiqot natijalari asosida quyidagi taklif va tavsiyalar ishlab chiqildi:

15. “Yashil” iqtisodiyotga o‘tish strategiyasi va “O‘zbekiston-2030” strategiyasi bilan uyg‘unlashtirilgan O‘zbekiston Respublikasining 2035-yilgacha bo‘lgan milliy bioiqtisodiyot strategiyasini ishlab chiqish hamda tarmoqlararo muvofiqlashtiruvchi kengash tuzish;

16. Milliy statistika qo‘mitasi tomonidan JRC metodologiyasiga moslashtirilgan bioiqtisodiyotni statistik hisobga olish tizimini (tarmoqlarning bioasosli ulushi, qo‘shilgan qiymat, bandlik ko‘rsatkichlari) joriy etish va uni milliy BRM ko‘rsatkichlari monitoringiga kiritish;

17. Qishloq xo‘jaligi mahsulotining asosiy qismini yetishtirayotgan dehqon va fermer xo‘jaliklarida kichik biogaz qurilmalari va kompost ishlab chiqarishni keng rivojlantirish maqsadida imtiyozli “yashil” kreditlar va subsidiyalarni joriy etish zarur;

18. Maishiy chiqindilarni manbasida saralashni bosqichma-bosqich joriy etib, biomassani biogaz va organik o‘g‘itga aylantirish uchun yangi quvvatlarini o‘rnatish va mavjudlarini zamonaviylashtirish asosida chiqindidan energiya olish loyihalari bilan uyg‘un rivojlantirish;

19. O‘simlikchilik, chorvachilik, baliqchilik va suv o‘tlari yetishtirishni samarali tashkil etish, seleksiya va urug‘chilikni rivojlantirish, tuproq unumdorligi va chorva mahsuldorligini oshirishga yo‘naltirilgan yangi biotexnologiyalarni joriy etish;

20. Viloyatlarda oliy ta’lim muassasalari, ilmiy tashkilotlar va korxonalar ishtirokida hududiy bioiqtisodiy klasterlar tashkil etish, sirkulyar ishlab chiqarishni keng joriy etish hamda yuqori qo‘shilgan qiymatli biomahsulotlar ishlab chiqarish va eksportini ko‘paytirish;

21. Xorijiy oliy ta’lim va ilmiy-tadqiqot muassasalari bilan hamkorlikda bioiqtisodiyot bo‘yicha magistratura dasturlari, kadrlar tayyorlash va qayta tayyorlash tizimini kengaytirish;

22. Qayta tiklanuvchi energetika va bioenergetika loyihalari uchun yerni uzoq muddatli imtiyozli foydalanishga berish, soliq imtiyozlari hamda energiyani tarmoqqa ulash infratuzilmasini davlat tomonidan rivojlantirish.

Xulosa sifatida ta’kidlash joizki, mamlakatimizda bioiqtisodiyotni rivojlantirish uchun zarur shart-sharoitlarni yaratish va mavjud salohiyatdan kengroq foydalanish

atrof-muhit holatini yaxshilash, aholining oziq-ovqat ta'minoti va xavfsizligini oshirish, ishsizlikni yumshatish, qo'shilgan qiymat yaratish hamda tovarlar eksportini ko'paytirish orqali global va milliy barqaror rivojlanish maqsadlariga erishishga muhim hissa qo'shadi.

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INTEGRATING CIRCULAR BIOECONOMY PRINCIPLES INTO REGIONAL EVENT TOURISM: STRATEGIC DIRECTIONS FOR ENHANCING DESTINATION ATTRACTIVENESS IN BUKHARA

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Аннотация

В статье рассматриваются международные научные конгрессы как форма MICE-туризма (деловые встречи, инсентив-поездки, конференции, выставки) и предлагается модель их организации на основе принципов циркулярной биоэкономики в историко-культурных дестинациях. На примере III Международной конвенции по биоэкономике (Бухара, 24-25 сентября 2026 г.) применён смешанный исследовательский дизайн, сочетающий анализ документов организаторов, картирование ресурсных потоков мероприятия и сценарную оценку прямых расходов. Полученные оценки носят предварительный (ex-ante) характер и подлежат проверке по данным после проведения мероприятия. Результаты показывают, что пакетная структура взносов направляет расходы иностранных делегатов непосредственно в местную гостиничную сферу и общественное питание, а гибридный формат снижает углеродоёмкость участия. Питание, материалы и транспорт определены как три потока с наибольшим потенциалом цикличности. В качестве инструмента политики рекомендуется внедрение «Зелёного стандарта мероприятий» для Бухары, позволяющего превратить научные мероприятия в регенеративный фактор повышения привлекательности дестинации в межсезонье.

Ключевые слова: циркулярная биоэкономика; событийный туризм; MICE; привлекательность дестинации; Бухара; зелёный стандарт мероприятий

Annotatsiya

Maqolada xalqaro ilmiy anjumanlar MICE (uchrashuvlar, rag‘batlantirish sayohatlari, konferensiyalar, ko‘rgazmalar) turizmining bir shakli sifatida o‘rganildi hamda tarixiy-madaniy destinatsiyalarda ularni aylanma bioiqtisodiyot tamoyillari asosida tashkil etish modeli taklif qilindi. III Xalqaro bioiqtisodiyot konvensiyasi (Buxoro, 2026-yil 24-25-sentyabr) misolida aralash usullarga asoslangan tadqiqot dizayni qo‘llanildi: tashkilotchilar hujjatlarini tahlil qilish, tadbir faoliyatidagi resurs oqimlarini xaritalash va bevosita xarajatlarni ssenariy asosida baholash. Baholashlar dastlabki (ex-ante) xarakterga ega bo‘lib, tadbirdan keyingi ma’lumotlar bilan tekshirilishi lozim. Natijalar shuni ko‘rsatdiki, yig‘ma badal tuzilmasi xorijiy delegatlar xarajatlarini bevosita mahalliy mehmonxona va ovqatlanish xizmatlariga yo‘naltiradi, gibrid format esa ishtirokning uglerod sig‘imini kamaytiradi. Ovqatlanish, materiallar va transport aylanma iqtisodiyot salohiyati eng yuqori bo‘lgan uchta resurs oqimi ekanligi aniqlandi. Ilmiy tadbirlarni destinatsiya jozibadorligini mavsumdan

tashqari davrda oshiruvchi regenerativ omilga aylantirish uchun siyosiy vosita sifatida Buxoro uchun "Yashil tadbir standarti"ni joriy etish tavsiya etiladi.

Kalit so'zlar: aylanma bioiqtisodiyot; tadbir turizmi; MICE; destinatsiya jozibadorligi; Buxoro; yashil tadbir standarti

Abstract

The paper examines international scientific conventions as a form of MICE (meetings, incentives, conferences, exhibitions) tourism and proposes a framework for organising them according to circular bioeconomy principles in heritage destinations. Using the III International Bioeconomy Convention (Bukhara, 24-25 September 2026) as a case, the study applies a mixed-methods design combining document analysis of organiser data, resource-flow mapping of event operations and scenario-based estimation of direct expenditure. The results show that a bundled fee structure channels foreign delegate spending directly into local hospitality, that a hybrid format lowers the carbon intensity of participation, and that catering, materials and mobility are the three streams with the highest circularity potential. A "Green Event Standard" for Bukhara is recommended as a policy instrument for turning scientific events into a regenerative, off-season driver of destination attractiveness.

Keywords: circular bioeconomy; event tourism; MICE; destination attractiveness; Bukhara; green event standard

INTRODUCTION

Uzbekistan's tourism strategy increasingly relies on diversifying beyond monument-based sightseeing towards knowledge-intensive segments, among which scientific and business events are the most resilient to seasonality. Bukhara, a UNESCO-listed historic city whose international arrivals grew from about 13 thousand in 2020 to over 1.7 million in 2024 [17], faces the classic risks of a narrow heritage product: seasonality, crowding pressure on historic sites and short length of stay [11]. Recent studies in the destination show that the quality of events is a strong predictor of tourist satisfaction and, through it, of local economic outcomes [16], and that educational and academic mobility generates measurable economic benefits for host universities and cities [15]. Every international gathering, however, creates a temporary population spike that loads municipal waste, water, energy and food systems. The research gap addressed here is the absence of an operational model that links event tourism to the circular bioeconomy, i.e. to the regenerative use of biological resources and the closing of material loops [3]; [13]. The aim of the paper is to conceptualise academic event tourism as a closed-loop bioeconomic engine and to derive strategic directions for Bukhara on the basis of the III International Bioeconomy Convention.

LITERATURE REVIEW

Event tourism research treats planned events as instruments of destination development, image formation and demand smoothing [9]. Business and academic events are distinguished by high per-capita expenditure, long average stays and low sensitivity to weather [5], which makes them particularly valuable for heritage cities

with pronounced seasonality; in Bukhara, event quality has been shown to explain the bulk of the variation in perceived economic outcomes via tourist satisfaction [16], while sport and event products are being reframed around social sustainability [17]. The sustainability of events has been discussed mainly through the lens of greening - waste reduction and carbon management [14] - and, more recently, through accessibility and smart-city infrastructure for large gatherings in Bukhara [6]; [8]. The circular economy literature offers a more systemic framing based on the reduce-reuse-recycle-regenerate hierarchy [7]; [13], and the bioeconomy strand adds the dimension of biological resources: biomass sourcing, organic waste valorisation and bio-based substitutes for fossil materials [3]. Enterprise-level evidence from the Bukhara region indicates that sustainability expenditure is associated with revenue performance of ecotourism firms [12], and destination-level work has begun to integrate ESG dimensions into tourism assessment through digital tools [2]; [10]. Communication research from the same faculty shows that sustainability messaging and heritage interpretation shape visitor behaviour [18]; [19], and that sustainability competencies are being embedded in local tourism curricula [1]. The Bio-Circular-Green (BCG) model integrates these perspectives into a single agenda; what the literature has not yet done is translate BCG principles to the operational level of a single scientific event in a regional heritage destination, which is the contribution of this paper.

The resulting conceptual framework is shown in Figure 1: a scientific event is treated as an operational platform that converts delegate, biomass, material and energy inputs either into linear outputs (waste, emissions, expenditure leakage) or, under circular design, into regenerative loops; its impacts are assessed along the E, S and G dimensions and fed back into event policy through a Green Event Standard.

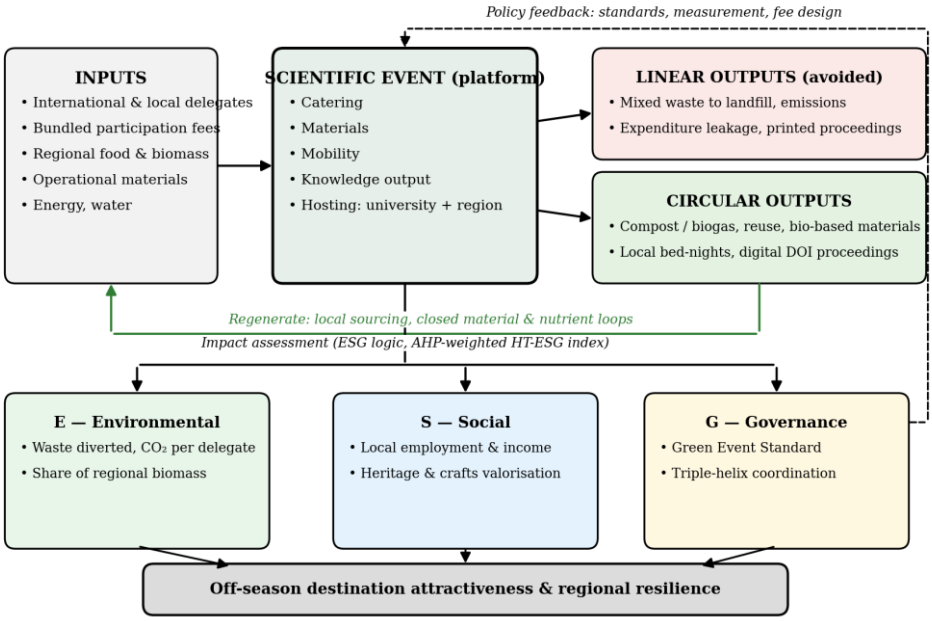


Figure 1. Conceptual framework of the bio-circular-green (BCG) event tourism model for a heritage destination[1]

[1] Source: developed by the author.

Figure 1 shows that the same scientific event can follow two alternative trajectories. Along the linear trajectory, the inputs leave the destination as mixed waste, emissions, expenditure leakage and printed proceedings. Along the circular trajectory, catering, materials, mobility and knowledge output are redesigned so that biomass returns to the system as compost or biogas, materials are reused, delegate spending is retained as local bed-nights and proceedings are issued in digital DOI-indexed form. The environmental, social and governance blocks translate these outcomes into measurable indicators, and the dashed feedback line shows that standards, measurement and fee design return to the event platform as policy levers. The final outcome of the model is off-season destination attractiveness and regional resilience.

METHODOLOGY

A mixed-methods case-study design is used. First, the official information letter and organisational documents of the III International Bioeconomy Convention were analysed to extract the event's structural parameters (dates, venue, participant composition, fee structure, publication outputs) [4]. Second, event operations were mapped as resource streams (catering, materials, mobility, knowledge output) and each stream was compared with linear and circular practice. Third, a scenario-based estimation of direct local expenditure was performed using the organiser's fee structure; because the event takes place after the submission deadline of this paper, the estimates are ex-ante and are to be verified with post-event registration and hospitality data. The analytical categories follow the ESG logic (environmental, social, governance) so that the results can later be integrated into a regional tourism sustainability index, with indicator weights derived through expert pairwise comparison [20].

ANALYSIS AND RESULTS

Economic footprint. The fee design is the first circularity lever. Because the foreign in-person fee of USD 180 already includes three hotel nights and a meal [4], the largest share of each delegate's outlay is captured by Bukhara hotels and caterers rather than by intermediaries; each foreign in-person delegate therefore generates at least three commercial bed-nights in late September, a shoulder period for leisure demand. With the planned 30 local participants, the local fee alone yields UZS 6.0 million of organisational revenue, while the optional Scopus Q3 publication channel (USD 450) monetises the knowledge output of the event. The USD 20 remote track widens the geographic reach of the gathering without air travel, which is the single largest carbon item of international events. These mechanisms are consistent with the satisfaction-mediated pathway from event quality to economic outcomes documented for the region [16].

Circularity of resource streams. Table 1 contrasts linear and circular practice for the four principal streams identified in the mapping exercise.

Table 1

Linear versus circular organisation of the event's resource streams[1]

Resource stream	Linear event practice	Circular practice recommended for the event
Catering	Imported inputs, mixed waste to landfill	Regional agricultural sourcing; separate collection of organic waste for composting/biogas
Materials	Plastic badges, printed programmes, single-use packaging	Reusable/biobased badges, QR-based programme, local artisan gifts
Mobility	Individual taxi transfers	Shared shuttles, walkable venue-hotel cluster in the historic centre
Knowledge output	Printed proceedings	DOI-indexed digital proceedings, hybrid (online) track
Offsetting	None	University-led tree planting / restoration linked to delegate numbers

The mapping shows that catering and materials are the streams where biological resources are directly involved and where the bioeconomy dimension is strongest: regional sourcing of food shortens supply chains and supports the Bukhara agricultural economy, while organic waste can be diverted to composting or small-scale biogas units instead of landfill. Mobility and knowledge output depend mainly on design choices (venue clustering, hybrid format, digital proceedings) that require little investment; GIS-based optimisation of public transport in the historic centre [8] provides a ready basis for shuttle planning. The joint organisation of the event by a university, a regional ecology department and an applied research centre is itself a governance asset that aligns stakeholders around one green agenda and offers a channel for the strategic sustainability communication recommended by Radjabov et al. [18].

CONCLUSION AND SUGGESTIONS

International scientific conventions can be reconceptualised from resource-consuming gatherings into regenerative bioeconomic platforms that strengthen destination attractiveness in the off-season. On the basis of the case analysis the following recommendations are proposed:

1. Adopt a regional “Green Event Standard” jointly by Bukhara State University and the Department of Ecology and Climate Change, with mandatory criteria for local sourcing, organic-waste separation, paperless proceedings and a hybrid track.

2. Institutionalise measurement: collect delegate expenditure, bed-nights and waste data at every scientific event so that the ex-ante estimates of this paper are replaced by audited indicators and fed into a regional tourism ESG index.

3. Bundle circular services into the fee: extend the current accommodation-inclusive model to shuttle transport and locally produced meals, guaranteeing that delegate spending stays within the regional economy.

[1] Source: compiled by the author based on the resource-flow mapping of the event [4].

4. Link events to restoration: tie an offset action (tree planting, riparian or oasis restoration) to the number of in-person delegates, creating a visible ecological legacy of each event.

Future research should apply the framework after the September 2026 event to obtain empirical values for the indicators, and should test the transferability of the model to other heritage destinations of Uzbekistan.

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GREEN FINANCE AND THE DECOUPLING OF ECONOMIC GROWTH FROM CARBON EMISSIONS: EMPIRICAL EVIDENCE FROM UZBEKISTAN

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Abstract

The article examined the relationship between economic growth and carbon dioxide emissions amid Uzbekistan's green finance development. World Bank data for 2000-2023 supported carbon intensity analysis, Tapio elasticity calculations and structural break regressions. Robustness was assessed using alternative period boundaries and excluding the pandemic year. Carbon intensity declined over time, while changes in the relationship after 2019 were not statistically significant. Findings were interpreted considering limited observations and financing implementation lags. Recommendations addressed recording green financial flows, monitoring energy indicators and extending data coverage. Additional observations were considered necessary to assess the direct causal contribution of green finance to emissions decoupling.

Keywords: green finance, economic growth, carbon dioxide emissions, carbon intensity, decoupling, Tapio elasticity, renewable energy, Uzbekistan.

Annotatsiya

Maqolada O'zbekistonda yashil moliyalashtirish rivoji sharoitida iqtisodiy o'sish va karbonat angidrid chiqindilari o'rtasidagi bog'liqlik o'rganildi. Jahon bankining 2000-2023-yillardagi ma'lumotlari asosida uglerod intensivligi, Tapio elastikligi va tarkibiy o'zgarishlar regressiyasi tahlil qilindi. Natijalarning barqarorligi muqobil davrlashtirish va pandemiya yilini chiqarib tashlash orqali tekshirildi. Uglerod intensivligining uzoq muddatli pasayishi qayd etildi, biroq 2019-yildan keyingi bog'liqlik o'zgarishi statistik jihatdan tasdiqlanmadi. Natijalar qisqa kuzatuv davri hamda moliyalashtirish bilan loyihalarning ishga tushishi o'rtasidagi vaqt farqi doirasida talqin qilindi. Yashil moliyaviy oqimlarni hisobga olish, energetik ko'rsatkichlarni izchil kuzatish va ma'lumotlar qamrovini kengaytirish bo'yicha takliflar ishlab chiqildi. Yashil moliyalashtirishning bevosita sababiy ta'sirini baholash uchun qo'shimcha ma'lumotlar zarurligi ta'kidlandi.

Kalit so'zlar: yashil moliyalashtirish, iqtisodiy o'sish, karbonat angidrid chiqindilari, uglerod intensivligi, dekapling, Tapio elastikligi, qayta tiklanuvchi energiya, O'zbekiston.

Аннотация

В статье была исследована взаимосвязь экономического роста и выбросов углекислого газа в условиях развития зелёного финансирования в Узбекистане. На данных Всемирного банка за 2000-2023 годы были проанализированы углеродная интенсивность, эластичность Тапио и регрессионные оценки

структурных изменений. Устойчивость результатов проверялась изменением границы периодов и исключением пандемийного года. Было установлено долгосрочное снижение углеродной интенсивности, однако изменение рассматриваемой взаимосвязи после 2019 года статистически не подтвердилось. Результаты интерпретировались с учётом короткого периода наблюдений и временного разрыва между финансированием и вводом объектов. Были предложены совершенствование учёта зелёных финансовых потоков, последовательный мониторинг энергетических показателей и расширение данных. Была подчёркнута необходимость дополнительных наблюдений для оценки непосредственного причинного влияния зелёного финансирования.

Ключевые слова: зелёное финансирование, экономический рост, выбросы углекислого газа, углеродная интенсивность, декаплинг, эластичность Тапио, возобновляемая энергия, Узбекистан.

INTRODUCTION

Uzbekistan's economy remains structurally dependent on energy-intensive sectors - natural gas, cotton, and metallurgy - with the energy sector alone responsible for approximately 75 percent of national greenhouse-gas emissions [19]. The World Bank estimates that achieving carbon neutrality by 2060 will require roughly $340 billion in investment to replace energy infrastructure and support decarbonisation, and that, absent such investment, GDP by 2050 could be as much as 10 percent lower than under a no-climate-impact scenario [19]. It was against this backdrop that, on October 4, 2019, Presidential Resolution PP-4477 adopted the "Strategy for the Republic of Uzbekistan's Transition to a Green Economy for 2019-2030," which set targets of a 10-percent reduction in greenhouse-gas intensity relative to 2010, a doubling of energy efficiency, and an increase in the renewable share of electricity generation to above 25 percent by 2030 [20].

Over the following four years, this strategic framework began to take the form of concrete financial instruments. The national green taxonomy was adopted in December 2023 [18]. In October 2023, Uzbekistan became the first country in the CIS to issue a sovereign green Eurobond, raising 660 million USD (4.25 trillion soums) on the London Stock Exchange, with proceeds allocated to water-conservation technologies, expansion of the railway and metro network, and afforestation [16]; Agrobank subsequently issued its own green Eurobonds worth 400 million USDand 700 billion soums [6]. International financial institutions likewise stepped up their engagement: in 2023 the EBRD arranged 205 million USD in financing for three solar power plants (a combined capacity of roughly 900 MW) in the Jizzakh, Samarkand, and Surkhandarya regions [4], while the Asian Development Bank, in partnership with ACWA Power, signed a 116 million USD financing agreement to expand wind-energy capacity [1]. Between 2019 and 2023, in other words, Uzbekistan's green-economy agenda moved from a strategic document to measurable flows of capital.

This study poses a deliberately narrow and falsifiable research question: has the green-economy policy adopted in 2019, together with the green-finance instruments that followed, changed the relationship between economic growth and carbon

emissions in Uzbekistan to a statistically detectable degree? To address this question, the analysis constructs a fully reproducible, open-data panel for 2000-2023, computes the annual Tapio decoupling elasticity, and tests both 2019 and, as a robustness check, 2021 as candidate structural-break dates.

The study's contribution is threefold. First, it constructs, from open World Bank WDI indicators, the first fully reproducible decoupling-elasticity series for Uzbekistan. Second, it formally tests the policy-linked structural break using heteroskedasticity-robust (HC3) standard errors, while being explicit about the constraints imposed by the small sample. Third, it identifies and explains what might be termed a "renewable-energy paradox" - a falling renewable share coinciding with declining carbon intensity - through a financing-to-outcome lag hypothesis, and it flags the absence of an official annual green-finance statistical series for Uzbekistan as a substantial data gap.

LITERATURE REVIEW

The relationship between green finance and carbon emissions is most commonly examined in the international literature through ARDL-ECM specifications or Granger-causality tests applied to long national or panel time series. Using an ARDL-ECM framework that controls for trade openness and the level of economic development, Li and Shao [10] find that green finance reduces CO_2 emissions over the long run. Bughio et al. [3] similarly report both short- and long-run causal linkages among green finance, renewable-energy consumption, and economic growth. Such methods, however, generally presuppose a consistent financial-flow series - for instance, the share of green credit within total credit - spanning at least two to three decades; no official series of this kind currently exists for Uzbekistan.

Decoupling analysis rests methodologically on the eight-state typology introduced by Tapio [15], originally developed to characterise the relationship between CO_2 emissions and GDP in Finland's road-transport sector, and since applied widely at the national and regional level, including extended variants that incorporate the energy mix - for example, studies combining the Tapio framework with the Logarithmic Mean Divisia Index (LMDI) for China's Xinjiang region [14]. A direct decoupling analysis for Uzbekistan covering 1990-2023 has recently appeared in Eurasian Geography and Economics [8], though its focus is the general CO_2-GDP relationship rather than green-finance instruments specifically.

Bakhtiyorov [2] compares Uzbekistan and Azerbaijan for 2010-2023 using multivariate regression and an Environmental Kuznets Curve (EKC) specification, finding the relationship among GDP growth, the share of foreign direct investment, and per-capita CO_2 to be statistically unreliable - a result the author attributes to limited institutional capacity and the short interval since reform. As the only other quantitative study of Uzbekistan's green transition known to the present author, this finding offers an important point of external consistency with the statistically insignificant results obtained here.

World Bank and OECD reports [11]; [12]; [18]; [19] offer detailed qualitative accounts of Uzbekistan's green-finance ecosystem - its taxonomy, its still-underdeveloped capital market, and the dominant role of the state within the banking

sector - but none subjects the growth-emissions relationship to quantitative testing. The resulting gap in the literature is therefore clear: no existing study has tested a structural break dated to the introduction of Uzbekistan's green-economy policy and green-finance architecture using a fully open, reproducible official data panel. The present study is designed to fill precisely this gap.

METHODOLOGY

Data and sources

All data are drawn from the World Bank's open World Development Indicators (WDI) API [17] and cross-checked against the most recent figures in the Our World in Data country profile [13]. The core variables are listed in Table 1. The resulting panel is a balanced annual series (N = 24) spanning 2000-2023; the WDI series for the renewable share of electricity generation is currently available only through 2021 (N = 22), a limitation discussed further below.

Table 1

Variables, definitions, and sources[1]

Variable	Definition	Source (WDI code)
GDP growth rate (%)	Annual real GDP growth, %	World Bank WDI, NY.GDP.MKTP.KD.ZG
GDP (billion USD)	At constant 2015 prices	World Bank WDI, NY.GDP.MKTP.KD
CO_2 emissions (Mt)	Excluding LULUCF, AR5 inventory	World Bank WDI, EN.GHG.CO2.MT.CE.AR5
CO_2 per capita (t)	Same inventory, divided by population	World Bank WDI, EN.GHG.CO2.PC.CE.AR5
Renewable electricity share (%)	Share of total electricity generation	World Bank WDI, EG.ELC.RNEW.ZS
Energy efficiency	GDP / unit of energy use, 2021 PPP US$	World Bank WDI, EG.GDP.PUSE.KO.PP.KD

Table 1 shows that all six variables are taken from a single official source, the World Bank WDI [17], which keeps the series methodologically consistent. Economic output is measured both as an annual growth rate and as a level in constant 2015 prices, emissions are measured both in total and per capita, and the energy transition is captured through the renewable share of electricity generation and the energy efficiency of GDP. Because each indicator is identified by its standard WDI code, every step of the analysis can be reproduced from open data.

Research methods

Carbon intensity is computed for each year as CO_2 emissions (kt) divided by GDP (billions of constant 2015 US dollars).

$$CI_t = \frac{CO_{2t}\,(\text{kt})}{GDP_t\,(\text{billion constant 2015 USD})} \quad (1)$$

where CI_t is the carbon intensity of GDP in year t, CO_{2t} is total CO_2 emissions excluding LULUCF and GDP_t is real GDP. A falling CI_t means that each unit of output

[1] Source: World Bank, World Development Indicators [17].

is produced with fewer emissions, that is, the economy is moving towards at least relative decoupling of growth from emissions.

The Tapio decoupling elasticity [15] is calculated for each year t as follows:

$$e_t = \frac{\%\Delta CO_{2t}}{\%\Delta GDP_t} \quad (2)$$

where GDP growth is taken directly from the officially reported annual growth rate rather than derived from levels. For the states actually observed in the Uzbekistan sample, the original eight-category Tapio typology is collapsed into three: decoupling ($e < 0.8$, including cases of "strong decoupling" in which CO_2 falls as GDP rises), expansive coupling ($0.8 \leq e \leq 1.2$), and expansive negative coupling ($e > 1.2$). Thus a negative e_t in a year of positive growth signals strong decoupling, whereas e_t above one means that emissions grow faster than output.

To test for a structural break, the CO_2 growth rate is regressed on centred GDP growth, a policy indicator (POLICY = 1 for years ≥ 2019), and their interaction, using heteroskedasticity-robust (HC3) standard errors, appropriate for a short (N = 23) series. The estimated equation is:

$$gCO_{2,t} = \beta_0 + \beta_1(gGDP_t - \bar{g}GDP) + \beta_2 POLICY_t + \beta_3 POLICY_t(gGDP_t - \bar{g}GDP) + \varepsilon_t \quad (3)$$

where $gCO_{2,t}$ is the annual growth rate of CO_2 emissions, $gGDP_t$ - $\bar{g}GDP$ is real GDP growth centred on its sample mean, $POLICY_t$ is the policy indicator and ε_t is the error term. The coefficient β_2 measures a shift in emissions growth after the policy date at average GDP growth, while β_3 measures a change in the sensitivity of emissions to growth; a negative and significant β_3 would indicate stronger decoupling after the policy date. Two robustness checks are performed: (i) substituting 2021 - identified by the OECD [12] as the year the green-bond market became active - as an alternative break date; and (ii) excluding the pandemic year 2020, whose GDP growth of only 1.62 percent destabilises the elasticity's denominator.

The association between carbon intensity and the renewable share is examined both in levels and in first differences, since two independently trending series can otherwise produce a spurious correlation in levels.

The principal limitation is stated explicitly: with N = 22-24 annual national observations, the design has limited statistical power - a constraint shared with the only comparable Uzbekistan study [2], which likewise reports statistically insignificant coefficients over a similar window. The results should accordingly be read not as a definitive causal test but as a preliminary screening exercise, to be revisited as longer post-policy series become available.

ANALYSIS AND RESULTS

Long-run dynamics of carbon intensity

The long-run trajectory of the carbon intensity of GDP in Uzbekistan is shown in Figure 1.

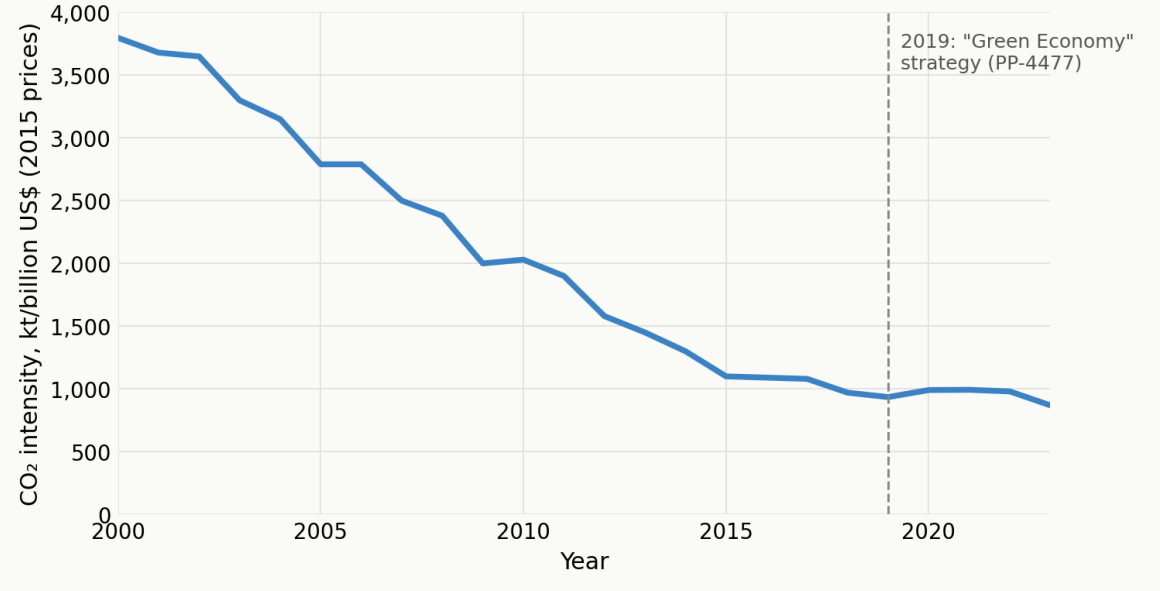


Figure 1. CO_2 intensity of GDP in Uzbekistan, 2000-2023[1]

Carbon intensity declined from 3,798 kt per billion dollars of GDP in 2000 to 935 kt per billion dollars in 2019 - a reduction of 75.4 percent (Figure 1; Table 2). This downward trend paused, and even reversed slightly (rising to 991-993 kt per billion dollars), during the pandemic years 2020-2021, as GDP growth collapsed to 1.62 percent in 2020 while emissions did not fall proportionately. The decline resumed thereafter, and by 2023 intensity had reached a historic low of 869 kt per billion dollars - a further 7.1-percent reduction from 2019 and a cumulative decline of 77.1 percent since 2000.

Table 2

Descriptive statistics, 2000-2023 (2000-2021 for renewable share)[2]

Variable	Mean	Std. Dev.	Min	Max	N
GDP growth, % (2000-2023)	6.56	1.92	1.62	9.47	24
CO_2, Mt (2000-2023)	126.46	9.04	107.55	138.68	24
CO_2 per capita, t (2000-2023)	4.36	0.68	3.48	5.39	24
CO_2 intensity, kt/billion USD (2000-2023)	1,966.4	1,012.6	868.9	3,798.1	24
Renewable share, % (2000-2021)	14.24	3.73	7.08	22.62	22

Table 2 shows that the variables differ sharply in their variability. Annual GDP growth averaged 6.56 percent, ranging from 1.62 percent in the pandemic year to 9.47 percent. Total CO_2 emissions were comparatively stable, averaging 126.46 Mt with a standard deviation of only 9.04 Mt, whereas carbon intensity varied widely, from 3,798.1 to 868.9 kt per billion dollars. The renewable share averaged 14.24 percent over 2000-2021, within a range of 7.08 to 22.62 percent. The combination of fast-growing output, nearly stable emissions and sharply falling intensity is the statistical signature of relative decoupling.

[1] Source: author's calculations based on World Bank WDI data [17].
[2] Source: author's calculations based on World Bank WDI data [17].

The renewable-energy paradox

Figure 2 presents the share of renewable sources in electricity generation according to the official WDI series [17].

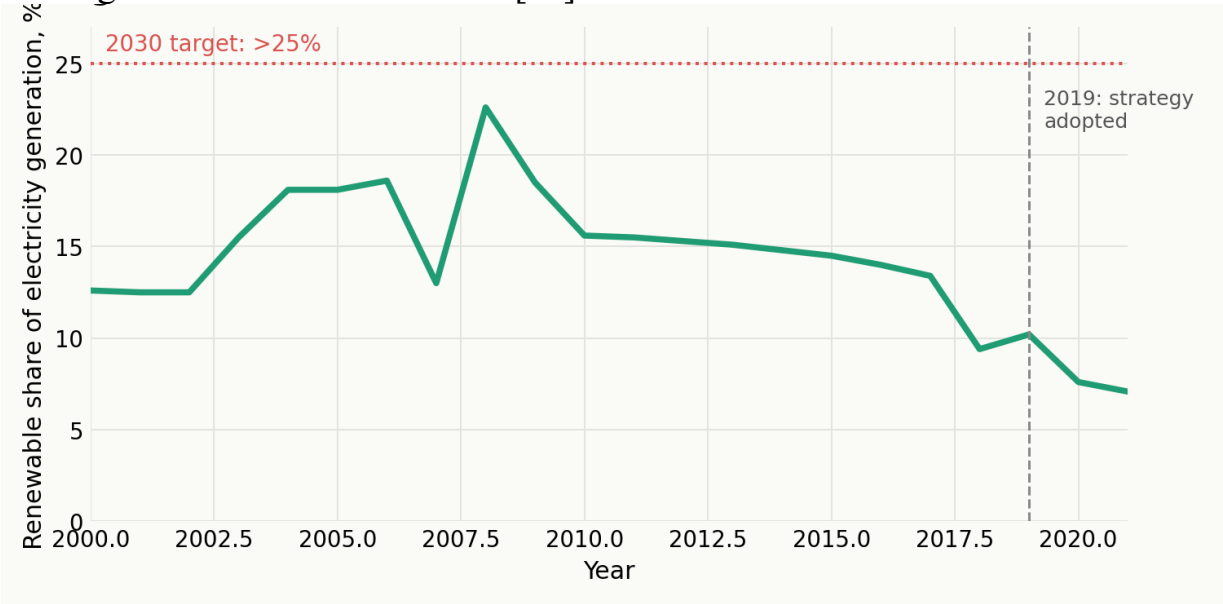


Figure 2. Share of renewable sources in electricity generation, 2000-2021[1]

Over the same period, the renewable share of electricity generation follows an unexpected trajectory (Figure 2). Having risen from 12.6 percent in 2000 to a peak of 22.6 percent in 2008, the share then declined almost continuously, falling to just 7.08 percent by 2021 - two years after the green-economy strategy's adoption, and far below the strategy's target of exceeding 25 percent by 2030 [20]. This apparent paradox is best explained by a denominator effect: Uzbekistan's renewable base rests largely on Soviet-era hydropower capacity, whose output has remained essentially flat, while total electricity generation has nearly doubled to meet rising demand, with most of that additional generation supplied by gas turbines. The absolute volume of renewable generation has therefore not fallen; only its share of a rapidly expanding total has.

It should be noted that the 2000-2021 series discussed above is the WDI's validated, methodologically consistent series. Outside this panel, press and official sources report a renewable share of approximately 18 percent by May 2024 [5] and a record renewable-generation year in 2025 [9] - coinciding closely with the commissioning of the large-scale solar and wind projects financed by the EBRD and ADB in 2022-2023 [1; 4]. This suggests that the customary two-to-three-year lag between financing and generation has not yet been fully captured in the official, methodologically consistent WDI series.

Tapio decoupling elasticity

The annual Tapio elasticities are plotted in Figure 3, and their distribution across decoupling states before and after the policy date is summarised in Table 3.

[1] Source: author's calculations based on World Bank WDI data [17].

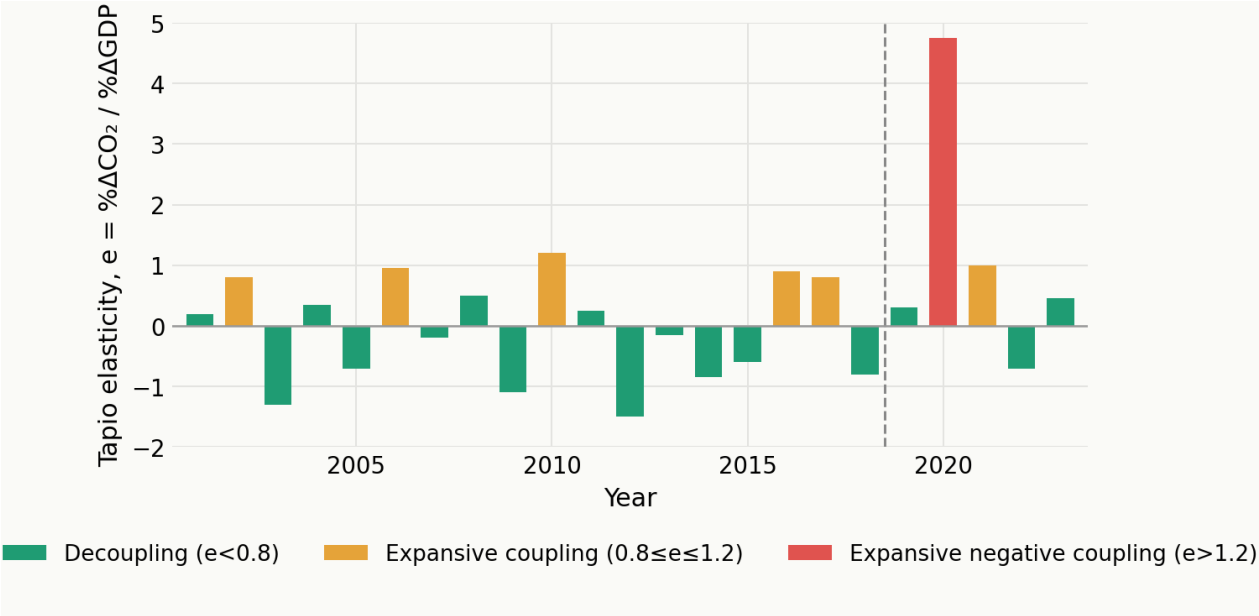


Figure 3. Tapio decoupling elasticity between GDP growth and CO_2 emissions, 2001-2023[1]

Figure 3 shows that most annual elasticities before 2019 lie below the 0.8 threshold, and several of them are negative, which corresponds to strong decoupling. After 2019 the picture is dominated by a single spike in 2020, when the elasticity exceeded 4 because GDP growth in the pandemic year was very low; in the other post-policy years the values return to the decoupling or expansive-coupling range.

Table 3

Tapio decoupling states, pre- and post-policy periods[2]

Period	Decoupling (e<0.8)	Expansive coupling (0.8≤e≤1.2)	Expansive negative coupling (e>1.2)	Total years
2001-2018 (pre-policy)	14	4	0	18
2019-2023 (post-policy)	3	1	1	5

For the pre-policy period 2001-2018, the mean Tapio elasticity is -0.09, with 14 of 18 years classified as decoupling - close, on average, to strong decoupling. For the post-policy period 2019-2023 (N = 5), the mean elasticity rises to +1.17 (+0.28 excluding the pandemic-affected year 2020), indicating a shift away from strong decoupling, even though three of the five years remain in the decoupling state. Neither Welch's t-test (t = -1.32, p = 0.25 for the full sample; t = -0.90, p = 0.41 excluding 2020) nor the Mann-Whitney U test (p = 0.17) confirms this shift as statistically reliable.

Structural-break regression

Table 4 reports the structural-break regression estimates for the main specification and the two robustness checks.

[1] Source: author's calculations based on World Bank WDI data [17].
[2] Source: author's calculations based on World Bank WDI data [17].

Table 4

Structural break regression results for CO_2 growth rate (HC3 robust standard errors)[1]

Model	Variable	Coefficient	Std. Error (HC3)	p-value
(1) Main: break=2019, N=23	const	-0.633	1.453	0.663
	GDP growth (centered)	-0.214	0.715	0.765
	Policy (≥2019)	3.685	4.160	0.376
	Policy × GDP growth	-0.177	5.297	0.973
(2) Excluding 2020, N=22	const	-0.633	1.453	0.663
	GDP growth (centered)	-0.214	0.715	0.765
	Policy (≥2019)	2.134	2.640	0.419
	Policy × GDP growth	4.970	3.082	0.107
(3) Alternative break=2021, N=23	const	-0.150	1.372	0.913
	GDP growth (centered)	-0.698	0.677	0.302
	Policy (≥2021)	1.641	12.659	0.897
	Policy × GDP growth	5.455	25.526	0.831

Across all three specifications, neither the policy indicator nor its interaction with GDP growth is statistically significant ($p > 0.3$ throughout), and the models' explanatory power remains low ($R^2 = 0.10$-0.15). This is an expected consequence of having only four to five post-2019 observations, but it also means that the official data as yet reveal no clear trace of a structural break.

Finally, the relationship between carbon intensity and the renewable share, weakly positive in levels ($r = 0.38$), falls to near zero in first differences ($r = 0.05$) - a standard diagnostic, also employed in prior studies, confirming that the level correlation is an artefact of two independently trending series rather than evidence that declining carbon intensity is genuinely related to a rising renewable share.

Taken together, the findings present an unspectacular but coherent picture. Uzbekistan's long-run decline in carbon intensity is real and substantial, but it predates the expansion of renewable electricity and is not statistically associated with it; it is better explained by structural change - a shift away from heavy industry toward services and light manufacturing - and by gains in energy efficiency, visible in the steady rise of GDP per unit of energy consumed. This interpretation is consistent with the OECD's qualitative assessment that Uzbekistan's energy system, while still gas-dependent, is becoming progressively more efficient [11]; [12].

The absence of a statistically detectable acceleration in decoupling after 2019 should not be read as evidence that the Green Economy strategy or green finance more broadly has failed. Nearly every green-financed generation asset identifiable by name in this study - the Nur Jizzakh, Nur Samarkand, and Nur Sherabad solar complexes (approximately 900 MW) [4], the ADB-ACWA wind project [1], and the projects financed through the 2023 sovereign green bond [16] - was contracted in 2022-2023 and commissioned in 2023-2025, that is, after both the most recent confirmed

[1] Source: author's calculations based on World Bank WDI data [17].

renewable-share observation in this panel (2021) and the end of the CO_2 series (2023). Should future WDI releases confirm the approximately 18-percent share reported for 2024 [5], that year may prove to be the first in which the financing-to-generation lag closes - precisely the test this study's design anticipates but cannot yet perform.

The elevated elasticity observed in 2020-2021 is more plausibly an artefact of the near-zero GDP-growth denominator under pandemic conditions (1.62 percent in 2020) than genuine 're-coupling' - a recognised weakness of the Tapio method, whereby elasticities derived from short annual differences are sensitive to denominator noise. This limitation is acknowledged rather than concealed.

These results are broadly consistent with those of Bakhtiyorov [2], the only other Uzbekistan-specific quantitative study of the green transition, which employs a different design - multivariate regression and an EKC specification over 2010-2023, benchmarked against Azerbaijan - and likewise reports statistically unreliable coefficients, attributing the result to limited institutional capacity and the short interval since reform.

Several limitations warrant emphasis. First, with N = 22-24 national annual observations - a constraint shared with the only comparable Uzbekistan study - any single year, particularly 2020, can materially influence the results. Second, the WDI renewable-electricity-share series for Uzbekistan currently extends only to 2021, so the years of greatest policy relevance (2022-2025, precisely when green-bond-financed capacity came online) cannot yet be tested against official, comparable data. Third, the CO_2 indicators used here are calculated on a territorial/production basis and are silent on emissions embedded in trade. Fourth, and most importantly, no Uzbek government body currently publishes an official, machine-readable annual series of green credit or green bond volumes; the 'green finance' variable in this study therefore remains a policy-date proxy (the 2019 strategy adoption, with 2021 as an alternative) rather than a direct measure of financial flows - arguably the single largest obstacle to causal identification in this strand of the Uzbekistan literature.

CONCLUSION AND SUGGESTIONS

This study set out to determine whether the green-economy policy adopted in Uzbekistan in 2019, together with the green-finance instruments subsequently developed, has statistically altered the relationship between economic growth and carbon emissions. Drawing on the official national panel for 2000-2023, four findings emerge: first, carbon intensity fell by 75.4 percent between 2000 and 2019, a decline attributable to structural change and efficiency gains rather than to renewable energy; second, the renewable share itself fell, from 22.6 percent to 7.1 percent between 2008 and 2021, owing to a denominator effect; third, although the direction of the post-2019 decoupling elasticity moved away from strong decoupling, the shift is not statistically reliable; and fourth, the results are better explained by the ordinary lag between financing and realised outcomes than by any shortcoming in green-finance policy.

On this basis, five recommendations follow.

1. The Ministry of Economy and Finance, the Central Bank, and the State Statistics Committee should jointly establish and publish an annual, machine-readable

registry of green credit and green bond issuance aligned with the 2023 green taxonomy - the most significant data gap this study identifies.

2. Because the renewable-share paradox is fundamentally a denominator problem, policy monitoring should track not only the percentage share but also the growth of renewable generation volume relative to total generation, so that genuine capacity gains are not obscured by a rapidly expanding denominator.

3. WDI-comparable reporting of the renewable electricity share should be extended through 2022-2025, or, failing that, IRENA's more current capacity statistics [7] should be adopted as a standardised supplement, enabling a proper assessment of the 2022-2025 commissioning wave against the pre-2019 baseline.

4. This analysis should be repeated in 2027-2028, once three to five further years of post-2021 data have accumulated, at which point ARDL/cointegration methods - which require longer series than are currently available - could be applied to conduct a genuine long-run causal test.

5. Since intensity gains to date have originated mainly in structural and efficiency channels, policy attention should be directed at least as much toward non-electricity decarbonisation - industrial energy efficiency and gas-distribution efficiency in particular - as toward the renewable-capacity build-out that currently dominates the green-finance narrative.

In sum, Uzbekistan has made real and meaningful progress in reducing carbon intensity, but most of that progress predates the recent wave of green finance. A genuine test of green finance's contribution will only become possible once the 2024-2026 statistics - reflecting the full commissioning of capacity financed in 2022-2023 - enter the official data panel.

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SANOAT KORXONALARIDA INNOVATSION FAOLIYATNI BOSHQARISHDA XORIJIY MAMLAKATLAR TAJRIBASI VA ENG YAXSHI AMALIYOTLAR

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Annotatsiya

Maqolada sanoat korxonalarida innovatsion faoliyatni boshqarishning xorijiy modellari va eng yaxshi amaliyotlari tadqiq etilgan. Germaniya, Yaponiya, Janubiy Koreya, Xitoy va AQSh tajribasi davlat, sanoat va ilm-fan hamkorligi, moliyalashtirish mexanizmlari hamda korxona ichidagi boshqaruv vositalari kesimida qiyosiy tahlil qilingan. Tadqiqotda tizimli yondashuv, qiyosiy va institutsional tahlil, guruhlash hamda umumlashtirish usullari qo‘llanildi. Global innovatsiyalar indeksi ma’lumotlari asosida O‘zbekistonning innovatsion salohiyati baholangan. Natijalar O‘zbekistonda innovatsion resurslar bo‘yicha o‘rin yaxshilanayotgan bo‘lsa-da, innovatsion natijalar ortda qolayotganini ko‘rsatdi. Asosiy muammo korxonalarda g‘oyani tijoratlashtirilgan mahsulotga aylantiruvchi boshqaruv tizimining zaifligi ekani aniqlandi. Bosqichli qaror qabul qilish, ochiq innovatsiyalar, uzluksiz takomillashtirish, natijaga bog‘langan moliyalashtirish va innovatsion ko‘rsatkichlar tizimi eng yaxshi amaliyotlar sifatida ajratildi. Korxona darajasida innovatsion faoliyatni boshqarishning besh bosqichli modeli va xorij tajribasini O‘zbekiston sanoat korxonalarida qo‘llash bo‘yicha takliflar ishlab chiqilgan.

Kalit so‘zlar: innovatsion faoliyat, sanoat korxonasi, innovatsion boshqaruv, ochiq innovatsiyalar, ilmiy-tadqiqot va tajriba-konstruktorlik ishlari (ITTKI), texnologiyalar transferi, “Sanoat 4.0”, Global innovatsiyalar indeksi.

Аннотация

В статье исследуются зарубежные модели и лучшие практики управления инновационной деятельностью на промышленных предприятиях. Опыт Германии, Японии, Южной Кореи, Китая и США сравнивается по взаимодействию государства, промышленности и науки, механизмам финансирования и инструментам внутрифирменного управления. В исследовании применены системный подход, сравнительный и институциональный анализ, группировка и обобщение. На основе данных Глобального инновационного индекса оценён инновационный потенциал Узбекистана. Результаты показали, что при улучшении позиций Узбекистана по инновационным ресурсам инновационные результаты отстают. Установлено, что основная проблема заключается в слабости системы управления, превращающей идею в коммерциализированный продукт на предприятиях. В качестве лучших практик выделены поэтапное принятие решений, открытые инновации, непрерывное совершенствование, финансирование, привязанное к результатам, и система инновационных показателей. Предложены пятиэтапная модель управления инновационной деятельностью на уровне предприятия и

рекомендации по применению зарубежного опыта на промышленных предприятиях Узбекистана.

Ключевые слова: инновационная деятельность, промышленное предприятие, инновационный менеджмент, открытые инновации, НИОКР, трансфер технологий, «Индустрия 4.0», Глобальный инновационный индекс.

Abstract

The article studies foreign models and best practices of managing innovation activity in industrial enterprises. The experience of Germany, Japan, South Korea, China and the USA is compared in terms of government-industry-science cooperation, financing mechanisms and in-company management tools. The study applies a systems approach, comparative and institutional analysis, grouping and generalisation. Uzbekistan's innovation potential is assessed using Global Innovation Index data. The results show that while Uzbekistan's position in innovation inputs is improving, innovation outputs are lagging behind. The main problem is found to be the weakness of enterprise management systems that turn ideas into commercialised products. Stage-gate decision-making, open innovation, continuous improvement, results-based financing and an innovation indicator system are identified as best practices. A five-stage model of innovation management at the enterprise level and recommendations for applying foreign experience in Uzbek industrial enterprises are proposed.

Keywords: innovation activity, industrial enterprise, innovation management, open innovation, R&D, technology transfer, Industry 4.0, Global Innovation Index.

KIRISH

Sanoat korxonalarining raqobatbardoshligi bugun arzon ishchi kuchi yoki xomashyo bilan emas, balki yangi mahsulot va texnologiyalarni tez yaratish va bozorga chiqarish qobiliyati bilan belgilanmoqda. Global innovatsiyalar indeksi (GII) 2025 reytingida yetakchi o‘rinlarni Shveytsariya, Shvetsiya, AQSh, Janubiy Koreya va Singapur egalladi, Xitoy esa ilk bor birinchi o‘ntalikka kirdi [17]. Bu mamlakatlarning umumiy jihati - innovatsiyalar korxona strategiyasining markazida turadi va tizimli boshqariladi.

O‘zbekistonda bu yo‘nalishda huquqiy asos yaratilgan. “Innovatsion faoliyat to‘g‘risida”gi Qonun [20], 2022-2026-yillarga mo‘ljallangan Innovatsion rivojlanish strategiyasi [22] va “O‘zbekiston - 2030” strategiyasi [21] sanoatni modernizatsiya qilish va ilm-fan bilan ishlab chiqarish integratsiyasini ustuvor vazifa sifatida belgilagan. Natijada mamlakat GIIda 2020-yildagi 93-o‘rindan 2025-yilda 79-o‘ringa ko‘tarildi [18].

Biroq bu o‘sish asosan innovatsion resurslar hisobiga bo‘lmoqda. O‘zbekiston 2025-yilda innovatsion resurslar bo‘yicha 69-o‘rinni, innovatsion natijalar bo‘yicha esa atigi 92-o‘rinni egalladi [18]. Demak, asosiy muammo mablag‘ yetishmasligida emas, balki korxonalarda g‘oyani tijoratlashtirilgan mahsulotga aylantiruvchi boshqaruv tizimining zaifligidadir.

Xalqaro tajriba shuni ko‘rsatadiki, innovatsion faoliyat tasodifiy ilhom mahsuli emas, balki rejalashtirish, moliyalashtirish, nazorat va rag‘batlantirishni talab qiladigan boshqaruv obyektidir [5]. Innovatsiyalarni o‘lchash bo‘yicha xalqaro metodologiya

ham korxonani innovatsion faoliyatning asosiy subyekti sifatida ko‘radi [13]. Shu sababli rivojlangan mamlakatlarning davlat siyosati bilan bir qatorda, ularning korxonalari innovatsion jarayonni qanday tashkil etishi va boshqarishini o‘rganish O‘zbekiston sanoati uchun amaliy ahamiyatga ega.

Tadqiqotning maqsadi - sanoat korxonalarida innovatsion faoliyatni boshqarishning ilg‘or xorij tajribasini umumlashtirish va uni O‘zbekiston sanoat korxonalarida qo‘llash bo‘yicha amaliy takliflar ishlab chiqishdan iborat.

Maqsadga erishish uchun quyidagi vazifalar belgilandi: yetakchi mamlakatlarning innovatsion boshqaruv modellarini davlat, sanoat va ilm-fan hamkorligi, moliyalashtirish mexanizmi va korxona ichidagi vositalar bo‘yicha qiyosiy tahlil qilish; ushbu modellardan sanoat korxonalarida qo‘llash mumkin bo‘lgan eng yaxshi amaliyotlarni ajratish; O‘zbekistonning innovatsion salohiyatini Global innovatsiyalar indeksi ma’lumotlari asosida baholash; korxona darajasida innovatsion faoliyatni boshqarish modelini ishlab chiqish.

ADABIYOTLAR SHARHI

Innovatsiyani iqtisodiy rivojlanishning asosiy harakatlantiruvchi kuchi sifatida birinchi bo‘lib J. Shumpeter asoslagan. U yangi mahsulot, yangi texnologiya, yangi bozor, yangi xomashyo manbai va yangi tashkiliy shakllarni “yangi kombinatsiyalar” deb atab, ularni tadbirkorning asosiy funksiyasi deb hisoblagan [14]. P. Druker esa innovatsiyani tasodifiy ilhom emas, balki maqsadli izlanish va tizimli boshqarish mumkin bo‘lgan faoliyat sifatida ko‘rsatib, innovatsion imkoniyatlarning yettita manbasini ajratgan [5].

Milliy innovatsion tizim konsepsiyasi K. Friman, B.-A. Lundvall va R. Nelson ishlarida shakllangan [8]; [11]; [12]. K. Friman Yaponiya misolida davlat, korxonalar va ta’lim muassasalari o‘rtasidagi aloqalar texnologik yutuqlarni belgilashini ko‘rsatgan. H. Etskovits va L. Leydesdorff bu g‘oyani “uchlik spiral” (davlat - sanoat - universitet) modeli sifatida rivojlantirgan [6].

B.-A. Lundvall milliy innovatsion tizimni ishlab chiqaruvchilar va iste’molchilar o‘rtasidagi interaktiv o‘rganish jarayoni sifatida talqin qilgan bo‘lsa [11], R. Nelson tahriri ostidagi qiyosiy tadqiqot turli mamlakatlarning innovatsion tizimlari institutsional tuzilishi, sanoat tarkibi va davlat siyosatiga ko‘ra sezilarli farq qilishini ko‘rsatgan [12]. Bu xulosa bitta mamlakat modelini mexanik ravishda ko‘chirish emas, balki uning alohida vositalarini mahalliy sharoitga moslashtirish zarurligini asoslaydi.

Korxona darajasidagi boshqaruv vositalari bo‘yicha R. Kuperning “Stage-Gate” modeli yangi mahsulot yaratish jarayonini bosqichlar va ular orasidagi qaror nuqtalariga ajratadi [4]. H. Chesbro esa “ochiq innovatsiyalar” paradigmasini taklif etib, korxonalar tashqi g‘oya va texnologiyalardan ham faol foydalanishi kerakligini asoslagan [2]. Yaponiya tajribasini umumlashtirgan M. Imai uzluksiz takomillashtirish (kaydzen) tamoyilini kichik, ammo doimiy innovatsiyalar manbai sifatida ko‘rsatgan [9]. Innovatsion faoliyatni o‘lchash bo‘yicha xalqaro metodologik asos OECD va Evrostatning Oslo qo‘llanmasi hisoblanadi [13].

O‘zbekiston sharoitiga oid so‘nggi tadqiqotlarda ham innovatsion faoliyat masalalari o‘rganilmoqda. Jumladan, S. Siddikova va hammualliflar O‘zbekistonda ITTKI xarajatlari bilan nominal YaIM o‘sishi o‘rtasidagi bog‘liqlikni birinchi farqlar va taqsimlangan lag modellari asosida tahlil qilgan [16]. Boshqa bir tadqiqotda O‘zbekistonning innovatsion samaradorligi GII natijalar va resurslar sub-indekslari nisbati orqali yetakchi va rivojlanayotgan iqtisodiyotlar bilan taqqoslangan [3]. Biroq bu ishlar asosan makrodarajadagi ko‘rsatkichlarga qaratilgan.

Xorijiy boshqaruv modellarini O‘zbekiston sanoat korxonalari sharoitiga moslashtirish, ya’ni qaysi vosita qaysi bosqichda qo‘llanishi kerakligini asoslash masalasi ilmiy adabiyotda yetarlicha yoritilmagan.

METODOLOGIYA

Tadqiqotda tizimli yondashuv, qiyosiy va institutsional tahlil, guruhlash hamda umumlashtirish usullaridan foydalanildi. Xorijiy tajriba besh mamlakat - Germaniya, Yaponiya, Janubiy Koreya, Xitoy va AQSh misolida o‘rganildi. Ular GII 2025 reytingining birinchi o‘n ikkiligiga kiradi va innovatsion boshqaruvning bir-biridan farq qiluvchi modellarini ifodalaydi [17].

Har bir model uch mezon bo‘yicha taqqoslandi: davlat, sanoat va ilm-fan o‘rtasidagi hamkorlik shakli; innovatsiyalarni moliyalashtirish mexanizmi; korxona ichidagi boshqaruv vositalari. Empirik baza sifatida WIPO, OECD va milliy statistika idoralari ma’lumotlari, me’yoriy asos sifatida esa O‘zbekiston Respublikasining innovatsion faoliyatga oid qonun hujjatlari olindi [20; 21; 22].

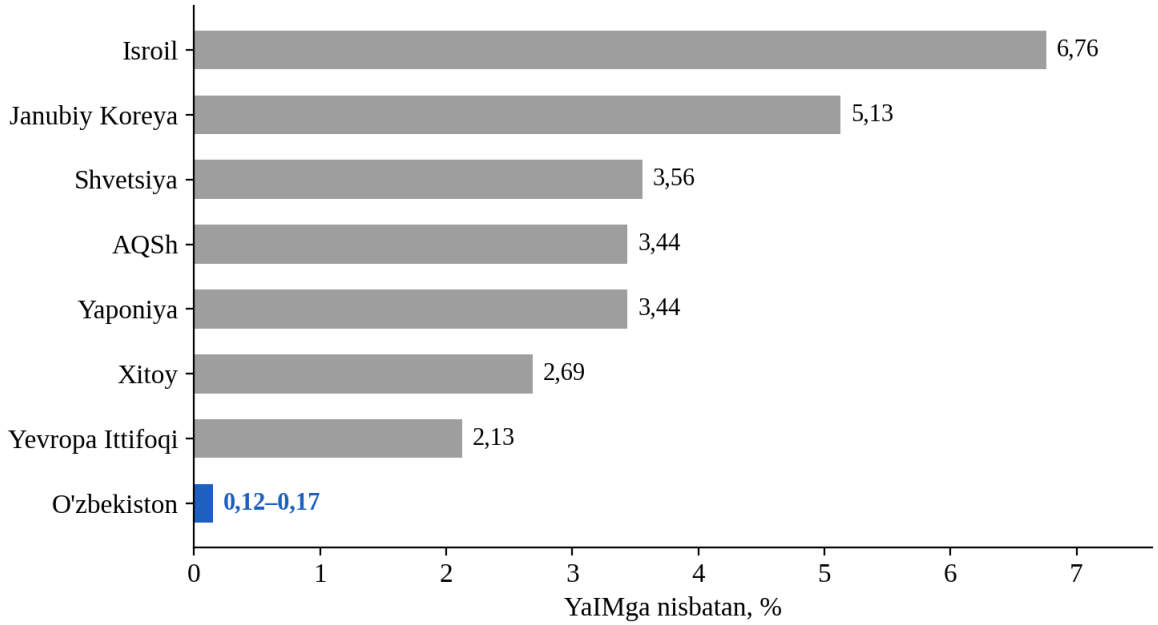
Tadqiqot uch bosqichda amalga oshirildi. Birinchi bosqichda innovatsion faoliyatni boshqarishga oid nazariy yondashuvlar - innovatsiya nazariyasi, milliy innovatsion tizim, “uchlik spiral”, “Stage-Gate” va ochiq innovatsiyalar konsepsiyalari umumlashtirilib, qiyosiy tahlil mezonlari asoslandi [2; 4; 6; 8; 14]. Ikkinchi bosqichda har bir mamlakat bo‘yicha ITTKI xarajatlarining YaIMga nisbati, ularni moliyalashtirish manbalari va korxonalarning ulushi kabi ko‘rsatkichlar ochiq rasmiy manbalar asosida to‘plandi va guruhlandi [1; 7; 10; 15; 19]. O‘zbekistonning innovatsion salohiyati GII bo‘yicha 2020-2025-yillardagi umumiy o‘rni, innovatsion resurslar va innovatsion natijalar sub-indekslari bo‘yicha o‘rinlari dinamikasi orqali baholandi [18]. Uchinchi bosqichda aniqlangan eng yaxshi amaliyotlar innovatsion jarayon bosqichlariga biriktirilib, korxona darajasidagi boshqaruv modeli shakllantirildi; natija ko‘rsatkichlarini tanlashda Oslo qo‘llanmasi tavsiyalariga tayanildi [13]. Tadqiqotning cheklovi shundaki, turli mamlakatlar ma’lumotlari turli manbalar va yillarga tegishli, shu sababli qiyosiy tahlil asosan sifat xarakteriga ega.

TAHLIL VA NATIJALAR

Innovatsiyalarni moliyalashtirish ko‘lami

Innovatsion yetakchi mamlakatlarda ITTKI xarajatlari YaIMning 2,7-5 foizini tashkil etadi, O‘zbekistonda esa bu ko‘rsatkich 0,2 foizdan oshmaydi (1-rasm). Janubiy Koreyada 2024-yilda ITTKI xarajatlari 131 trln vonga yetib, YaIMning 5,13 foizini tashkil etdi va dunyoda Isroildan keyin ikkinchi o‘rinni egalladi [1]. Xitoyda 2025-yilda ITTKI xarajatlari 3,9 trln yuanga yetib, YaIMning 2,80 foiziga teng bo‘ldi va ilk

bor OECD mamlakatlari o‘rtacha darajasidan oshdi [15]. O‘zbekistonda esa 2010-2024-yillarda bu ko‘rsatkich YaIMning 0,12-0,17 foizi atrofida bo‘lgan [16].



1-rasm. ITTKI xarajatlarining YaIMga nisbati, foizda (2024-yil)[1]

Izoh: O‘zbekiston uchun 2010-2024-yillardagi oraliq ko‘rsatilgan.

1-rasmda ITTKI xarajatlarining YaIMga nisbati bo‘yicha Isroil (6,76 foiz) va Janubiy Koreya (5,13 foiz) yetakchilik qiladi, Shvetsiya (3,56 foiz), AQSh va Yaponiya (3,44 foizdan) undan keyingi o‘rinlarda turadi. Xitoyda bu ko‘rsatkich 2,69 foizni, Yevropa Ittifoqida 2,13 foizni tashkil etgan. O‘zbekistondagi 0,12-0,17 foizlik daraja esa Yevropa Ittifoqi o‘rtachasidan qariyb 12-18 baravar, Janubiy Koreyadan esa 30 baravardan ziyod past. Bunday farq innovatsiyalarni moliyalashtirish hajmini oshirish bilan birga, mavjud mablag‘lardan foydalanish samaradorligini ham oshirish zarurligini ko‘rsatadi.

Muhimi, yetakchi mamlakatlarda innovatsiyalarning asosiy moliyachisi davlat emas, balki korxonalarning o‘zidir. Xitoyda ko‘p yillardan beri ITTKI xarajatlarining 75 foizdan ortig‘ini korxonalar qoplaydi [19]. Demak, innovatsion faoliyatni boshqarish, avvalo, korxona darajasidagi vazifadir.

Germaniya: amaliy tadqiqotlar tarmog‘i va o‘rta biznes

Germaniya modelining tayanchi - amaliy tadqiqotlar tashkilotlari va o‘rta sanoat korxonalari (Mittelstand) o‘rtasidagi barqaror hamkorlik. Uning markazida Fraunhofer jamiyati turadi: 74 ta institut va ilmiy bo‘linmada 30 mingdan ortiq xodim ishlaydi, yillik byudjeti 3,6 mlrd yevro [7]. Byudjetning 3,2 mlrd yevrosini buyurtma asosidagi tadqiqotlar tashkil etadi, davlat bazaviy moliyalashtirishi esa uning uchdan biridan oshmaydi; 2025-yilda sanoatdan tushum 966 mln yevroga yetgan [7].

Bu modelning boshqaruv mantig‘i aniq: institut davlatdan qancha ko‘p moliyalashtirish olishi sanoatdan qancha buyurtma topishiga bog‘liq. Natijada

[1] Manba: [1]; [16] ma’lumotlari asosida muallif tomonidan tuzilgan.

tadqiqotchilar bozor talabiga yo‘naltiriladi, o‘z ITTKI bo‘linmasiga ega bo‘lmagan o‘rta korxonalar esa tashqi ilmiy salohiyatdan foydalanadi. Germaniyaning “Sanoat 4.0” (Industrie 4.0) konsepsiyasi ham shu hamkorlik asosida raqamli ishlab chiqarishni joriy etishga qaratilgan.

Yaponiya: uzluksiz takomillashtirish va korporativ laboratoriyalar

Yaponiya modeli yirik korporatsiyalar ichidagi kuchli ITTKI markazlari va ishlab chiqarishdagi uzluksiz takomillashtirish (kaydzen) uyg‘unligiga asoslanadi [9]. Innovatsiya bu yerda faqat laboratoriya mahsuli emas: har bir ishchi taklif berish tizimi orqali jarayonni yaxshilashda qatnashadi. “Toyota ishlab chiqarish tizimi”dagi tejamkor ishlab chiqarish (lean) va sifat to‘garaklari kichik, ammo ko‘p sonli innovatsiyalarni doimiy oqimga aylantiradi. K. Friman ta’kidlaganidek, Yaponiyaning texnologik yutug‘i vazirliklar, korporatsiyalar va ta’lim tizimi o‘rtasidagi uzoq muddatli muvofiqlashtirishga tayangan [8].

Janubiy Koreya: davlat tomonidan yo‘naltirilgan korporativ innovatsiya

Janubiy Koreya davlat strategik ustuvorliklarni belgilab, yirik biznes guruhlari (chebollar) ularni amalga oshiradigan modelni shakllantirgan. Bu model yuqori natija bergan, ammo jiddiy nomutanosiblikni ham yuzaga keltirgan: 2021-yilda Samsung Electronics mamlakat korporativ ITTKI xarajatlarining 49,1 foizini, eng yirik besh kompaniya esa 75,5 foizini ta’minlagan [10]. Shu sababli Koreya tajribasi yirik korxonalar bilan bir qatorda kichik va o‘rta sanoat korxonalarining innovatsion salohiyatini ham rivojlantirish zarurligini ko‘rsatadi.

Xitoy: davlat rejasi va korxonalarning yetakchi roli

Xitoy modeli uzoq muddatli davlat dasturlari (masalan, “Made in China 2025”) va korxonalarning ITTKIdagi hal qiluvchi ulushini birlashtiradi. 2021-2024-yillarda ITTKI xarajatlari yiliga o‘rtacha 10,5 foizga o‘sgan [19]. Natija sanoatda yaqqol ko‘rinmoqda: 2025-yilda yuqori texnologiyali ishlab chiqarishning qo‘shilgan qiymati 9,4 foizga o‘sib, barcha yirik sanoat korxonalari qo‘shilgan qiymatining 17,1 foizini tashkil etdi [15].

AQSh: venchur moliyalashtirish va kichik biznes innovatsiyalari

AQSh modeli bozor mexanizmlari, rivojlangan venchur kapital va universitetlardan texnologiyalar transferiga tayanadi. Davlatning asosiy vositasi - kichik biznes innovatsion tadqiqotlari dasturi (SBIR): yirik federal agentliklar tashqi ITTKI byudjetining belgilangan qismini kichik korxonalarning tanlov asosidagi loyihalariga yo‘naltiradi. Bu dastur g‘oyani tekshirishdan prototipgacha bosqichma-bosqich moliyalashtiradi va keyingi bosqichga o‘tishni oldingi natijaga bog‘laydi. Korxona darajasida esa H. Chesbro asoslagan ochiq innovatsiyalar amaliyoti - startaplarni sotib olish, korporativ venchur fondlar va litsenziyalash keng tarqalgan [2].

Modellarning qiyosiy tavsifi

Ko‘rib chiqilgan modellar davlat roli va moliyalashtirish manbai bo‘yicha farqlansa-da, korxona darajasida ularning barchasi innovatsiyani alohida boshqariladigan jarayon sifatida tashkil etadi (1-jadval).

1-jadval

Sanoat korxonalarida innovatsion faoliyatni boshqarish modellarining qiyosiy tavsifi[1]

Model	Davlatning roli	Asosiy moliyalashtirish manbai	Korxona darajasidagi asosiy vosita	O‘zbekiston uchun asosiy saboq
Germaniya	Amaliy tadqiqot institutlarini bazaviy moliyalashtirish	Buyurtma asosidagi tadqiqotlar, sanoat buyurtmalari	O‘rta korxonalarning tadqiqot institutlari bilan shartnomaviy hamkorligi	Davlat moliyalashtirishini sanoat buyurtmalariga bog‘lash
Yaponiya	Uzoq muddatli muvofiqlashtirish	Korporatsiyalarning o‘z mablag‘lari	Kaydzen, sifat to‘garaklari, taklif berish tizimi	Ishchilarning takomillashtirish takliflarini rag‘batlantirish
Janubiy Koreya	Strategik ustuvorliklarni belgilash, yo‘naltirish	Yirik biznes guruhlari	Korporativ ITTKI markazlari	Yirik korxonalar bilan birga KO‘B innovatsiyalarini qo‘llab-quvvatlash
Xitoy	Uzoq muddatli rejalashtirish, maqsadli dasturlar	Korxonalar (ITTKIning 75 foizdan ortig‘i)	Maqsadli ko‘rsatkichlar, texnologik parklar	Korxonalar ITTKI ulushini ko‘rsatkich sifatida belgilash
AQSh	Tanlov asosidagi bosqichli grantlar (SBIR)	Venchur kapital, korporatsiyalar	Ochiq innovatsiyalar, korporativ venchur fondlar	Bosqichli, natijaga bog‘langan moliyalashtirish

1-jadvalda besh model davlatning roli bo‘yicha farqlanadi: Germaniya va AQShda davlat natijaga yoki sanoat buyurtmasiga bog‘langan moliyalashtirish orqali, Janubiy Koreya va Xitoyda strategik ustuvorliklar va maqsadli dasturlar orqali, Yaponiyada esa uzoq muddatli muvofiqlashtirish orqali ta’sir ko‘rsatadi. Shu bilan birga, barcha modellarda innovatsiyalarning asosiy moliyalashtirish manbai korxonalar, sanoat buyurtmalari yoki xususiy kapital hisoblanadi. Jadvalning oxirgi ustunida keltirilgan saboqlar keyingi qismda eng yaxshi amaliyotlar sifatida umumlashtirildi.

Eng yaxshi amaliyotlar

Xorij tajribasini umumlashtirib, sanoat korxonalarida qo‘llash mumkin bo‘lgan beshta eng yaxshi amaliyot ajratildi:

1. Bosqichli qaror qabul qilish (Stage-Gate). Loyiha g‘oyadan bozorga chiqishgacha bosqichlarga bo‘linadi va har bir bosqich oxirida davom ettirish yoki to‘xtatish to‘g‘risida qaror qabul qilinadi [4]. Bu mablag‘ni istiqbolsiz loyihalarga sarflashning oldini oladi.

[1] Manba: [1]; [2]; [7]; [8]; [9]; [10]; [15]; [16]; [19] asosida muallif tomonidan tuzilgan.

2. Ochiq innovatsiyalar. Korxona universitetlar, tadqiqot institutlari va startaplarning g‘oyalaridan foydalanadi, o‘zi ishlatmayotgan texnologiyalarni esa litsenziya orqali sotadi [2].

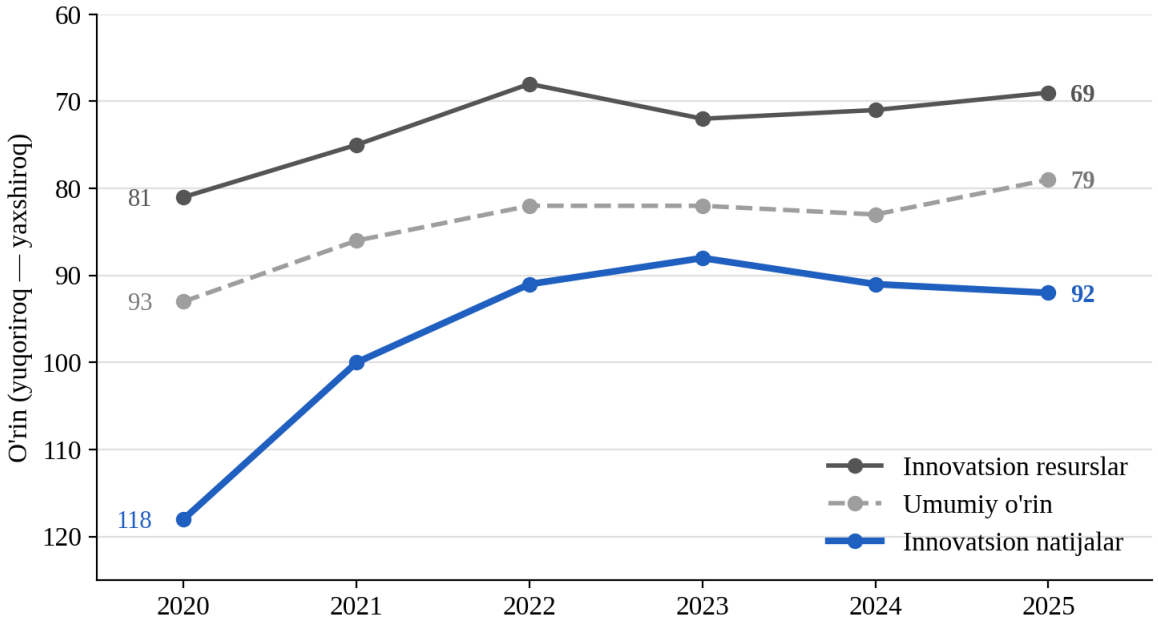
3. Uzluksiz takomillashtirish. Ishchilarning takliflari tizimli yig‘iladi, baholanadi va rag‘batlantiriladi [9].

4. Natijaga bog‘langan moliyalashtirish. Fraunhofer va SBIR tajribasidagi kabi keyingi mablag‘ oldingi natija yoki sanoat buyurtmasi mavjudligiga bog‘lanadi [7].

5. Innovatsion ko‘rsatkichlar tizimi. ITTKI xarajatlarining tushumga nisbati, yangi mahsulotlar ulushi va patentlar soni rahbariyat samaradorligini baholash ko‘rsatkichlariga kiritiladi [13].

O‘zbekiston sanoat korxonalarida qo‘llash imkoniyatlari

O‘zbekiston GIIda to‘rt yil ketma-ket kutilganidan yuqori natija ko‘rsatayotgan mamlakatlar qatoriga kiradi, biroq resurslar va natijalar o‘rtasidagi farq qisqarmayapti (2-rasm) [17]. 2020-2025-yillarda innovatsion resurslar bo‘yicha o‘rin 81-dan 69-ga yaxshilangan bo‘lsa, natijalar bo‘yicha 2022-yildan beri 88-92-o‘rinlar oralig‘ida qolmoqda [18].



2-rasm. O‘zbekistonning Global innovatsiyalar indeksidagi o‘rinlari, 2020-2025-yillar[1]

2-rasmda 2020-2025-yillarda O‘zbekistonning umumiy o‘rni 93-dan 79-ga, innovatsion resurslar bo‘yicha o‘rni 81-dan 69-ga, innovatsion natijalar bo‘yicha esa 118-dan 92-ga ko‘tarilgan. Natijalar bo‘yicha asosiy yutuq 2020-2022-yillarga to‘g‘ri keladi (118-dan 91-ga), 2023-yilda 88-o‘ringa chiqilgandan so‘ng esa ko‘rsatkich yana 92-o‘ringa tushgan. Resurslar va natijalar o‘rinlari o‘rtasidagi farq 2023-yilda 16 pog‘onagacha qisqargan bo‘lsa, 2025-yilda yana 23 pog‘onaga kengaygan.

[1] Manba: WIPO ma’lumotlari [18] asosida muallif tomonidan tuzilgan.

Bu holat mahalliy tadqiqotlar xulosasi bilan ham tasdiqlanadi: asosiy muammo investitsiya tanqisligida emas, balki ilm-fan va sanoat aloqalarining zaifligi va tadqiqot natijalarining past tijoratlashuvida [3]. Demak, O‘zbekiston uchun eng dolzarb vazifa - korxona darajasida g‘oyadan bozorgacha bo‘lgan yo‘lni boshqarishdir.

Xorij tajribasi asosida sanoat korxonalarida innovatsion faoliyatni boshqarishning besh bosqichli modeli taklif etiladi. Har bir bosqich yuqorida ajratilgan eng yaxshi amaliyotlardan biriga tayanadi (2-jadval).

2-jadval

Sanoat korxonasida innovatsion faoliyatni boshqarishning taklif etilayotgan modeli[1]

Bosqich	Mazmuni	Tayanch xorij amaliyoti	Natija ko‘rsatkichi
1. G‘oyalarni yig‘ish	Ishchilar takliflari, mijozlar talablari, universitetlar va startaplar bilan hamkorlik	Kaydzen (Yaponiya), ochiq innovatsiyalar (AQSh)	Yil davomida kelib tushgan va ko‘rib chiqilgan takliflar soni
2. Tanlash va baholash	Innovatsion kengash g‘oyalarni texnik va iqtisodiy mezonlar bo‘yicha saralaydi	Stage-Gate qaror nuqtalari	Keyingi bosqichga o‘tgan loyihalar ulushi
3. Ishlab chiqish	Prototip yaratish, tadqiqot institutlari bilan shartnomaviy ishlar	Fraunhofer modeli (Germaniya)	ITTKI xarajatlarining sotish hajmiga nisbati
4. Joriy etish va tijoratlashtirish	Ishlab chiqarishga joriy etish, bozorga chiqarish, litsenziyalash	Bosqichli moliyalashtirish (SBIR, AQSh)	Yangi mahsulotlarning sotishdagi ulushi
5. Monitoring va rag‘batlantirish	Natijalarni baholash, mualliflarni rag‘batlantirish, tajribani umumlashtirish	Korxona ITTKI ko‘rsatkichlari (Xitoy, Koreya)	Innovatsiyalardan olingan qo‘shimcha foyda, patentlar soni

2-jadvalda keltirilgan model innovatsion jarayonni g‘oyalarni yig‘ishdan monitoringgacha bo‘lgan besh bosqichga ajratadi va har bir bosqich uchun tayanch xorij amaliyoti hamda o‘lchanadigan natija ko‘rsatkichini belgilaydi. Birinchi va ikkinchi bosqich ko‘rsatkichlari g‘oyalar oqimi va ularni saralash sifatini, uchinchi va to‘rtinchi bosqich ko‘rsatkichlari ITTKI xarajatlari va yangi mahsulotlar ulushini, beshinchi bosqich ko‘rsatkichlari esa innovatsiyalardan olingan iqtisodiy samarani aks ettiradi. Bu ko‘rsatkichlar Oslo qo‘llanmasidagi innovatsion faoliyatni o‘lchash yondashuviga tayanadi [13].

Modelni joriy etishda ikki cheklov hisobga olinishi kerak. Birinchidan, ko‘pchilik mahalliy sanoat korxonalarida alohida ITTKI bo‘linmasi yo‘q, shuning uchun Germaniya tajribasidagi kabi tashqi tadqiqot tashkilotlari bilan shartnomaviy hamkorlik ichki bo‘linma tashkil etishdan arzonroq va tezroq yo‘l hisoblanadi. Ikkinchidan, Koreya tajribasi ko‘rsatganidek, qo‘llab-quvvatlash faqat yirik

[1] Manba: muallif ishlanmasi.

korxonalarga qaratilsa, innovatsion salohiyat bir necha kompaniyada to‘planib qoladi [10].

XULOSA VA TAKLIFLAR

Tadqiqot natijalari shuni ko‘rsatdiki, innovatsion yetakchi mamlakatlarning modellari davlat roli bo‘yicha turlicha bo‘lsa-da, ularning barchasida innovatsiya korxona darajasida alohida boshqariladigan jarayon sifatida tashkil etilgan va uning asosiy moliyachisi korxonaning o‘zi hisoblanadi. O‘zbekistonda innovatsion resurslar o‘sayotgan bo‘lsa-da, natijalar ortda qolmoqda; bu korxonalarda g‘oyani tijoratlashtirilgan mahsulotga aylantiruvchi boshqaruv tizimi zaifligidan dalolat beradi. Shu asosda quyidagi takliflar ishlab chiqildi:

1. Yirik va o‘rta sanoat korxonalarida innovatsion kengash tuzib, taklif etilgan besh bosqichli boshqaruv modelini va “Stage-Gate” qaror nuqtalarini ichki me’yoriy hujjatlarga kiritish.
2. Germaniya tajribasi asosida ilmiy-tadqiqot institutlarini davlat tomonidan moliyalashtirish hajmini ularning sanoat korxonalaridan olgan buyurtmalari hajmiga bog‘lash.
3. AQShning SBIR dasturi tajribasi asosida kichik va o‘rta sanoat korxonalari uchun g‘oyani tekshirish, prototip yaratish va tijoratlashtirish bosqichlarini alohida moliyalashtiruvchi tanlov asosidagi grant mexanizmini joriy etish.
4. Yaponiya tajribasi asosida ishchilarning texnik takomillashtirish takliflarini qabul qilish, baholash va moddiy rag‘batlantirish tizimini joriy etish.
5. Davlat ishtirokidagi sanoat korxonalari rahbarlari faoliyatini baholash ko‘rsatkichlariga ITTKI xarajatlarining sotish hajmiga nisbati va yangi mahsulotlarning sotishdagi ulushini kiritish.
6. Korxonalar va oliy ta’lim muassasalari o‘rtasida ochiq innovatsiyalar platformasini yaratish orqali “uchlik spiral” hamkorligini mustahkamlash.

Taklif etilgan yondashuv sanoat korxonalarida innovatsion resurslardan samarali foydalanish, tadqiqot natijalarini tijoratlashtirish va O‘zbekistonning Global innovatsiyalar indeksidagi natijalar sub-indeksini yaxshilash imkonini beradi.

Keyingi tadqiqotlarda taklif etilgan modelni muayyan sanoat tarmoqlari korxonalarida sinovdan o‘tkazish va uning natija ko‘rsatkichlarini korxonalar hisobotlari asosida baholash maqsadga muvofiq.

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SUSTAINABLE TOURISM FLOW ECONOMY AND GOVERNMENT GOVERNANCE OF CULTURAL HERITAGE SITES WITHIN THE CIRCULAR BIOECONOMY FRAMEWORK LESSONS FROM THE MOGAO CAVES OF DUNHUANG AND IMPLICATIONS FOR SAMARKAND

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Abstract

The article explored sustainable visitor flow governance at cultural heritage sites by adapting circular bioeconomy principles. A comparative case study examined the Mogao Caves in Dunhuang and Samarkand through document analysis, literature review, field observations and informal interviews. Four mechanisms were organised: reducing heritage pressures, digital substitution, community benefit circulation and institutional coordination. Recommendations for Samarkand addressed carrying capacity assessment, electronic reservations, digitisation and preventive monitoring. Mahalla participation and interagency cooperation were highlighted. Implementation was structured into short, medium and long term phases. Findings remained qualitative, and subsequent observation and quantitative evaluation were identified as necessary for assessing the effectiveness of the proposals.

Keywords: sustainable tourism, visitor flows, cultural heritage, circular bioeconomy, digital substitution, mahalla participation, preventive monitoring, Samarkand, Mogao Caves.

Annotatsiya

Maqolada madaniy meros obyektlarida turistik oqimlarni barqaror boshqarish imkoniyatlari sirkulyar bioiqtisodiyot tamoyillarini moslashtirish orqali o'rganildi. Dunxuandagi Mogao g'orlari va Samarqand tajribasi qiyosiy tahlil qilindi. Tadqiqotda hujjatlar va ilmiy adabiyotlar tahlili, dala kuzatuvlari hamda norasmiy suhbatlardan foydalanildi. Merosga tushadigan yukni kamaytirish, raqamli muqobillar, manfaatlarni mahalliy jamoalarda taqsimlash va institutsional muvofiqlashtirishdan iborat to'rtta mexanizm tizimlashtirildi. Samarqand uchun tashrif sig'imini baholash, elektron bronlash, raqamlashtirish va preventiv monitoring yo'nalishlari taklif etildi. Mahallalar ishtiroki hamda idoralararo hamkorlikning ahamiyati yoritildi. Qisqa, o'rta va uzoq muddatli amalga oshirish bosqichlari belgilandi. Xulosalar sifat tadqiqoti doirasida shakllantirilib, takliflarning natijadorligini keyingi kuzatuvlar va miqdoriy baholash orqali tekshirish zarurati alohida qayd etildi.

Kalit so‘zlar: barqaror turizm, turistik oqimlar, madaniy meros, sirkulyar bioiqtisodiyot, raqamli muqobillar, mahalla ishtiroki, preventiv monitoring, Samarqand, Mogao g‘orlari.

Аннотация

В статье были изучены возможности устойчивого управления туристическими потоками на объектах культурного наследия посредством адаптации принципов циркулярной биоэкономики. Сопоставлялся опыт пещер Могао в Дуньхуане и Самарканда. Использовались анализ документов и научной литературы, полевые наблюдения и неформальные интервью. Были систематизированы четыре механизма: снижение нагрузки на наследие, цифровое замещение, распределение выгод среди местных сообществ и институциональная координация. Для Самарканда были предложены оценка допустимой посещаемости, электронное бронирование, цифровизация и превентивный мониторинг. Рассматривалось значение участия махаллей и межведомственного сотрудничества. Были определены краткосрочные, среднесрочные и долгосрочные этапы реализации. Выводы были сформулированы в рамках качественного исследования; необходимость последующей проверки результативности предложений посредством дальнейших наблюдений и количественной оценки была отдельно отмечена.

Ключевые слова: устойчивый туризм, туристические потоки, культурное наследие, циркулярная биоэкономика, цифровое замещение, участие махаллей, превентивный мониторинг, Самарканд, пещеры Могао.

INTRODUCTION

Walking through Registan Square on a Friday afternoon in spring 2025, I counted more than forty tour buses parked along the perimeter, their groups funneling through the narrow archways of the three madrasahs. Inside, visitors pressed close to the tilework, guides raised their voices above one another, and the air felt thick with humidity and breath. A UNESCO report released the same year would later confirm what my eyes could see: overcrowding during peak seasons is accelerating the degradation of Samarkand's heritage fabric [17]. Yet unlike Dunhuang, where a decade-old appointment system caps daily visitation at 6,000 [5], Samarkand has no comparable mechanism in place. Tickets are bought on-site, entry is first-come-first-served, and the carrying capacity of individual monuments has never been formally assessed.

This gap is not unique to Samarkand. Across the Silk Road, heritage cities are grappling with what might be called the "flow paradox": the same social media attention that brings visitors and revenue also brings congestion, degradation, and community resentment [13]. Cities like Zibo and Harbin have shown that viral fame can arrive overnight-and vanish just as quickly [2]. For cultural heritage sites, however, the stakes are higher. A mural damaged by excess humidity cannot be restored by the next marketing campaign. The question, then, is not whether to manage tourism flows, but how-and at what scale, through what institutions, and with what distribution of benefits.

The circular bioeconomy offers a useful lens for thinking through this problem. Originally developed for agricultural and industrial systems, its core principles-reduce, reuse, recycle, substitute, and govern-translate surprisingly well [1]; [4] to heritage tourism when one treats the heritage body itself as a finite, non-renewable resource. A physical visit "consumes" a unit of that resource; digital display can substitute for some consumption; community participation circulates the benefits; and government governance provides the institutional scaffolding that makes the other three mechanisms work. This paper develops that translation systematically, using Dunhuang as a proven model and Samarkand as a site of urgent adaptation.

The choice of these two cases is not arbitrary. Both are Silk Road World Heritage sites with comparable visitor pressures, yet their governance trajectories diverge sharply. Dunhuang's Academy, established in 1944 [5], has built a vertically integrated system spanning conservation, research, and visitor management. Samarkand, by contrast, operates under a fragmented multi-sectoral arrangement in which culture, tourism, and urban planning often pull in different directions. This "difference within similarity"-to borrow from the most-similar-systems-design tradition-makes the comparison analytically productive.

As a doctoral candidate based in Samarkand for a full academic year, I had the opportunity to conduct informal interviews with heritage officials, tour guides, and mahalla residents, and to observe visitor patterns across seasons. These field observations inform the analysis throughout, particularly in the sections on Samarkand's current challenges and the feasibility of proposed adaptations. The paper is also a phased outcome of a National Social Science Fund project on tourism flow economy in the all-media era, and focuses on the project's third plateau: sustainable development mechanisms and government governance models.

Four questions guide the inquiry. First, what makes tourism flows at heritage sites different from those at ordinary destinations, and what does this imply for governance? Second, how can the circular bioeconomy's vocabulary be operationalized for heritage tourism without stretching the analogy beyond its useful limits? Third, what specifically did Dunhuang do right-and which elements of its model are genuinely transferable versus context-dependent? Fourth, what would a realistic adaptation pathway look like for Samarkand, given its institutional constraints, community structure, and heritage geography? The paper proceeds by reviewing relevant literature, outlining the research design, analyzing the Dunhuang case, diagnosing Samarkand's situation, proposing mechanism-specific adaptations, and concluding with policy recommendations and a phased roadmap.

LITERATURE REVIEW

Tourism Flow Economy and Government Governance

The concept of "flow economy" was first articulated by Chinese scholars Zhou and Han in 2002 [19], who described it as a regional development model in which external resources-capital, talent, information-are attracted, reorganized, and integrated to generate economic energy that radiates outward. Their framework was developed in the context of urban and regional economics, well before social media transformed

how tourism destinations gain attention. What the all-media era has added is speed and volatility: a destination can go from obscurity to millions of visitors in weeks, driven not by deliberate marketing but by a single viral video or influencer post. Collins's [3] interaction ritual chain theory helps explain why this happens-collective emotion, shared symbols, and rhythmic interaction create moments of "emotional energy" that participants want to reproduce, and tourism has become one of the primary arenas in which these rituals play out.

Yet the literature on tourism flow economy remains uneven in several respects. Monetization has received the most attention: Xie et al. [18] analyzed how e-commerce live streaming creates value for destinations, while Hu [11] identified platform aggregation, innovative attraction, and mechanism-based management as the three key levers for sustaining flow-driven growth. Government governance, by contrast, has been studied largely through the lens of crisis response-Chen et al. [2] documented how "internet-famous cities" managed sudden influxes, and Nunkoo [14] emphasized the role of trust, power, and social capital in sustainable destination governance. What is missing, in my view, is a middle layer: not just how governments respond to crises, but how they build routine, preventive systems that manage flows before they become crises. This gap is particularly acute for cultural heritage sites, where the cost of a crisis-mural degradation, structural damage-is irreversible. The present study attempts to occupy that middle layer.

Circular Bioeconomy and Its Applicability to Heritage Tourism

The circular bioeconomy has emerged over the past decade as a policy framework that combines the resource-efficiency logic of circular economy with the renewable-resource focus of bioeconomy. The European Commission's 2018 strategy and its 2025 update frame it as a way to maximize the value of biological resources by keeping them in use longer and minimizing waste [1]; [6]; [7]. Its core principles-resource reduction, circular reuse, recycling, renewable substitution, and systemic governance [4]-were designed for agricultural and industrial systems. The question is whether they travel well to cultural heritage tourism.

I would argue that they do, but only with a deliberate act of translation. The key move is to treat the heritage body itself-the murals, the architecture, the archaeological deposits-as a finite, non-renewable resource [8]. A physical visit "consumes" a small unit of that resource through foot traffic, humidity, carbon dioxide, and wear. Once consumed, that unit cannot be recovered. From this starting point, the circular bioeconomy's principles map onto heritage governance in the following way. Resource reduction becomes appointment-based visitor caps and carrying capacity management-limiting how much of the resource is consumed in a given period. Digital substitution becomes the use of digital replicas, virtual tours, and immersive exhibitions-infinitely replicable at near-zero marginal cost-to satisfy some of the demand that would otherwise be met through physical visitation [10]. Social circulation becomes the participation of local communities in tourism benefits-ensuring that the economic energy generated by heritage flows circulates within the community rather than leaking out to external operators. Governance assurance becomes the institutional

infrastructure-preventive monitoring, regulatory frameworks, multi-sectoral coordination-that makes the other three mechanisms function reliably.

This translation is not without risks. One could accuse it of stretching the bioeconomy metaphor beyond its useful limits, particularly since heritage is not "biological" in any literal sense. But I would counter that the value of the framework lies not in biological literalism but in its systematic attention to resource flows, substitution possibilities, and governance infrastructure-precisely the dimensions that heritage tourism management often treats in isolation. The systematic application of this framework to heritage tourism remains, to my knowledge, a gap in the existing literature.

Research Gaps and Analytical Framework

Three gaps structure the present inquiry. First, tourism flow economy research has been oriented primarily toward ordinary destinations and viral phenomena, with relatively little theoretical construction specifically for cultural heritage scenarios, where the resource being "consumed" is irreplaceable. Second, circular bioeconomy research has concentrated on agriculture, forestry, and industrial biotechnology; its application to heritage tourism, if it exists at all, remains fragmentary. Third, Dunhuang-Samarkand comparative studies-where they exist-tend to stay at the level of experience introduction rather than mechanism extraction and adaptive design.

The analytical framework developed here takes the circular bioeconomy as its theoretical perspective, organizes the analysis around four mechanism dimensions-resource reduction, digital substitution, social circulation, and governance assurance-treats Dunhuang as the primary experience source, and tests the framework's applicability through Samarkand as the adaptation object (Figure 1). The framework is not intended as a universal model but as a diagnostic tool: it helps identify which mechanisms are present, which are missing, and what institutional conditions would be needed to activate them.

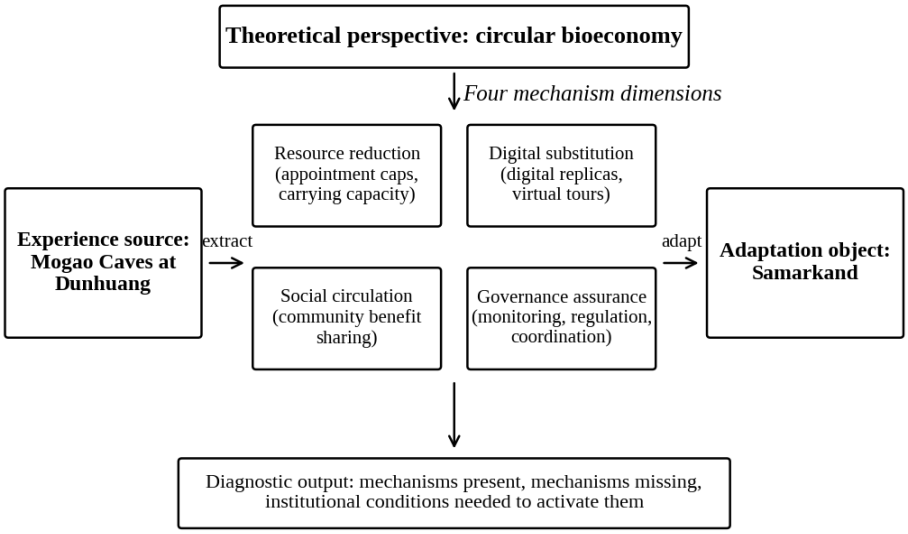


Figure 1. Analytical framework of the study[1]

[1] Source: developed by the author based on the framework described in the text.

Figure 1 shows how the study is organized. The circular bioeconomy serves as the theoretical perspective from which four mechanism dimensions are derived: resource reduction, digital substitution, social circulation, and governance assurance. The Mogao Caves at Dunhuang act as the experience source from which working practices under each dimension are extracted, while Samarkand is the adaptation object to which these practices are tested and adjusted. The output of the framework is diagnostic rather than prescriptive: it shows which mechanisms are already present, which are missing, and which institutional conditions are needed to activate them.

METHODOLOGY

This paper adopts the comparative case study method, policy text analysis, and literature analysis. The comparative case study follows the "Most Similar Systems Design" logic: both cases are Silk Road World Cultural Heritage sites facing tourism growth and heritage protection pressures, but differ in governance models, institutional environments, and technology applications-this "difference within similarity" provides analytical space for causal inference. Data sources include UNESCO state of conservation reports (2024, 2025) [16]; [17], Dunhuang Academy monitoring reports [5], Uzbekistan State Committee for Tourism data, policy documents, and field observation materials.

Table 1

Comparative Framework of the Mogao Caves at Dunhuang and Samarkand[1]

Dimension	Mogao Caves Dunhuang	Samarkand
Heritage type	Buddhist grotto site, inscribed 1987	Central Asian ancient city, inscribed 2001
Management system	Dunhuang Academy, unified protection-research-promotion	Multi-sectoral decentralized, no unified heritage agency
Visitor scale (2024)	2 million, steady growth	2.6 million foreign visitors, rapid growth
Appointment system	Online since 2014, daily cap 6,000	No unified platform, mainly on-site tickets
Digitalization	300 caves acquired, digital center serves 6,000/day	Initial stage, no systematic acquisition
Monitoring	Provincial platform covering 6 grotto sites	No systematic preventive monitoring
Community participation	"Mogao Academy" brand, 22 study bases	Hunarmand Association (3,000+), limited decision participation

The analysis was carried out in three steps. First, documents and published data on both sites were coded along the four mechanism dimensions of the analytical framework, so that each practice or gap could be assigned to resource reduction, digital substitution, social circulation, or governance assurance. Second, the two cases were compared dimension by dimension to separate elements of the Dunhuang model that

[1] Source: compiled by the author based on Demas et al. (2015), UNESCO World Heritage Centre (2024, 2025) and field observations.

depend on its specific context, such as a single concentrated cave precinct and a long-established managing academy, from principles that can be transferred. Third, the transferable principles were checked against Samarkand's institutional setting, heritage geography, and existing studies of its tourism development [15], as well as against field observations and informal interviews with heritage officials, tour guides, and mahalla residents. The main features of the two cases used in the comparison are summarized in Table 1.

Table 1 shows that the two sites share key similarities: both are Silk Road World Heritage properties and both receive visitor flows of a comparable order, about 2 million visitors at the Mogao Caves and about 2.6 million foreign visitors in Samarkand in 2024. The differences lie in governance and tools. Dunhuang has a unified managing body, an online appointment system with a daily cap of 6,000 visitors since 2014, 300 digitally acquired caves, and a provincial monitoring platform covering six grotto sites. Samarkand, in contrast, has a multi-sectoral management arrangement, mainly on-site ticket sales, an initial stage of digitization, and no systematic preventive monitoring, while community participation relies on the Hunarmand Association with more than 3,000 members. This combination of similar pressures and different institutional responses is what makes the comparison useful.

ANALYSIS AND RESULTS

1 The Dunhuang Experience: Four Mechanisms under the Circular Bioeconomy

1.1 Resource Reduction: Total Volume Control and Appointment-Based Caps

The turning point came around 2000, when visitor numbers began climbing steeply and conservators noticed that cave micro-environments-temperature, humidity, carbon dioxide-were spiking beyond safe thresholds during peak hours. The response was not immediate; it took more than a decade of internal debate, technical experimentation, and institutional coordination before the current system took shape. When the Mogao Caves Digital Exhibition Center opened in 2014, it introduced a model that was novel for Chinese museums at the time: "total volume control, online appointment, digital display, cave visitation." The daily cap was set at 6,000 visitors-a figure derived from conservation science, not from marketing targets or revenue projections [5].

What makes the system work in practice is less the cap itself than the infrastructure behind it. The Tourism Opening Scheduling Command Center pulls together real-time appointment data, turnstile counts at the entrance, and in-cave visitor tracking, cross-referencing each against heritage protection thresholds. During peak season, the system draws on historical patterns plus real-time weather and traffic data to anticipate congestion, then pushes personalized off-peak suggestions through the official mini-program. The result is a closed loop: prediction feeds into planning, planning into guidance, and guidance back into measured outcomes. Peak-off-peak differential pricing adds a market signal on top of the informational one, nudging price-sensitive visitors toward quieter periods. From a circular bioeconomy perspective, this is the "reduction" principle made operational: the consumption of a finite, non-

renewable resource is bounded by scientifically determined limits, not by demand alone.

1.2 Digital Substitution: Digital Interpretation and Online Experience

If appointment caps limit how much heritage is consumed, digital substitution expands what can be experienced without consuming it at all. The numbers are striking. By the end of 2024, the Dunhuang Academy had completed high-precision acquisition of 300 caves and 28,100 square meters of murals, produced 196 panoramic tours, and 3D-scanned 212 caves. The "Digital Dunhuang" resource library has logged over 23 million visits from users in 78 countries [9]. What these figures do not fully capture is the substitution effect: the digital exhibition center's second phase, with its 8K dome screens, serves another 6,000 visitors daily-people who would otherwise be adding foot traffic and humidity inside the caves. Academy staff estimate that body reception pressure has dropped by roughly 30% as a result.

The online ecosystem extends the substitution further. The "Cloud Tour Dunhuang" mini-program, the "Digital Library Cave" interactive experience, and various VR exhibitions allow remote users to engage with the heritage at near-zero marginal cost [10]. From the circular bioeconomy standpoint, digital resources function as "renewable substitutes": infinitely replicable, non-depleting, and capable of satisfying demand that would otherwise be met through physical visitation. The carbon footprint argument is secondary but real-every visitor who experiences Dunhuang digitally rather than by flying to Gansu represents avoided emissions. What matters most for heritage governance, though, is that digital substitution decouples access from physical impact, allowing the site to serve a global audience while protecting the caves themselves.

1.3 Social Circulation: Community Participation and Living Heritage

The Dunhuang Academy created the "Mogao Academy" study tour brand, and Dunhuang City has launched 22 types of study tour products with 22 bases. Through the "cultural tourism + all industries" strategy, local residents share tourism benefits by participating in interpretation, homestays, handicrafts, and catering. In 2025, Dunhuang ranked among China's top 100 counties for comprehensive tourism strength. When residents perceive the alignment between heritage protection and their own interests, they transform from "potential threats" to "heritage guardians," forming a virtuous cycle of "protection-benefit-more active protection." This embodies the "reuse" and "recycling" principles-social capital is activated and circulated into an endogenous driving force for heritage protection.

1.4 Governance Assurance: Preventive Monitoring and Proactive Intervention

The Dunhuang Academy established the Gansu Provincial Grotto Temple Monitoring and Early Warning Platform, deploying temperature/humidity sensors and CO_2 monitors inside caves for real-time micro-environment monitoring. When data exceeds thresholds, the system automatically issues warnings. The platform links with the meteorological bureau, suspending cave openings during extreme weather such as sandstorms. Currently covering six grotto temple sites, the platform achieves real-time aggregation through IoT and wireless sensor technologies. Institutionally, the 2002

"Regulations on the Protection of the Mogao Caves at Dunhuang" provides a special legal basis [5], and the Dunhuang Academy as a unified management agency coordinates cultural relic protection, tourism management, and local government. This system shifts protection from "mending the fold after the sheep is lost" to "preparing for rain before it falls," providing a stable institutional environment for the other three mechanisms.

1.5 Special Logic of Tourism Flow Monetization at Heritage Sites

Tourism flow monetization at cultural heritage sites differs from ordinary internet-famous cities in four aspects: (1) high ticket dependence with a short monetization chain, limiting price regulation room; (2) heritage protection constraints restrict commercial development space and visitor consumption behavior; (3) digital products become a new growth point-high-precision digital assets can achieve value transformation through authorized use, virtual experiences, and cultural creative products at near-zero marginal cost, without increasing heritage carrying pressure; (4) community participation is the key increment for extending the monetization chain-guiding visitor flows to community consumption links through study tours, homestays, and handicraft displays extends the chain and shares benefits [18]. Heritage sites must break through ticket dependence through digital value addition and community chain extension under protection constraints.

2 Samarkand: Current Situation and Challenges

Samarkand's trajectory is, in some ways, a mirror image of Dunhuang's-except that the growth curve has been steeper and the institutional response slower. The city has over 2,750 years of continuous urban history and was inscribed as a World Heritage site in 2001 [17]. International visitor numbers climbed from roughly 180,000 in 2015 to approximately 2.6 million in 2024, with projections exceeding 3 million for 2025. Average length of stay has crept up from 2.6 days in 2024 to 3.5 days in 2025, suggesting that visitors are beginning to move beyond the standard day-tour itinerary. Samarkand International Airport handled 1.38 million passengers in 2024, a 37% year-on-year increase, and was recognized by Airports Council International as one of the fastest-growing airports in Europe and Central Asia [12].

These headline figures, however, obscure a set of structural problems that became visible during my fieldwork. Five challenges stand out.

First, heritage conservation pressures are mounting but largely unmeasured. UNESCO's 2025 state of conservation report [17] notes that core scenic areas experience severe overcrowding during peak seasons, and the heritage fabric faces accelerated degradation. What the report does not quantify-and what Samarkand currently lacks the infrastructure to quantify-is the relationship between visitor density and micro-environmental change inside enclosed monuments like Gur-e-Amir and Bibi-Khanym. During my visits, I observed that the air inside these domed structures becomes noticeably warm and humid when groups are present, yet no continuous monitoring system tracks these conditions.

Second, urban development and heritage protection are in tension. UNESCO's 2024 joint reactive monitoring mission [16] raised concerns about the "Third

Renaissance" renovation plan, which encompasses Registan Square, Shah-i-Zinda, Gur-e-Amir, and the Ulugbek Observatory. The mission warned that without prudent management and evidence-based assessment, these projects could have significant impacts on the heritage site. Of particular concern was the proposed site for a New Silk Road Museum near Bibi-Khanym Mosque-an area that falls within a traditional mahalla neighborhood and may conceal substantial underground archaeological deposits.

Third, community participation remains shallow despite existing institutional resources. The Hunarmand Craftsmen Association claims over 3,000 members and has organized multiple master classes for visitors, which is genuinely encouraging. But in conversations with residents in the old city, I heard a recurring theme: tourism revenue flows primarily to hotels, tour operators, and external businesses, while families who have lived in the mahallas for generations see little direct benefit [14]. Some core-area residents also face uncertainty about potential relocation as renovation projects advance. Decision-making about tourism development happens largely without community input.

Fourth, management capacity and professional expertise are stretched thin. UNESCO has repeatedly pointed to insufficient professional personnel and inadequate management systems, recommending a comprehensive national capacity-building plan covering World Heritage site management, heritage impact assessment, and technical conservation [16; 17]. In practice, the responsibility for Samarkand's heritage is dispersed across multiple agencies-culture, tourism, urban planning, local administration-with no single body empowered to coordinate across them.

Fifth, there is no unified appointment or monitoring system. Core attractions still operate primarily on walk-up ticket sales. There is no carrying capacity assessment for individual monuments, no real-time visitor tracking, and no preventive monitoring of micro-environmental conditions. In effect, Samarkand is managing a 2.6-million-visitor destination with the institutional tools of a much smaller one-a gap that will only widen as visitor numbers continue to grow.

3 Mechanism Adaptation and Pathway Design for Samarkand

3.1 Resource Reduction: Unified Appointment Platform and Carrying Capacity Management

Samarkand should unite core attractions and, with the State Committee for Tourism's coordination, build a unified electronic appointment platform. First, organize experts to conduct carrying capacity assessments for Registan Square, Gur-e-Amir, Bibi-Khanym, and Shah-i-Zinda, determining daily and instantaneous maximum capacities based on heritage protection thresholds [5; 8]. Second, implement time-slot appointments, tiered ticket prices, and off-peak prompts, using price leverage and information guidance to balance visitor distribution. Third, establish a real-time scheduling mechanism integrating ticket sales, entrance flows, and in-site visitor counts, with automatic warnings when flows approach capacity limits. Given Samarkand's more dispersed heritage layout, regulation plans must be more holistic and flexible than Dunhuang's centralized model.

3.2 Digital Substitution: Heritage Digitization and "Cloud Tour Samarkand"

Drawing on Dunhuang's technical experience, prioritize high-precision digital acquisition of core monuments with fragile conditions and high visitor pressure, establishing Samarkand heritage digital archives. Construct a digital exhibition center at the heritage area entrance, guiding visitors to first understand historical context through dome films and VR experiences before entering core areas, achieving orderly diversion and promoting transformation from "short-term sightseeing" to "in-depth experience." Launch a "Cloud Tour Samarkand" mini-program with panoramic tours, virtual guides, and AR interpretation, serving remote users and achieving "online + offline" dual-track experience [10].

3.3 Social Circulation: Mahalla Community Co-construction and Benefit Sharing

Samarkand's unique mahalla traditional community system is an important institutional resource. Support mahalla communities in developing family guesthouses, folk custom experiences, and intangible heritage projects, with government microloans and training. Deepen the Hunarmand Craftsmen Association's role by combining handicraft display with tourism experiences-"craftsman studio visits," "traditional craft workshops," and "intangible heritage shopping festivals." Establish a community tourism development fund, extracting a proportion of core attraction ticket revenue for community development and heritage maintenance, so residents directly feel the connection between protection and their interests [14]. Explore diverse business formats including handicrafts, song and dance, wellness, and ethnic cuisine to extend visitor stay time.

3.4 Governance Assurance: Preventive Monitoring and Multi-sectoral Coordination

Deploy temperature/humidity sensors, CO_2 monitors, and visitor flow counters inside key monuments (prioritizing enclosed spaces like Gur-e-Amir and Bibi-Khanym), building a real-time micro-environment monitoring platform linked with meteorological departments. Accelerate the establishment of a unified Samarkand heritage management agency coordinating culture, tourism, and urban planning functions, responsible for carrying capacity determination, appointment platform operation, monitoring, project approval, and community coordination. Promote the formulation of special regulations for Samarkand heritage protection, clarifying protection requirements and approval procedures. Formulate a comprehensive capacity building plan covering World Heritage management, heritage impact assessment, and tourism flow management.

4 Institutional Safeguards and Policy Recommendations

At the regulatory level, accelerate the establishment of a specialized heritage management agency and promote the formulation of the "Regulations on the Protection of the Samarkand World Heritage Site"; within the UNESCO framework, continue suspending large-scale new construction in heritage areas and buffer zones until new urban design guidelines receive positive reviews [16]. At the cooperation level, deepen technical exchanges with the Dunhuang Academy in digitalization, preventive monitoring, and tourism flow management; expand heritage protection cooperation

with Italy and other countries; actively participate in UNESCO capacity building programs.

The proposed measures are grouped into three implementation phases in Table 2.

Table 2

Phased Implementation Roadmap[1]

Phase	Timeframe	Key Tasks	Expected Outcomes
Short-term	1-2 years	Determine carrying capacities; launch appointment platform; deploy monitoring at key monuments; personnel training	Carrying capacity standards issued; appointment platform operational; monitoring coverage at key sites
Medium-term	3-5 years	Complete digital acquisition of core heritage; build digital exhibition center; scale mahalla tourism; establish unified heritage agency	Digital substitution mechanism established; community participation significantly increased; unified management operational
Long-term	5-10 years	Improve regulatory system; deepen international cooperation; form promotable "Samarkand Model"	Heritage protection and tourism development achieve virtuous cycle; benchmark for Central Asian heritage tourism

Table 2 shows that the roadmap moves from basic tools to institutional consolidation. In the short term (1-2 years), the priority is to determine carrying capacities, launch the appointment platform, deploy monitoring at key monuments, and train personnel. In the medium term (3-5 years), digital acquisition of core heritage, a digital exhibition center, scaled-up mahalla tourism, and a unified heritage agency are expected to establish the digital substitution mechanism and raise community participation. In the long term (5-10 years), an improved regulatory system and deeper international cooperation should allow a transferable "Samarkand Model" to take shape. Each phase builds on the previous one, so that technical measures are backed by the institutions needed to sustain them.

CONCLUSION AND SUGGESTIONS

This paper set out to do two things: to develop a theoretically grounded framework for sustainable tourism flow governance at cultural heritage sites, and to test that framework through a concrete comparison between Dunhuang and Samarkand. The resulting model-resource reduction, digital substitution, social circulation, and governance assurance-should be read not as a universal prescription but as a diagnostic tool. It helps identify which mechanisms are in place, which are missing, and what institutional conditions would be needed to activate them.

The core insight from the Dunhuang case is deceptively simple: heritage sites can transform uncontrollable flow outbreaks into governable flow steady states, but only through deliberate institutional design. The daily cap of 6,000 visitors works not because it is a magic number but because it is backed by a command center, real-time

[1] Source: developed by the author.

data, a digital exhibition center that absorbs demand, a monitoring platform that detects risk, and a specialized legal framework that gives the system teeth. Remove any one of these elements and the cap becomes merely aspirational. This is the lesson that Samarkand-and, I would argue, many other heritage cities along the Silk Road-most needs to absorb: flow governance is not a single policy but a system.

For Samarkand specifically, the adaptation pathway must account for three structural differences from Dunhuang. First, Samarkand's heritage is geographically dispersed across multiple independent monuments and their surrounding neighborhoods, whereas Dunhuang's caves are concentrated in a single managed precinct. This means that carrying capacity assessment and visitor scheduling cannot be centralized in the same way; they require a networked approach that coordinates across sites while respecting each site's conservation constraints. Second, the mahalla system-Samarkand's traditional neighborhood governance structure-represents an institutional resource that Dunhuang does not have in the same form. If properly engaged, mahallas could become the primary vehicle for social circulation, distributing tourism benefits more evenly and building community buy-in for conservation measures. Third, Samarkand's current multi-sectoral fragmentation means that institutional building-not technical implementation-should be the first priority. A unified heritage management agency, even a small one, would do more to improve outcomes in the short term than any number of sensor deployments.

The policy implications follow from this analysis. A unified appointment platform should be built, but it cannot function without first conducting scientifically grounded carrying capacity assessments. Heritage digitization should proceed, but it should prioritize the most fragile and most visited monuments rather than attempting comprehensive coverage from the start. Community benefit-sharing mechanisms should be designed in partnership with mahalla leaders and the Hunarmand Association, not imposed from above. And international cooperation-particularly with the Dunhuang Academy-should focus on capacity building and technical training rather than one-off equipment donations.

This study has limitations that should be acknowledged. The fieldwork, while immersive, was conducted over a single academic year and relied heavily on informal interviews and observation rather than structured survey data. Some figures-particularly those related to visitor flows and economic impact-come from official statistics whose methodologies I was not able to independently verify. As a phased outcome of a larger research project, this paper focuses on the sustainable governance plateau and does not attempt quantitative modeling of flow outbreak mechanisms or efficiency evaluation of flow monetization; these are natural next steps. Future research could also expand the comparison to include Bukhara, Khiva, and Merv, which would allow for a more systematic assessment of how the four mechanisms function across different institutional and cultural contexts. Tracking Samarkand's policy implementation over the coming years-particularly whether a unified management agency is established and whether carrying capacity assessments are actually conducted-would provide a valuable longitudinal test of the framework proposed here.

The broader significance of this study, I believe, lies in its attempt to bridge two conversations that have largely proceeded separately: the literature on tourism flow economy, which is rich in analysis of viral phenomena and monetization but thin on heritage-specific governance; and the literature on circular bioeconomy, which is conceptually powerful but has been applied almost exclusively to agricultural and industrial systems. By bringing these conversations into dialogue, and by grounding the resulting framework in the concrete realities of two Silk Road heritage cities, this paper hopes to contribute to a more systematic approach to managing the flows that will only intensify as heritage tourism continues to grow.

Based on the analysis, the following recommendations are proposed for Samarkand:

1. Conduct scientifically grounded carrying capacity assessments for Registan Square, Gur-e-Amir, Bibi-Khanym, and Shah-i-Zinda before launching visitor caps.
2. Build a unified electronic appointment platform with time-slot booking, tiered ticket prices, and off-peak prompts, coordinated by the State Committee for Tourism.
3. Prioritize high-precision digitization of the most fragile and most visited monuments, and create a digital exhibition center and a "Cloud Tour Samarkand" service.
4. Deploy preventive micro-environment monitoring in enclosed monuments and link it with meteorological services.
5. Establish a unified Samarkand heritage management agency and prepare special regulations for the protection of the World Heritage site.
6. Design community benefit-sharing mechanisms, including a community tourism development fund, together with mahalla leaders and the Hunarmand Association.
7. Focus international cooperation, particularly with the Dunhuang Academy and within UNESCO programs, on capacity building and technical training.

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SANOAT KORXONALARINING ASOSIY BIZNES-JARAYONLARINI ANIQLASH, TASNIFLASH VA ESG BILAN INTEGRATSIYASI

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Annotatsiya

Maqolada sanoat korxonalarining biznes jarayonlarini aniqlash, tasniflash va ekologik, ijtimoiy hamda boshqaruv mezonlari bilan uyg'unlashtirish masalalari o'rganildi. Jarayonli yondashuv, qiymat zanjiri tahlili va ilmiy manbalarni umumlashtirish asosida konseptual model ishlab chiqildi. Jarayonlar asosiy, yordamchi, boshqaruv va rivojlantiruvchi guruhlarga ajratildi. Ularning chegaralari, mas'ul shaxslari, kirish resurslari va natijalarini belgilash tartibi yoritildi. ESG ustuvorliklarini baholash uchun vaznli ko'rsatkich, jarayonlar bilan mezonlarni bog'lovchi matritsa va samaradorlik ko'rsatkichlari pasportlari taklif etildi. Integratsiyani diagnostika, loyihalash, tajriba sinovi, kengaytirish va ishonchlilikni ta'minlash bosqichlarida amalga oshirish belgilandi. Modelning amaliy qo'llanishi namunaviy baholar orqali tushuntirildi. Uni real korxona ma'lumotlari asosida tekshirish va tarmoq xususiyatlariga moslashtirish zarurati qayd etildi.

Kalit so'zlar: sanoat korxonalari, biznes jarayonlari, jarayonli boshqaruv, ESG integratsiyasi, qiymat zanjiri, ustuvorlikni baholash, samaradorlik ko'rsatkichlari.

Аннотация

В статье были рассмотрены вопросы выявления, классификации и интеграции бизнес-процессов промышленных предприятий с экологическими, социальными и управленческими критериями. На основе процессного подхода, анализа цепочки создания стоимости и обобщения научных источников была разработана концептуальная модель. Процессы были разделены на основные, вспомогательные, управленческие и развивающие. Определён порядок установления их границ, ответственных лиц, входных ресурсов и результатов. Предложены взвешенный показатель приоритетности ESG, матрица интеграции и паспорта показателей эффективности. Внедрение было организовано в последовательность диагностики, проектирования, пилотного испытания, масштабирования и обеспечения достоверности. Применение модели было объяснено на условных оценках. Отмечена необходимость проверки на данных реальных предприятий и адаптации к отраслевым особенностям в последующих исследованиях.

Ключевые слова: промышленные предприятия, бизнес-процессы, процессное управление, интеграция ESG, цепочка создания стоимости, оценка приоритетности, показатели эффективности.

Abstract

The article examined the identification, classification and integration of industrial business processes with environmental, social and governance criteria. A conceptual model was developed through a process approach, value chain analysis and synthesis

of scholarly sources. Processes were classified as core, supporting, managerial and developmental. Procedures for defining boundaries, responsibilities, inputs and outputs were outlined. A weighted ESG priority score, an integration matrix and performance indicator specifications were proposed. Implementation was structured around diagnosis, design, pilot testing, scaling and assurance. Illustrative assessments explained the model's application. Validation using actual enterprise data and adaptation to sectoral conditions were identified as necessary next steps.

Keywords: industrial enterprises, business processes, process management, ESG integration, value chain, priority assessment, performance indicators.

KIRISH

Jahon sanoatida raqobat ustunligi endilikda faqat tannarx, ishlab chiqarish quvvati va mahsulot sifati bilan belgilanmaydi. Korxonaning energiya va materiallardan foydalanishi, chiqindilarni boshqarishi, xodimlar xavfsizligini ta'minlashi, yetkazib beruvchilar bilan mas'uliyatli ishlashi hamda qarorlar shaffofligini kafolatlashi investorlar, banklar, mijozlar va davlat uchun muhim mezonga aylandi. Shu sababli ESG tamoyillarini alohida hisobot shaklida emas, balki kundalik biznes-jarayonlarning vazifalari, javobgarligi va natija ko'rsatkichlariga kiritish zarur.

Xalqaro tadqiqotlar ham ushbu yondashuvni qo'llab-quvvatlaydi. 2000 dan ortiq empirik tadqiqot natijalarini umumlashtirgan ishda ESG omillari va moliyaviy natijalar o'rtasidagi bog'liqlik aksariyat hollarda salbiy emasligi ko'rsatilgan [3]. Barqarorlik siyosatini erta joriy etgan kompaniyalarda esa boshqaruv jarayonlari, manfaatdor tomonlar bilan muloqot va uzoq muddatli natijalar boshqa kompaniyalardan sezilarli farq qilgani aniqlangan [2]. O'zbekistonda ham "yashil" iqtisodiyotga o'tish strategiyasi va unga oid islohotlar sanoat korxonalaridan energiya va resurs samaradorligini oshirishni talab qilmoqda [16]; [17].

Muammoning amaliy jihati shundaki, ko'plab sanoat korxonalarida bo'linmalar funksiyalar bo'yicha boshqariladi, jarayonning boshidan oxirigacha bo'lgan egasi esa aniq belgilanmaydi. Natijada energiya sarfi faqat energetika bo'limining, mehnat xavfsizligi faqat tegishli xizmatning, korrupsiyaviy xavf esa faqat yuridik bo'limning vazifasi sifatida qaraladi. Aslida ushbu omillar xarid shartlaridan boshlab ishlab chiqarish rejimi, ombor operatsiyalari, sotuv va servisgacha bo'lgan yagona qiymat zanjirida shakllanadi [12].

Tadqiqotning maqsadi - sanoat korxonalarining asosiy biznes-jarayonlarini aniqlash va tasniflashning uslubiy asoslarini takomillashtirish hamda ularni ESG mezonlari bilan integratsiyalovchi amaliy modelni ishlab chiqish. Ushbu maqsadga erishish uchun jarayon chegaralarini belgilash, jarayonlar arxitekturasini shakllantirish, ESG ta'sir nuqtalarini aniqlash, o'lchanadigan KPIlarni tanlash va joriy etish bosqichlarini asoslash vazifalari bajarildi.

ADABIYOTLAR SHARHI

Jarayonli boshqaruv nazariyasida M. Porter qiymat zanjirini kiruvchi logistika, operatsiyalar, chiquvchi logistika, marketing-sotuv va servis kabi asosiy faoliyatlar hamda ularni ta'minlovchi infratuzilma, inson resurslari, texnologiyalar va xarid

faoliyatiga ajratadi [12]. A. Ostervalder va I. Pigneur qiymat taklifini mijoz segmentlari, asosiy resurslar va hamkorlar bilan bog‘lash orqali biznes modelining yaxlitligini ko‘rsatadi [11]. ISO 9001 jarayonlar o‘zaro bog‘liqligi va natijadorligini boshqarishni [8], ISO 14001 esa ekologik jihatlar, risklar va doimiy yaxshilashni tizimli tashkil etishni talab qiladi [7]. Jarayonlarni loyihalash, tahlil qilish va takomillashtirishning zamonaviy metodik asoslari biznes-jarayonlarni boshqarish (BPM) sohasidagi ishlarda tizimlashtirilgan [1].

Strategik maqsadlarni operatsion ko‘rsatkichlarga aylantirish masalasi muvozanatli ko‘rsatkichlar tizimi konsepsiyasida ishlab chiqilgan: unda moliyaviy, mijoz, ichki jarayonlar hamda o‘qish va rivojlanish nuqtai nazarlari o‘zaro bog‘langan [9]. Ekologik buxgalteriya hisobiga oid tadqiqotlarda esa ekologik xarajat va ta’sirlarni boshqaruv hisobiga kiritish korxona qarorlarini asoslashning muhim sharti sifatida ko‘rsatilgan [13].

ESG sohasida GRI standartlari korxonaning iqtisodiyot, atrof-muhit va insonlarga ta’sirini ochib berishga yo‘naltirilgan bo‘lsa [4], IFRS S1 va IFRS S2 investorlar qaroriga ta’sir qilishi mumkin bo‘lgan barqarorlik hamda iqlim bilan bog‘liq risk va imkoniyatlarni moliyaviy axborot bilan bog‘laydi [5]; [6]. Mazkur yondashuvlarning umumiy jihati - muhimlikni aniqlash, boshqaruv nazorati, strategiya, risklarni boshqarish, metrikalar va maqsadlarni yagona tizimda ko‘rishdir. Mas’uliyatli biznes yuritish bo‘yicha OECD yo‘riqnomalari hamda BMT Global shartnomasining o‘nta tamoyili inson huquqlari, mehnat, atrof-muhit va korrupsiyaga qarshi kurash sohalarida korxona va uning ta’minot zanjiri uchun asosiy talablarni belgilaydi [10; 14]. Empirik tadqiqotlar barqarorlik amaliyotlarining tashkiliy jarayonlar va moliyaviy natijalar bilan bog‘liqligini tasdiqlaydi [2]; [3].

O‘zbekistonda “yashil” iqtisodiyotga o‘tish strategiyasi energiya samaradorligini oshirish, tabiiy resurslardan oqilona foydalanish va past uglerodli rivojlanishni jadallashtirishni ko‘zda tutadi [17]. 2030-yilgacha bo‘lgan davrda ushbu yo‘nalishdagi islohotlar samaradorligini oshirish chora-tadbirlari ham belgilangan [16]. Jahon bankining tadqiqotida ham O‘zbekiston iqtisodiyotini yashil rivojlanishga yo‘naltirishda energiya samaradorligi va sanoatni modernizatsiya qilish muhimligi ta’kidlangan [15]. Biroq strategik maqsadlarni korxona darajasiga tushirish uchun ularni muayyan jarayon egasi, o‘lchov birligi, ma’lumot manbai va nazorat davriyligi bilan bog‘lash lozim. Tadqiqotdagi jarayon-ESG matritsasi aynan shu metodik bo‘shliqni to‘ldirishga qaratilgan.

METODOLOGIYA

Tadqiqot konseptual-amaliy xarakterga ega. Birinchi bosqichda korxona faoliyati “yetkazib beruvchidan mijozgacha” tamoyili asosida xaritalanadi. Ikkinchi bosqichda jarayonlar qiymat yaratishga bevosita hissasi bo‘yicha asosiy, resurs va infratuzilma bilan ta’minlashi bo‘yicha yordamchi, maqsad va nazoratni belgilashi bo‘yicha boshqaruv jarayonlariga ajratiladi [1]; [12]. Uchinchi bosqichda har bir jarayon uchun kirishlar, yetkazib beruvchilar, amallar, chiqishlar va mijozlar SIPOCda aniqlanadi. To‘rtinchi bosqichda manfaatdor tomonlar talabi va ikki tomonlama muhimlik yondashuvi asosida ESG ta’sir, risk va imkoniyatlari baholanadi [4]; [5].

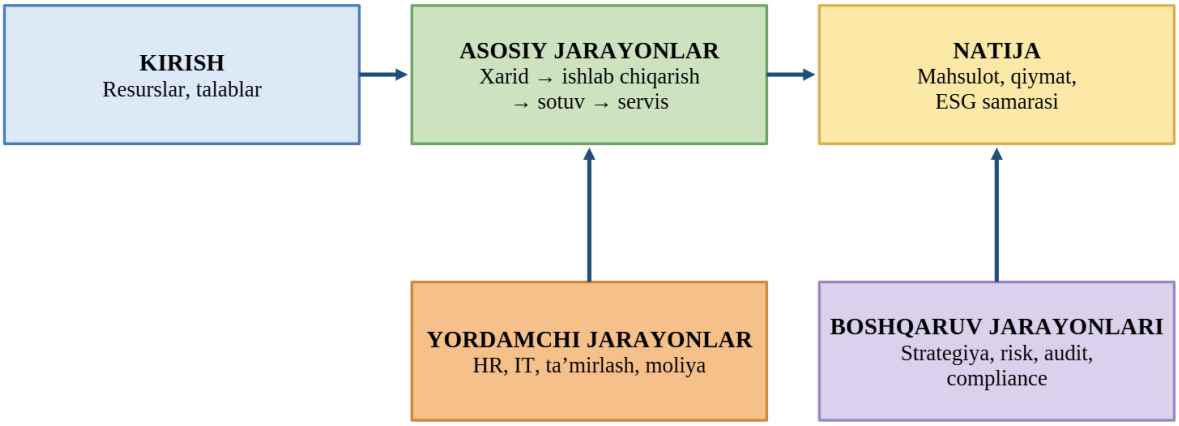
Ustuvorlikni aniqlash uchun quyidagi integral ko‘rsatkich tavsiya etiladi (1-formula):

$$P_i = 0{,}30I_i + 0{,}25F_i + 0{,}20R_i + 0{,}15S_i + 0{,}10D_i \quad (1)$$

Bu yerda I - ekologik yoki ijtimoiy ta’sir ko‘lami; F - moliyaviy ta’sir; R - huquqiy va reputatsion risk; S - manfaatdor tomonlar sezgirligi; D - ma’lumotlarning mavjudligi. Har bir mezon 1 dan 5 gacha baholanadi. $P_i \geq 4{,}0$ bo‘lsa kritik, 3,0-3,99 bo‘lsa yuqori, 2,0-2,99 bo‘lsa o‘rta, $P_i < 2{,}0$ bo‘lsa past ustuvorlik belgilanadi. Og‘irliklar korxona tarmog‘i strategiyaga muvofiq ekspertlar tomonidan qayta kalibrlanishi mumkin. Masalan, jarayonning ta’sir ko‘lami 5, moliyaviy ta’siri va huquqiy riski 4, manfaatdor tomonlar sezgirligi va ma’lumotlar mavjudligi 3 ball bilan baholansa, $P_i = 1{,}50 + 1{,}00 + 0{,}80 + 0{,}45 + 0{,}30 = 4{,}05$ bo‘lib, jarayon kritik ustuvorlik guruhiga kiradi. Formulada eng katta og‘irlik ta’sir ko‘lamiga berilgani ESG integratsiyasida birinchi navbatda korxona faoliyatining atrof-muhit va insonlarga real ta’siri hisobga olinishini bildiradi.

TAHLIL VA NATIJALAR

Biznes-jarayon - ma’lum iste’molchi uchun qiymat yaratadigan, kirish resurslarini belgilangan natijaga aylantiradigan, egasi, chegarasi, ijrochilari va o‘lchanadigan ko‘rsatkichlariga ega o‘zaro bog‘liq ishlar majmuasidir [1]. Jarayonni oddiy funksiyadan ajratadigan asosiy belgi uning bo‘linmalararo xususiyati va yakuniy natijaga yo‘naltirilganidir. Masalan, “xarid bo‘limi” tashkiliy birlik, “xomashyoni ehtiyojdan qabul qilishgacha ta’minlash” esa bir nechta bo‘linma qatnashadigan jarayondir. Ushbu yondashuv asosida tuzilgan sanoat korxonasining jarayonlar arxitekturasi quyida keltirilgan (1-rasm).



1-rasm. Sanoat korxonasining jarayonlar arxitekturasi[1]

1-rasmda kirish resurslari va talablar asosiy jarayonlar zanjiri (xarid, ishlab chiqarish, sotuv, servis) orqali natijaga - mahsulot, qiymat va ESG samarasiga aylanishi ko‘rsatilgan. Yordamchi jarayonlar (HR, IT, ta’mirlash, moliya) asosiy jarayonlarni resurs bilan ta’minlaydi, boshqaruv jarayonlari (strategiya, risk, audit, komplayens) esa yakuniy natijaga maqsad va nazorat orqali ta’sir qiladi.

[1] Manba: muallif ishlanmasi.

Jarayonlarning to‘liq tasnifi rivojlantiruvchi jarayonlar bilan birga keltirilgan (1-jadval).

1-jadval

Sanoat korxonasi biznes-jarayonlarining tasnifi[1]

Jarayon turi	Asosiy mazmuni	Namunaviy jarayonlar	Natija mezoni
Asosiy	Tashqi mijoz uchun bevosita qiymat yaratadi	Talabni rejalash; xarid; ishlab chiqarish; sifat; ombor-logistika; sotuv; servis	Sifat, tannarx, muddat, mijoz qoniqishi
Yordamchi	Asosiy jarayonlarni resurs va infratuzilma bilan ta’minlaydi	HR; IT; moliya; ta’mirlash; laboratoriya; huquqiy xizmat	Mavjudlik, uzluksizlik, xizmat darajasi
Boshqaruv	Maqsad, qoida, risk va nazorat mexanizmlarini belgilaydi	Strategiya; byudjet; risk; audit; komplayens; ESG boshqaruvi	Maqsadga erishish, risk darajasi, hisobdorlik
Rivojlantiruvchi	Kelajak qiymati va transformatsiyani yaratadi	R&D; raqamlashtirish; energiya modernizatsiyasi; sirkulyar yechimlar	Innovatsiya portfeli, ROI, emissiya kamayishi

1-jadvaldan ko‘rinadiki, jarayonlar to‘rt guruhga ajratiladi va har bir guruh o‘z natija mezoniga ega: asosiy jarayonlar sifat, tannarx va muddat bilan, yordamchi jarayonlar xizmat darajasi bilan, boshqaruv jarayonlari hisobdorlik bilan, rivojlantiruvchi jarayonlar esa innovatsiya va emissiya kamayishi bilan baholanadi. Tasniflashda bir jarayonni faqat bitta guruhga qattiq bog‘lashdan ko‘ra, uning korxona qiymat taklifidagi asosiy rolini belgilash maqsadga muvofiq. Masalan, laboratoriya nazorati kimyo korxonasida asosiy jarayonning ajralmas qismi, boshqa tarmoqda esa yordamchi xizmat bo‘lishi mumkin. Shuning uchun tasnif korxonaning mahsuloti, texnologiyasi, tartibga solish darajasi va mijoz talabidan kelib chiqadi.

ESG integratsiyasi jarayonga qo‘shimcha hujjat yuklash emas, balki mavjud qaror nuqtalarini yangi mezonlar bilan boyitishdir. Masalan, xaridda narx va yetkazib berish muddatiga qo‘shimcha ravishda materialning uglerod izi, mehnat standartlari va manfaatlar to‘qnashuvi tekshiriladi; ishlab chiqarishda esa quvvat va brak bilan bir qatorda energiya, suv, emissiya, xavfsizlik hodisalari va operatsion nazorat o‘lchanadi (2-jadval).

2-jadvalda yettita asosiy jarayonning har biri uchun ekologik, ijtimoiy va boshqaruv mezonlari hamda ularni o‘lchaydigan KPIlar bitta qatorda keltirilgan. Masalan, ishlab chiqarish jarayonida ekologik ta’sir tCO_2e/t va m^3/t, ijtimoiy ta’sir LTIFR ko‘rsatkichi bilan o‘lchanadi, ombor va logistikada esa $gCO_2/t\text{-km}$ va OTIF ko‘rsatkichlari qo‘llanadi. Shunday qilib, har bir jarayon egasi o‘z zonasidagi E, S va G omillari uchun aniq javobgarlikka ega bo‘ladi.

[1] Manba: [1]; [12] asosida muallif ishlanmasi.

2-jadval

Asosiy biznes-jarayonlar va ESG mezonlari integratsiyasi[1]

Jarayon	E - ekologik mezon	S - ijtimoiy mezon	G - boshqaruv mezoni	Asosiy KPI
Talab va ishlab chiqarishni rejalash	Energiya sig‘imi, resurs cheklovi, iqlim riski	Ish yuklamasi va smena xavfsizligi	Ssenariylar, vakolat va tasdiqlash izi	kWh/birlik; reja aniqligi
Xarid va ta’minot	Qayta ishlangan ulush, transport izi, xavfli modda	Yetkazib beruvchida mehnat huquqi	Tender shaffofligi, sanksiya va korrupsiya tekshiruvi	ESG skriningdan o‘tgan xaridlar, %
Ishlab chiqarish	Energiya, suv, emissiya, chiqindi, yo‘qotish	Jarohatlanish, ekspozitsiya, ergonomika	Texnologik intizom, hodisa eskalatsiyasi	tCO_2e/t; m^3/t; LTIFR; brak, %
Sifat nazorati	Ekodizayn va hayot sikli talabi	Mahsulot xavfsizligi	Sinov xolisligi, kuzatuvchanlik	Shikoyat; qaytarish; muvofiqlik, %
Ombor va logistika	Yoqilg‘i, marshrut, qadoq, sizib chiqish	Haydovchi va ombor xavfsizligi	Yuk va hujjat kuzatuvchanligi	$gCO_2/t\text{-}km$; OTIF; hodisalar
Sotuv va shartnoma	Ekologik da’volarning asoslanganligi	Mijoz huquqi, diskriminatsiyasiz xizmat	Narx va bonuslar nazorati, maxfiylik	Asoslangan “yashil” da’volar, %
Servis va qayta oqim	Ta’mirlash, qayta foydalanish, utilizatsiya	Mijoz va servis xodimi xavfsizligi	Kafolat qarorlari shaffofligi	Qaytarib olingan mahsulot, %

Har bir muhim jarayon uchun bir betlik “jarayon pasporti” tuziladi. Unda jarayon nomi va kodi, boshlanish-tugash chegarasi, egasi, maqsadi, kirish-chiqishlar, ichki va tashqi mijozlar, ishtirokchilar, axborot tizimi, asosiy risklar, nazorat nuqtalari, ESG ta’sirlari, KPI formulalari, ma’lumot egasi va hisobot davriyligi qayd etiladi. Jarayon egasi natija uchun javob beradi; ESG mutaxassisi metodologiyani muvofiqlashtiradi; funksional rahbarlar esa ma’lumot va nazoratning ishonchliligini ta’minlaydi [6]; [10]; [14]. Asosiy ESG KPIlari uchun pasport namunasi quyida keltirilgan (3-jadval).

3-jadvaldagi yettita KPI ekologik (energiya, GHG, suv, chiqindi), ijtimoiy (LTIFR) va boshqaruv (ta’minotchi skriningi, etika murojaatlari) yo‘nalishlarini qamrab oladi va har biri uchun hisoblash formulasi, ma’lumot manbai, davriyligi hamda mas’ul bo‘linmasi belgilangan. KPIlar mutlaq va nisbiy ko‘rsatkichlarni birgalikda qamrab olishi kerak [9]. Masalan, ishlab chiqarish oshganda jami energiya sarfi ko‘payishi mumkin, biroq bir birlik mahsulotga sarf kamayishi samaradorlikni ko‘rsatadi. Shu bilan birga faqat intensivlik ko‘rsatkichidan foydalanish korxonaning mutlaq ekologik bosimini yashirishi mumkin [13]. Shuning uchun jami sarf,

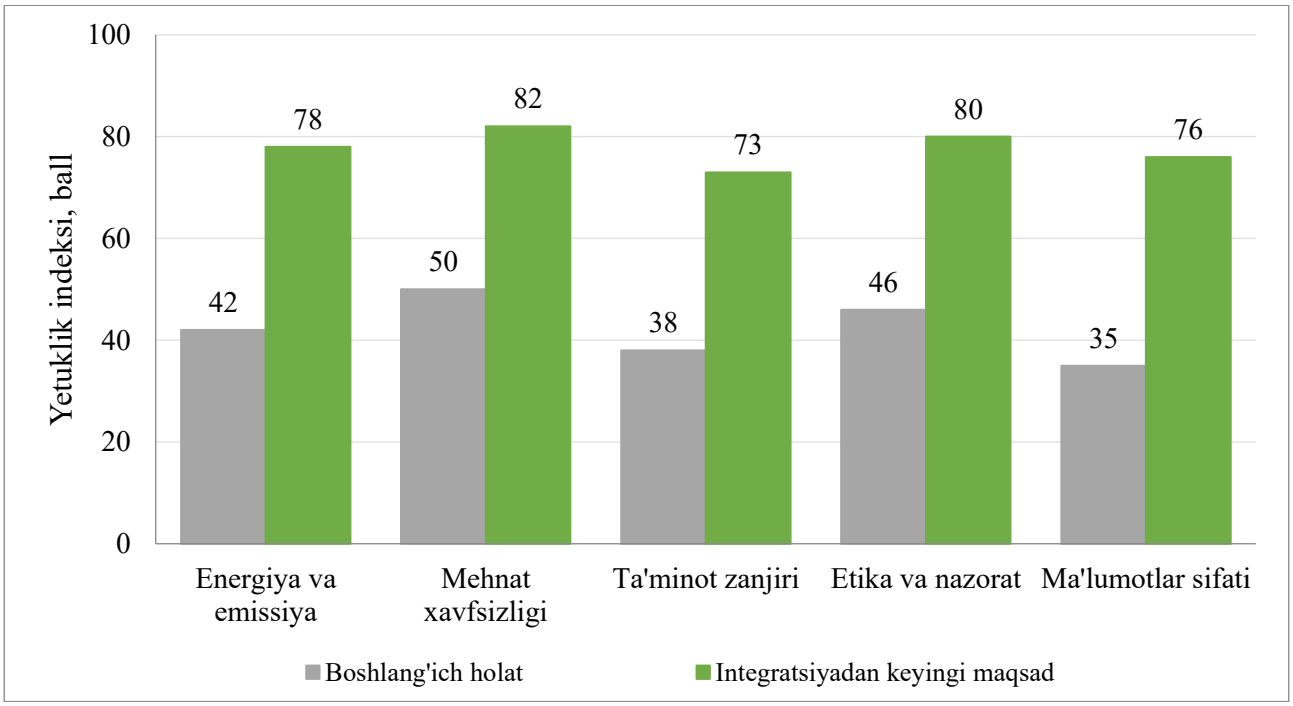
[1] Manba: [4]; [6]; [7]; [10] asosida muallif ishlanmasi.

intensivlik, maqsadga nisbatan og‘ish va iqtisodiy samara bir panelda beriladi. Besh yo‘nalish bo‘yicha boshlang‘ich va maqsadli yetuklik darajasini baholash namunasi keltirilgan (2-rasm).

3-jadval

ESG KPIlarining tavsiya etiladigan pasporti[1]

KPI	Hisoblash usuli	Manba / davriylik	Mas’ul
Energiya sig‘imi	Jami energiya sarfi / yaroqli mahsulot hajmi	Hisoblagich + ERP / oylik	Ishlab chiqarish va energetika
GHG intensivligi	Scope 1+2 tCO_2e / mahsulot yoki tushum	Yoqilg‘i va elektr ma’lumoti / choraklik	Ekologiya va moliya
Suv sig‘imi	Olingan chuchuk suv m^3 / mahsulot	Suv hisoblagichi / oylik	Bosh muhandis
Chiqindini qayta yo‘naltirish	Qayta ishlangan va qayta foydalanilgan / jami chiqindi ×100	Dalolatnoma / oylik	Ekologiya va ombor
LTIFR	Mehnatga layoqatsizlik hodisalari ×1 000 000 / ish soati	HSE reyestri / oylik	Mehnat xavfsizligi
ESG skriningli ta’minotchi	Tekshirilgan muhim ta’minotchi / jami muhim ta’minotchi ×100	Xarid reyestri / choraklik	Xarid va komplayens
Etika murojaatlari yopilishi	Muddatida yopilgan asoslangan holatlar / jami holatlar ×100	Ishonch kanali / choraklik	Komplayens



2-rasm. ESG jarayonlarining diagnostik va maqsadli yetuklik profili[2]

[1] Manba: [4]; [6] asosida muallif ishlanmasi.
[2] Manba: muallif ishlanmasi (namunaviy ekspert bahosi).

2-rasmdagi qiymatlar aniq korxona statistikasi emas, balki metodikani namoyish etuvchi namunaviy ekspert bahosidir. Unda boshlang‘ich holat 35-50 ball, integratsiyadan keyingi maqsad esa 73-82 ball oralig‘ida ko‘rsatilgan. Eng katta tafovut ma’lumotlar sifatida (35 dan 76 ballgacha, 41 ball), eng kichigi esa mehnat xavfsizligida (50 dan 82 ballgacha, 32 ball) kuzatiladi. Amaliy tadqiqotda ular audit dalillari, hisoblagichlar, ERP ma’lumotlari, xodimlar so‘rovi va boshqaruv hujjatlari asosida hisoblanadi. Boshlang‘ich hamda maqsadli holat o‘rtasidagi tafovut ESG yo‘l xaritasidagi ustuvor loyihalarni tanlashga xizmat qiladi.

Taklif etilgan modelning asosiy afzalligi ESGni operatsion boshqaruvga “vertikal” va “gorizontal” ravishda ulashidir. Vertikal integratsiya kuzatuv kengashi va rahbariyat maqsadlaridan sex hamda ish joyi ko‘rsatkichlarigacha bo‘lgan javobgarlikni yaratadi. Gorizontal integratsiya esa bir mahsulot oqimida xarid, ishlab chiqarish, logistika, sotuv va servisning o‘zaro ta’sirini ko‘rsatadi. Natijada ekologik yoki ijtimoiy muammo bir bo‘limda qayd etilib, boshqa bo‘limda nazoratsiz qolmaydi.

Integratsiya darajasini besh pog‘onada baholash mumkin: 1) fragmentar - ESG faoliyati alohida aksiyalar bilan cheklanadi; 2) muvofiqlik - asosiy e’tibor qonun talabiga qaratiladi; 3) tizimli - siyosat, risklar va KPIlar mavjud; 4) integratsiyalashgan - ESG mezonlari investitsiya, xarid, rejalash va rag‘batlantirishga kiritiladi; 5) transformatsion - sirkulyar biznes modeli, past uglerodli texnologiya va manfaatdor tomonlar bilan birgalikda qiymat yaratish ustunlik qiladi. Korxona barcha yo‘nalishda birdan beshinchi darajaga chiqmasdan, kritik jarayonlardan boshlashi maqsadga muvofiq. Buning uchun bosqichma-bosqich yo‘l xaritasi taklif etiladi (4-jadval).

4-jadval

ESG integratsiyasini joriy etish yo‘l xaritasi[1]

Bosqich	Asosiy ishlar	Natijaviy hujjat	Muddat
1.Diagnostika	Jarayonlar reyestri; manfaatdor tomonlar; muhim ESG mavzulari; ma’lumot sifati	Boshlang‘ich baholash va muhimlik xaritasi	1-2 oy
2.Loyihalash	Jarayon egalari; RACI; risk va nazorat; KPI formulasi; IT talabi	Jarayon-ESG matritsasi va pasportlar	2-3 oy
3.Pilot	1-2 kritik jarayonda hisoblagich, trening, nazorat va dashboard	Pilot hisoboti, tuzatishlar, iqtisodiy effekt	3-6 oy
4.Masshtablash	Qolgan jarayonlar, ta’minotchilar, byudjet va motivatsiyaga integratsiya	Korxona bo‘yicha yagona ESG boshqaruv tizimi	6-12 oy
5.Ishonchlilik	Ichki audit, dalillar, rahbariyat tahlili, zarur bo‘lsa tashqi assurance	Tekshiriladigan hisobot va yaxshilash rejasi	Doimiy

4-jadvalda ESG integratsiyasi besh bosqichda amalga oshiriladi: diagnostika va loyihalash birgalikda 3-5 oyni, 1-2 kritik jarayondagi pilot 3-6 oyni, butun korxona bo‘yicha masshtablash esa 6-12 oyni oladi. Oxirgi bosqich - ishonchlilikni ta’minlash doimiy jarayon bo‘lib, ichki audit va zarur hollarda tashqi tasdiqlash orqali hisobotning ishonchliligini kafolatlaydi. Har bir bosqich aniq natijaviy hujjat bilan yakunlanishi joriy etish jarayonini nazorat qilishni osonlashtiradi.

[1] Manba: [6]; [10]; [14] asosida muallif ishlanmasi.

Amaliyotda uchta xatardan qochish kerak. Birinchisi - o‘lchab bo‘lmaydigan umumiy maqsadlar: “ekologik toza bo‘lish” o‘rniga bazaviy yil, birlik, muddat va javobgar belgilanadi. Ikkinchisi - ma’lumotlarni qo‘lda ko‘paytirish: bitta ko‘rsatkich uchun yagona manba va ma’lumot egasi tayinlanadi. Uchinchisi - “yashil” da’volarni dalilsiz marketing qilish: mahsulot bayonotlari sifat, yuridik va ESG nazoratidan o‘tishi kerak. Ayniqsa kichik va o‘rta sanoat korxonalarida dastlab 8-12 ta muhim KPI bilan boshlash, keyinchalik tizim yetuklashgan sari ko‘rsatkichlarni kengaytirish samaralidir.

Taklif etilgan uslubning cheklovi shundaki, KPI vaznlari va chegaralari tarmoqlar kesimida farq qiladi: metallurgiyada emissiya va sanoat xavfsizligi, to‘qimachilikda suv, kimyoviy moddalar va mehnat sharoiti, oziq-ovqatda esa mahsulot xavfsizligi hamda yetkazib beruvchilar kuzatuvchanligi yuqori ustuvorlikka ega. Keyingi empirik tadqiqotlarda modelni O‘zbekiston sanoat tarmoqlari va hududlari kesimida real korxona ma’lumotlari bilan sinovdan o‘tkazish, iqtisodiy natija bilan ESG yetukligi o‘rtasidagi bog‘liqlikni ekonometrik baholash zarur.

XULOSA VA TAKLIFLAR

Sanoat korxonasining barqaror rivojlanishi ESG siyosati mavjudligi bilan emas, bu siyosatning konkret biznes-jarayonlarda qanday ishlashi bilan belgilanadi. Tadqiqot natijasida biznes-jarayonlarni asosiy, yordamchi, boshqaruv va rivojlantiruvchi guruhlarga ajratish, ularning chegarasi va egasini belgilash hamda har bir jarayonga muhim E, S va G omillarini bog‘lashning yaxlit mexanizmi taklif qilindi. Taklif etilgan integral ustuvorlik ko‘rsatkichi, jarayon-ESG matritsasi va KPI pasporti korxonaga ESG resurslarini eng muhim jarayonlarga yo‘naltirish imkonini beradi. Tadqiqot natijalari asosida quyidagi takliflar ishlab chiqildi:

1. korxonada yuqori darajadagi 15-25 ta jarayondan iborat reyestr tuzish va har biriga aniq egani tayinlash;
2. xarid, ishlab chiqarish, logistika va sotuv jarayonlarida ESG risklarini SIPOC hamda ikki tomonlama muhimlik asosida baholash;
3. 8-12 ta boshlang‘ich KPI uchun formula, bazaviy qiymat, maqsad, ma’lumot manbai, davriylik va javobgarni tasdiqlash;
4. energiya, suv, chiqindi, mehnat xavfsizligi va ta’minotchi skriningi bo‘yicha pilot dashboardni bitta sex yoki mahsulot liniyasida sinash;
5. ESG natijalarini investitsiya tanlovi, xarid reytingi, rahbarlar KPIlari, ichki audit va yillik boshqaruv tahliliga kiritish;
6. hisobot ko‘rsatkichlari uchun dalillar zanjiri va ichki nazoratni yaratib, kelgusida mustaqil tasdiqlashga tayyorlash.

Mazkur takliflar ESGni korxona uchun tashqi talabdan resurs tejamkorligi, risklarning pasayishi, xodimlar ishonchi, moliyalashtirish imkoniyati va uzoq muddatli raqobatbardoshlik manbaiga aylantiradi.

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XALQARO EKOLOGIK STANDARTLAR VA ULARNING MILLIY BIOIQTISODIYOT TIZIMLARIGA INTEGRATSIYALASHUVI

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Annotatsiya

Maqolada xalqaro ekologik standartlashtirish tizimining shakllanish bosqichlari va ularning milliy bioiqtisodiyot institutlariga integratsiyalashuv mexanizmlari tahlil qilingan. ISO 14000 seriyasi standartlari, Yevropa Ittifoqining bioiqtisodiyot strategiyasi, Yevropa Ittifoqi taksonomiyasi, shuningdek Biologik xilma-xillik to'g'risidagi konvensiya va unga tegishli protokollar misolida xalqaro amaliyot ko'rib chiqilgan. Tadqiqotda qiyosiy-huquqiy tahlil, xalqaro tashkilotlarning ochiq statistik ma'lumotlarini umumlashtirish va milliy me'yoriy-huquqiy bazaning kontent-tahlili usullari qo'llanilgan. Tadqiqot davomida O'zbekistonning "yashil" iqtisodiyotga o'tish strategiyasi va biologik xilma-xillikni saqlash strategiyasi tahlil qilinib, mavjud me'yoriy-huquqiy bazadagi bo'shliqlar - jumladan, genetik resurslardan foydalanish bo'yicha Nagoya protokoliga qo'shilmaganlik, milliy "yashil" taksonomiyaning va majburiy issiqxona gazlari monitoring tizimining yo'qligi - aniqlangan. Maqola yakunida xalqaro standartlarni milliy amaliyotga bosqichma-bosqich moslashtirish bo'yicha besh bosqichli protsedura taklif etilgan.

Kalit so'zlar: ekologik standartlashtirish, bioiqtisodiyot, ISO 14000, Yevropa Ittifoqi taksonomiyasi, "yashil" iqtisodiyot, biologik xilma-xillik, barqaror rivojlanish.

Аннотация

В статье проанализированы этапы формирования международной системы экологической стандартизации и механизмы её интеграции в национальные институты биоэкономики. Международная практика рассмотрена на примере стандартов серии ISO 14000, стратегии биоэкономики Европейского союза, таксономии Европейского союза, а также Конвенции о биологическом разнообразии и связанных с ней протоколов. В исследовании применены сравнительно-правовой анализ, обобщение открытых статистических данных международных организаций и контент-анализ национальной нормативно-правовой базы. Проанализированы стратегия перехода Узбекистана к «зелёной» экономике и стратегия сохранения биологического разнообразия, выявлены пробелы в действующей нормативно-правовой базе - в том числе неприсоединение к Нагойскому протоколу о доступе к генетическим ресурсам, отсутствие национальной «зелёной» таксономии и обязательной системы мониторинга парниковых газов. В заключение предложена пятиэтапная процедура поэтапной адаптации международных стандартов к национальной практике.

Ключевые слова: экологическая стандартизация, биоэкономика, ISO 14000, таксономия Европейского союза, «зелёная» экономика, биологическое разнообразие, устойчивое развитие.

Abstract

The article analyses the stages in the formation of the international environmental standardisation system and the mechanisms of its integration into national bioeconomy institutions. International practice is examined through the ISO 14000 series of standards, the European Union Bioeconomy Strategy, the EU Taxonomy, and the Convention on Biological Diversity together with its protocols. The study applies comparative legal analysis, a synthesis of open statistical data from international organisations and content analysis of the national regulatory framework. Uzbekistan's strategy for the transition to a green economy and its biodiversity conservation strategy are analysed, and gaps in the current regulatory framework are identified, including non-accession to the Nagoya Protocol on access to genetic resources and the absence of a national green taxonomy and of a mandatory greenhouse gas monitoring system. The article concludes by proposing a five-stage procedure for the step-by-step adaptation of international standards to national practice.

Keywords: environmental standardisation, bioeconomy, ISO 14000, EU Taxonomy, green economy, biological diversity, sustainable development.

KIRISH

Bioiqtisodiyot tushunchasi so‘nggi o‘n besh yil ichida iqtisodiy siyosatning alohida yo‘nalishiga aylandi: u qishloq xo‘jaligi, o‘rmon xo‘jaligi, oziq-ovqat sanoati, biotexnologiya va energetikani bitta - biologik resurslarni qayta tiklanadigan tarzda qayta ishlash - mantig‘i atrofida birlashtiradi [2]; [11]. Biroq bu tarmoqlararo model faqat texnologik yechimlar bilan emas, balki uni tartibga soluvchi me’yoriy-texnik asos, ya’ni standartlar, sertifikatlar va xalqaro bitimlar bilan ham belgilanadi. Xalqaro amaliyotda bunday asos bir necha o‘n yillar davomida shakllanib kelgan bo‘lib, bugungi kunda o‘zaro bog‘liq, ammo bir-biridan tabiatan farq qiluvchi uchta qatlamdan iborat: majburiy davlatlararo bitimlar (masalan, Biologik xilma-xillik to‘g‘risidagi konvensiya), mintaqaviy tartibga solish tizimlari (Yevropa Ittifoqining taksonomiyasi va bioiqtisodiyot strategiyasi) hamda ixtiyoriy bozor standartlari (ISO seriyasi, GRI, FSC) [10]; [22].

O‘zbekiston uchun bu mavzu alohida ahamiyat kasb etadi. 2019-yil 4-oktyabrda qabul qilingan “2019-2030-yillar davrida O‘zbekiston Respublikasining “yashil” iqtisodiyotga o‘tish strategiyasi” [25] va shu yilning 30-oktyabrida tasdiqlangan atrof-muhitni muhofaza qilish konsepsiyasi [26] mamlakat iqtisodiyotini resurs tejamkor va biologik jihatdan barqaror modelga yo‘naltirishni ko‘zda tutadi. Biroq bu hujjatlar, ko‘p hollarda, xalqaro standartlashtirish tizimiga qanday bog‘lanishi kerakligini batafsil belgilamaydi - bu esa amaliyotchilar va qonun ijodkorlari oldida ochiq savol bo‘lib qolmoqda.

Ushbu maqolaning maqsadi - xalqaro ekologik standartlashtirish tizimining asosiy elementlarini tizimlashtirish, ularning O‘zbekiston sharoitida qo‘llanilish darajasini baholash va milliy amaliyotdagi bo‘shliqlarni aniqlash, shuningdek

standartlarni yangilash va moslashtirish bo‘yicha aniq tartib-taomil taklif etishdan iborat.

ADABIYOTLAR SHARHI

Xalqaro ilmiy adabiyotda bioiqtisodiyot boshqaruvi va uning institutsional-huquqiy asoslari mustaqil tadqiqot yo‘nalishi sifatida so‘nggi o‘n yilda faol shakllanib bormoqda, biroq bu jarayonning boshida bir necha muallif guruhining ishlari turadi. T. Dietz, J. Börner, J.J. Forster va J. fon Braun 41 mamlakatning milliy bioiqtisodiyot strategiyasini Barqaror rivojlanish maqsadlari nuqtai nazaridan qiyosiy tahlil qilib, davlatlar qo‘llaydigan vositalarni “imkoniyat yaratuvchi” (rag‘batlantiruvchi) va “cheklovchi” (tartibga soluvchi) boshqaruv turlariga ajratgan holda tasniflagan [2]. Mualliflar bioiqtisodiy rivojlanishning to‘rtta yo‘nalishini farqlab, ularning har biri bo‘yicha barqarorlikka faqat samarali boshqaruv mexanizmlari mavjud bo‘lgandagina erishish mumkinligini ko‘rsatgan - bu xulosa quyida O‘zbekiston strategiyalarini baholashda ham boshlang‘ich mezon sifatida qo‘llaniladi.

M. Böxer, A.E. Toller, D. Perbandt, K. Beer va T. Vogelpohl bioiqtisodiyot siyosati va boshqaruviga oid xalqaro adabiyotni tizimli ravishda ko‘zdan kechirib, mavzuni to‘rtta asosiy tadqiqot yo‘nalishiga ajratgan [1]. Ular, xususan, bioiqtisodiyot masalasi o‘rmon xo‘jaligi sohasida ayniqsa keng muhokama qilinishini qayd etib, siyosiy fanlar nuqtai nazaridan bir qator bo‘shliqlarni - jumladan, bioiqtisodiyot siyosatidagi manfaatlar va kuch munosabatlarining yetarli o‘rganilmaganligini - aniqlagan.

Berlin texnika universitetining Innovatsiya iqtisodiyoti kafedrasida faoliyat yurituvchi A. Gottinger, L. Ladu va K. Blind ISO va Yevropa standartlashtirish tashkilotlari qabul qilgan bioiqtisodiyotga oid standartlarning ilmiy adabiyotlarga va me’yoriy-huquqiy hujjatlarga qay darajada tayanishini miqdoriy usullar bilan tahlil qilgan [10]. Ularning xulosasiga ko‘ra, fan va tartibga solish o‘rtasidagi o‘zaro ta’sir standartlarni muntazam yangilab borishning muhim omili bo‘lib, aynan shu o‘zaro ta’sir standartlashtirish jarayonining ilmiy bilimlarni sanoat amaliyotiga qanchalik tez singdirishini belgilaydi - bu kuzatuv 6-bo‘limda taklif etiladigan besh bosqichli yangilash protsedurasi uchun ham nazariy zamin bo‘lib xizmat qiladi.

T. Vogelpohl bioiqtisodiyotni uning boshqaruv instrumentlari orqali tushunishga bag‘ishlangan alohida tadqiqotida barqarorlik standartlarini tanqidiy nuqtai nazardan tahlil qilib, ularning Yevropa Ittifoqi, Braziliya va Indoneziya kabi turli mintaqalardagi qo‘llanilishini solishtirgan [22]. Muallifning asosiy xulosasiga ko‘ra, ixtiyoriy standartlarning “barqarorlik”ni qanchalik ta’minlashi ko‘p jihatdan bozor mantig‘iga - ya’ni iste’molchi va investorlar talabiga - bog‘liq bo‘lib qoladi, bu esa davlat ishtirokisiz ishlaydigan standartlashtirish tizimining tabiiy chegarasini ko‘rsatadi.

H. Gould, L. Kelleher va E. O’Nil 2010-2021-yillarda chop etilgan bioiqtisodiyotga oid ilmiy nashrlarni Scopus bazasi asosida bibliometrik tahlil qilgan [11]. Tadqiqot davomida nashrlar soni o‘n yil ichida yigirma olti baravardan ortiq - 2010-yildagi sakkiz tadan 2021-yilda ikki yuzu o‘ntagacha - o‘sgani, shuningdek nashrlarning katta qismi Shimoliy va Shimoli-g‘arbiy Yevropa

institutlariga tegishli ekanligi aniqlangan; standartlashtirish va sertifikatlash mavzusi esa, mualliflarning ta'kidlashicha, ushbu adabiyot ichida nisbatan kam yoritilgan.

O'zbek iqtisodchilari orasida "yashil" iqtisodiyot muammolariga bag'ishlangan tadqiqotlar soni so'nggi yillarda sezilarli darajada oshdi. A.V. Vaxabov va Sh.X. Xajibakiyev "yashil" iqtisodiyot asosida barqaror iqtisodiy o'sishni ta'minlashning nazariy va amaliy jihatlarini tahlil qilib, milliy iqtisodiyotni resurs tejamkor modelga o'tkazishning asosiy yo'nalishlarini asoslab bergan [37].

T.T. Jo'rayev va D. Jumanov O'zbekistonda yashil iqtisodiyotni rivojlantirish imkoniyatlari va istiqbollarini respublika ilmiy-amaliy konferensiyasi materiallarida yoritib, mamlakat sharoitida "yashil" transformatsiyani tezlashtiruvchi omillarni tizimlashtirgan [30].

B.B. Shoyqulovning tadqiqotlarida "yashil" iqtisodiyot, "yashil taraqqiyot" va "yashil makon" kabi tushunchalarning mazmun-mohiyati nazariy jihatdan ochib berilgan, bu esa milliy iqtisodiy adabiyotda tegishli tushunchaviy apparatni aniqlashtirishga xizmat qilgan [36].

N. Yormonqulova esa iqtisodiy o'sish omillarini takomillashtirish va barqaror rivojlanishga erishish masalalarini o'rganib, iqtisodiy o'sish sifatini oshirishning institutsional shartlarini tahlil qilgan [38].

M.K. Matyakubovna va S.F. Kamolovna O'zbekistonda yashil iqtisodiyotni joriy etishning amaliy imkoniyatlarini va uni rivojlantirish istiqbollarini tahlil qilib, mamlakat sharoitida yashil transformatsiyani ta'minlovchi institutsional va iqtisodiy omillarni tizimlashtirgan [32]. Ushbu mavzuga bevosita yondosh yo'nalishda M.K. Matyakubovna alohida tadqiqotida xalqaro sertifikatlash va standartlashtirish tizimlarining O'zbekistonda rivojlanish jarayonini ko'rib chiqib, milliy standartlashtirish infratuzilmasining xalqaro (jumladan ISO) talablarga moslashtirilishi bilan bog'liq institutsional bosqichlarni tahlil qilgan [31] - bu xulosalar ushbu maqolaning 5 va 6-bo'limlarida ko'rib chiqiladigan milliy standartlashtirish tizimidagi bo'shliqlarni baholashda qo'shimcha empirik asos bo'lib xizmat qiladi. Shuningdek, M.K. Matyakubovna va I. Ozodbekning tashkiliy madaniyat va yetakchilik uslublariga bag'ishlangan qiyosiy tadqiqoti G'arb va Sharq boshqaruv modellarining farqlarini ochib berib [33], ISO 14001 kabi boshqaruv standartlarini joriy etishda rahbariyat majburiyati va tashkiliy madaniyatning ahamiyatini tushunish uchun qo'shimcha kontekst yaratadi.

O'tkazilgan tahlil shuni ko'rsatadiki, keltirilgan milliy tadqiqotlarning katta qismi "yashil" iqtisodiyotning umumiy kontseptual va strategik jihatlariga qaratilgan bo'lib, xalqaro texnik standartlar - ISO seriyasi, GRI, FSC, Yevropa Ittifoqi taksonomiyasi - ning milliy bioiqtisodiyot institutlariga qanday integratsiyalashishi masalasi alohida tadqiqot predmeti sifatida deyarli o'rganilmagan. Xuddi shunday, xalqaro adabiyotda ham standartlashtirish va bioiqtisodiyot bog'liqligi asosan Yevropa Ittifoqi tajribasi misolida tahlil qilingan bo'lib, o'tish iqtisodiyoti mamlakatlari, jumladan Markaziy Osiyo davlatlari kontekstida bu masala amalda ochiq qolmoqda. Aynan ushbu bo'shliq mazkur maqolaning tadqiqot predmeti va ilmiy yangiligini belgilaydi.

METODOLOGIYA

Tadqiqot uslubiyati uchta bir-birini to‘ldiruvchi usulga asoslangan. Birinchidan, rasmiy hujjatlarni qiyosiy-huquqiy tahlil qilish usuli qo‘llanildi - bunda ISO standartlari, Yevropa Ittifoqi me’yoriy-huquqiy hujjatlari (Reglament, Direktiva, strategik hisobotlar) va O‘zbekiston Respublikasining tegishli qonun hujjatlari (Prezident farmon va qarorlari, Vazirlar Mahkamasi qarorlari) o‘zaro solishtirildi, ularning qamrovi, majburiylik darajasi va amal qilish muddatlari aniqlandi. Ikkinchidan, xalqaro tashkilotlarning (ISO, Yevropa Komissiyasi, GRI, FSC, UNFCCC kotibiyati) ochiq statistik ma’lumotlari umumlashtirildi, bu esa standartlarga a’zolik ko‘lami va ularning amaliy miqyosi bo‘yicha miqdoriy ko‘rsatkichlar (1 va 2-rasmlarda, shuningdek 1-6-jadvallarda aks etgan) olish imkonini berdi. Uchinchidan, milliy me’yoriy-huquqiy bazaning kontent-tahlili o‘tkazildi - bunda O‘zbekistonning “yashil” iqtisodiyot va biologik xilma-xillikka oid asosiy hujjatlari xalqaro standartlarga bevosita yoki bilvosita havola qilish nuqtai nazaridan ko‘rib chiqildi. Ushbu uch usulning birgalikda qo‘llanilishi nafaqat mavjud holatni tasvirlash, balki milliy amaliyotdagi bo‘shliqlarni aniqlash va ularni bartaraf etish bo‘yicha asoslangan tartib-taomil ishlab chiqish imkonini berdi.

Tadqiqotning axborot bazasini ISO, Yevropa Komissiyasi, UNFCCC, GRI va FSC rasmiy saytlaridagi ma’lumotlar, EUR-Lex hamda lex.uz milliy qonunchilik bazasidagi hujjatlar, shuningdek bioiqtisodiyot boshqaruviga oid xalqaro va milliy ilmiy nashrlar tashkil etdi [7]; [13]; [20]; [25]. Tahlil davri 1992-yilda Biologik xilma-xillik to‘g‘risidagi konvensiya qabul qilinganidan 2025-yilda Yevropa Ittifoqining yangi bioiqtisodiyot strategik asosi qabul qilingunga qadar bo‘lgan bosqichlarni qamrab oladi. Milliy hujjatlarni baholashda T. Dietz va hammualliflari taklif etgan yondashuvdan - davlat vositalarini rag‘batlantiruvchi va tartibga soluvchi boshqaruv turlariga ajratishdan - boshlang‘ich mezon sifatida foydalanildi [2].

TAHLIL VA NATIJALAR

Xalqaro standartlashtirish tashkiloti (ISO) tomonidan ishlab chiqilgan “ISO 14000” seriyasi ekologik boshqaruv sohasidagi eng keng tarqalgan me’yoriy hujjatlar majmuidir. Uning yadrosini ISO 14001 standarti tashkil etadi - u tashkilotning ekologik boshqaruv tizimiga qo‘yiladigan talablarni belgilaydi va tizimli ravishda ekologik ta’sirni kamaytirish, qonunchilikka muvofiqlikni ta’minlash hamda uzluksiz takomillashtirishni talab qiladi [13]. Standartning 2015-yilgi uchinchi tahriri 2026-yilda yangi nashr bilan almashtirilmoqda [16], bu esa milliy standartlashtirish organlari uchun o‘tish davrini rejalashtirish zaruriyatini keltirib chiqaradi.

Bioiqtisodiyot nuqtai nazaridan alohida ahamiyatga ega bo‘lgan yana bir hujjatlar guruhi - hayot aylanishini baholash standartlaridir. ISO 14040 va ISO 14044 standartlari 2006-yilda to‘rtta oldingi hujjatni (ISO 14040:1997, 14041:1999, 14042:2000, 14043:2000) birlashtirib, mahsulotning xomashyo qazib olishdan tortib utilizatsiyagacha bo‘lgan barcha bosqichlaridagi ekologik ta’sirini baholash uslubiyatini yagona tizimga keltirdi [17]; [18]. Biomassaga asoslangan mahsulotlar - bioplastik, bioyoqilg‘i, qayta ishlangan to‘qimachilik xomashyosi - uchun aynan shu

uslubiyat ularning “yashilligi”ni raqamlar bilan isbotlashning yagona xalqaro tan olingan yo‘lidir.

Issiqxona gazlari emissiyasini hisoblash sohasida ISO 14064 seriyasi markaziy o‘rin tutadi. Uning birinchi qismi tashkilot darajasidagi issiqxona gazlari inventarizatsiyasini, ikkinchi qismi loyiha darajasidagi hisob-kitoblarni, uchinchi qismi esa mustaqil tekshiruv va tasdiqlash tartiblarini belgilaydi [14]. Bundan tashqari, mahsulot darajasida ISO 14067 (uglerod izi) va ISO 14046 (suv izi) qo‘llaniladi [17], ular birgalikda bioiqtisodiyot zanjiridagi resurs sarfini har tomonlama hisobga olish imkonini beradi (1-jadval).

1-jadval

ISO 14000 oilasiga kiruvchi bioiqtisodiyotga tegishli asosiy standartlar[1]

Standart kodi	Nomi va qamrovi	Amaldagi tahriri	Bioiqtisodiyotdagi vazifasi
ISO 14001	Ekologik boshqaruv tizimlari - talablar	2015 (2026-y. yangi tahrirga o‘tish jarayonida)	Korxona darajasidagi ekologik boshqaruvning umumiy asosi
ISO 14040 / 14044	Hayot aylanishini baholash - tamoyillar va talablar	2006 (2017, 2020-y. tuzatishlar bilan)	Bioasosli mahsulotlarning to‘liq ekologik izini baholash
ISO 14064-1/-2/-3	Issiqxona gazlari - tashkilot, loyiha va tekshiruv darajasi	2018 / 2019 / 2019	Bioiqtisodiyot korxonalarida uglerod hisobotini yuritish
ISO 14046	Suv izi - tamoyillar va hisoblash uslubiyati	2014	Sug‘oriladigan qishloq xo‘jaligi va qayta ishlash uchun suv sarfini baholash
ISO 14067	Mahsulotning uglerod izi	2018	Eksport mahsulotlari uchun uglerod belgilanishi

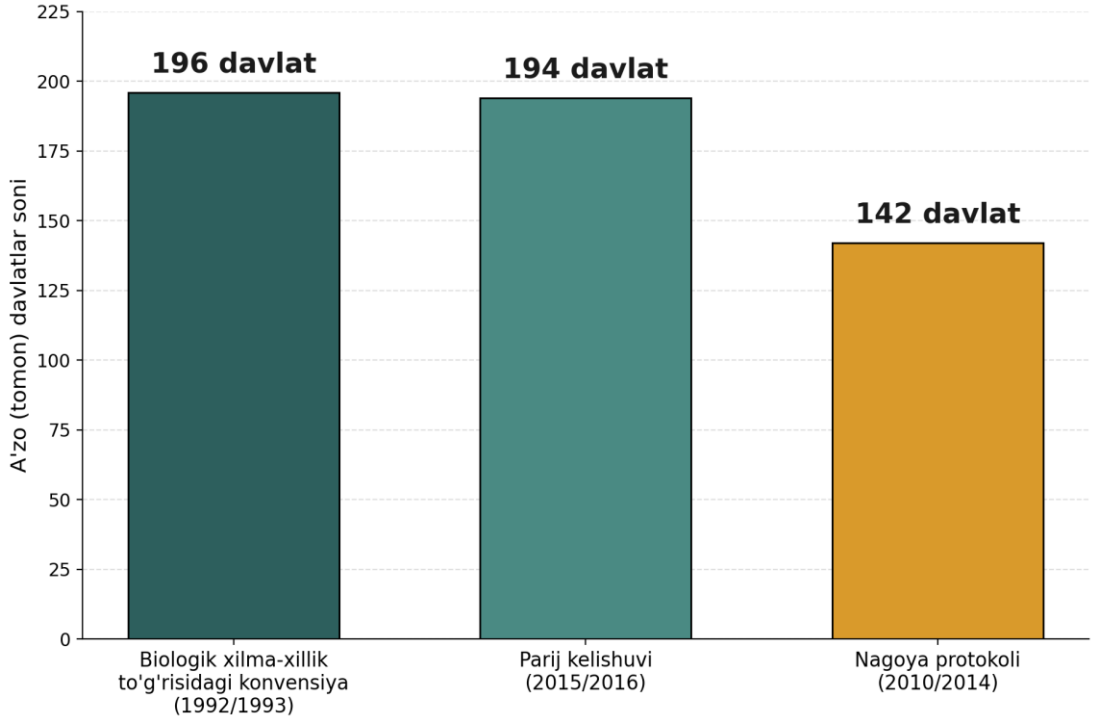
1-jadval ma’lumotlaridan ko‘rinib turibdiki, ISO 14000 oilasiga kiruvchi standartlar bioiqtisodiyot zanjirining turli bo‘g‘inlarini qamrab oladi: ISO 14001 korxona darajasidagi boshqaruvni, ISO 14040/14044 mahsulotning to‘liq hayot aylanishini, ISO 14064 seriyasi, ISO 14067 va ISO 14046 esa mos ravishda issiqxona gazlari, uglerod izi va suv izini hisoblashni tartibga soladi [13]; [14]; [17]. Jadvaldagi standartlarning aksariyati 2006-2019-yillarda qabul qilingan yoki yangilangan bo‘lib, ISO 14001 ning yangi tahrirga o‘tish jarayonida ekanligi milliy standartlarni ham muntazam yangilab borish zarurligini ko‘rsatadi [16].

Bioiqtisodiyotning xomashyo bazasi - biologik va genetik resurslar - xalqaro huquqda alohida rejim bilan tartibga solinadi. 1992-yilda qabul qilingan Biologik xilma-xillik to‘g‘risidagi konvensiya bugungi kunga kelib 196 davlat tomonidan ratifikatsiya qilingan [35] va uchta asosiy maqsadga - bioxilma-xillikni saqlash, undan barqaror foydalanish hamda genetik resurslardan olinadigan foydani adolatli taqsimlashga - xizmat qiladi. O‘zbekiston ushbu konvensiyaga 1995-yil 5-mayda qo‘shilgan [34].

[1] Manba: ISO rasmiy sayti (iso.org) va ISO-Library ma’lumotlari asosida muallif tomonidan tuzilgan.

Konvensiyaning ikkita amaliy protokoli mavjud. Bioxavfsizlik bo‘yicha Kartaxena protokoli genetik modifikatsiyalangan organizmlarning transchegaraviy harakatini tartibga soladi; O‘zbekistonda uni amalga oshirish chora-tadbirlari Vazirlar Mahkamasining 2020-yil 11-maydagi 275-son qarori bilan tasdiqlangan [29]. Genetik resurslarga kirish va ulardan olingan foydani taqsimlash bo‘yicha Nagoya protokoli esa 2014-yilda kuchga kirgan va hozirda 142 davlat tomonidan ratifikatsiya qilingan [24], biroq O‘zbekiston hali ushbu protokolga rasmiy ravishda qo‘shilmagan - bu holat 5-bo‘limda batafsilroq muhokama qilinadi.

Iqlim yo‘nalishidagi bitimlar orasida Parij kelishuvi alohida o‘rin tutadi - unga hozirda 194 davlat a’zo [20], jumladan O‘zbekiston ham 2018-yil 9-noyabrda uni ratifikatsiya qilgan; bundan oldin, 1999-yil 12-oktyabrda mamlakat Kioto protokolini ratifikatsiya qilgan edi [21]. 1-rasmda ushbu uchta hujjatga a’zolik ko‘lami solishtirilgan [20]; [24]; [35]: undan ko‘rinib turibdiki, genetik resurslarga oid Nagoya protokoli boshqa ikki hujjatga nisbatan ancha kam davlat tomonidan qabul qilingan, bu esa uning global “yetilish darajasi” nisbatan pastligidan dalolat beradi (1-rasm).



1-rasm. Asosiy xalqaro ekologik-huquqiy hujjatlarga a’zolik ko‘lamining qiyosiy tavsifi[1]

1-rasmda keltirilgan ma’lumotlarga ko‘ra, Biologik xilma-xillik to‘g‘risidagi konvensiyaga 196 davlat, Parij kelishuviga 194 davlat a’zo bo‘lgan holda, Nagoya protokolini 142 davlat ratifikatsiya qilgan [20]; [24]; [35]. Nagoya protokolining qamrovi konvensiyanikidan 54 davlatga kam bo‘lib, genetik resurslardan foydalanish bo‘yicha xalqaro rejim hali to‘liq shakllanmaganini ko‘rsatadi. Ushbu va boshqa asosiy bitimlarning qabul qilingan yillari, a’zolar soni hamda O‘zbekistonning ulardagi maqomi umumlashtirilgan (2-jadval).

[1] Manba: CBD, UNFCCC va Nagoya protokoli rasmiy ma’lumotlari asosida muallif tomonidan tuzilgan.

2-jadval

Bioiqtisodiyotga tegishli asosiy ko‘p tomonlama ekologik bitimlar[1]

Hujjat	Qabul qilingan / kuchga kirgan	A’zolar soni	O‘zbekiston maqomi
Biologik xilma-xillik to‘g‘risidagi konvensiya (CBD)	1992 / 1993	196	A’zo, 1995-yil 5-may
Kartaxena bioxavfsizlik protokoli	2000 / 2003	-	Amalga oshirish chora-tadbirlari qabul qilingan 2020-yil
Nagoya protokoli (genetik resurslar)	2010 / 2014	142	Hali qo‘shilmagan
Kioto protokoli	1997 / 2005	192 dan ortiq	Ratifikatsiya qilingan, 1999-yil
Parij kelishuvi	2015 / 2016	194	Ratifikatsiya qilingan, 2018-yil

2-jadvalda O‘zbekiston bioiqtisodiyotga tegishli beshta asosiy ko‘p tomonlama hujjatdan to‘rttasida ishtirok etadi: konvensiyaga 1995-yilda a’zo bo‘lgan, Kioto protokoli va Parij kelishuvini mos ravishda 1999 va 2018-yillarda ratifikatsiya qilgan hamda Kartaxena protokolini amalga oshirish chora-tadbirlarini 2020-yilda qabul qilgan [21]; [29]; [34]. Yagona istisno - genetik resurslarga oid Nagoya protokoli bo‘lib, unga hali qo‘shilinmaganligi milliy bioiqtisodiyotning xomashyo bazasi bo‘yicha huquqiy rejimdagi asosiy bo‘shliq ekanligini ko‘rsatadi.

Yevropa Ittifoqi bioiqtisodiyotni institutsional jihatdan eng izchil rivojlantirgan hudud hisoblanadi. Birinchi strategiya 2012-yilda qabul qilingan [4], 2018-yilda esa u tub yangilanishga uchragan - yangi tahrir doiraviy va barqaror biologik resurslardan foydalanishga urg‘u bergan. 2022-yilda Yevropa Komissiyasi strategiyaning amalga oshirilishi bo‘yicha hisobot (COM/2022/283) e’lon qildi, unda mintaqaviy bioiqtisodiyot strategiyalarining ko‘payishi va xususiy investitsiyalarning barqaror o‘sishi qayd etilgan [6]. Nihoyat, 2025-yilda “Raqobatbardosh va barqaror Yevropa Ittifoqi bioiqtisodiyoti uchun strategik asos” nomli yangi hujjat qabul qilindi, u 2040-yilgacha bo‘lgan istiqbolni belgilaydi [3].

Raqamlar strategiyaning amaliy miqyosini yaqqol ko‘rsatadi: 2023-yilda Yevropa Ittifoqi bioiqtisodiyotining qiymati 2,7 trillion yevroni tashkil etgan va unda 17 milliondan ortiq kishi, ya’ni Yevropa Ittifoqi bandligining taxminan 8 foizi band bo‘lgan [3]. Bu ko‘rsatkichlar bioiqtisodiyotning endi tor ixtisoslashgan yo‘nalish emas, balki makroiqtisodiy miqyosdagi tarmoq ekanligini tasdiqlaydi (3-jadval).

3-jadval Yevropa Ittifoqi bioiqtisodiyot siyosatining o‘n uch yil ichida kontseptual asosdan amaliy doktrinaga aylanganini ko‘rsatadi: 2012-yilgi strategiya dastlabki kontseptual asosni belgilagan bo‘lsa, 2018-yilgi tahrir doiraviylik va investitsiya xavfsizligiga, 2022-yilgi hisobot mintaqaviy strategiyalar tahliliga, 2025-yilgi strategik asos esa 2040-yilgacha raqobatbardoshlikka urg‘u beradi [3]; [4]; [6]. Strategiyaning har to‘rt-olti yilda yangilanib borgani

[1] Manba: CBD, UNFCCC va Vazirlar Mahkamasi hujjatlari asosida muallif tomonidan tuzilgan.

bioiqtisodiyotni tartibga solish doimiy yangilanib turadigan jarayon ekanligini tasdiqlaydi.

3-jadval

Yevropa Ittifoqi bioiqtisodiyot strategiyasining evolyutsiyasi[1]

Yil	Hujjat / voqea	Asosiy mazmuni
2012	Birinchi Bioiqtisodiyot strategiyasi	Biologik resurslarga asoslangan iqtisodiyotning dastlabki kontseptual asosi
2018	Yangilangan strategiya va Harakat rejasi	Doiraviy va barqaror biomassadan foydalanishga urg‘u; investitsiya xavfsizligi
2022	Amalga oshirish bo‘yicha hisobot (COM/2022/283)	Mintaqaviy strategiyalar sonining o‘sishi va yutuqlar tahlili
2025	“Strategik asos” (yangi bioiqtisodiyot doktrinasi)	2040-yilgacha raqobatbardoshlik va sanoat ishtiroki ustuvorligi

2020-yil 18-iyunda qabul qilingan (EI) 2020/852-sonli Reglament, ya’ni Yevropa Ittifoqi taksonomiyasi, iqtisodiy faoliyatning “ekologik jihatdan barqaror” deb topilishi uchun oltita mezonni belgilaydi [7]. Faoliyat turi ushbu maqsadlardan kamida bittasiga sezilarli hissa qo‘shishi, qolganlariga “sezilarli zarar keltirmasligi” hamda minimal ijtimoiy kafolatlarga rioya qilishi shart [12]. 2022-yil 1-yanvardan boshlab yirik kompaniyalar o‘z moliyaviy hisobotlarida ushbu ko‘rsatkichlarni oshkor qilishga majburdir [19]. Taksonomiyaning oltita ekologik maqsadi 4-jadvalda keltirilgan (4-jadval).

4-jadval

Yevropa Ittifoqi taksonomiyasining oltita ekologik maqsadi[2]

№	Ekologik maqsad
1	Iqlim o‘zgarishini yumshatish
2	Iqlim o‘zgarishiga moslashish
3	Suv va dengiz resurslarini barqaror foydalanish va muhofaza qilish
4	Doiraviy iqtisodiyotga o‘tish, jumladan chiqindilarning oldini olish
5	Ifloslanishning oldini olish va uni nazorat qilish
6	Biologik xilma-xillik va ekotizimlarni muhofaza qilish hamda tiklash

4-jadvalda keltirilgan oltita maqsad Yevropa Ittifoqi taksonomiyasining asosini tashkil etadi [7]. Ulardan uchtasi - suv resurslarini muhofaza qilish, doiraviy iqtisodiyotga o‘tish hamda biologik xilma-xillik va ekotizimlarni tiklash - bevosita bioiqtisodiyot tarmoqlariga taalluqli bo‘lib, qishloq xo‘jaligi, o‘rmon xo‘jaligi va biomassani qayta ishlash faoliyatining “yashil” deb tan olinishida aynan shu mezonlar hal qiluvchi ahamiyatga ega [7; 12].

Taksonomiya bilan bir qatorda, 2020-yil martida qabul qilingan Doiraviy iqtisodiyot bo‘yicha yangi harakat rejasi alohida ahamiyatga ega - u yettita ustuvor tarmoqni, jumladan biomassa va biologik asosdagi mahsulotlarni ham qamrab oladi hamda biomassadan kaskadli foydalanishni rag‘batlantiradi [5]. Rejaning kirish

[1] Manba: Yevropa Komissiyasi va The European Bioeconomy Network ma’lumotlari asosida muallif tomonidan tuzilgan.
[2] Manba: Regulation (EU) 2020/852 (EUR-Lex) asosida muallif tomonidan tuzilgan.

qismida ta'kidlanishicha, agar hozirgi tendensiya davom etsa, global material iste'moli - shu jumladan biomassa - keyingi qirq yil ichida ikki baravar oshishi mumkin [5], bu esa aynan resurs samaradorligini oshiruvchi standartlarning ahamiyatini yanada kuchaytiradi.

Davlat tomonidan tartibga solinadigan me'yorlardan farqli o'laroq, ixtiyoriy sertifikatlash tizimlari bozor mexanizmlari orqali ta'sir ko'rsatadi. Global hisobotlilik tashabbusi (GRI) 1997-yilda tashkil etilgan bo'lib, bugungi kunda 100 dan ortiq mamlakatda 14 000 dan ziyod tashkilot tomonidan qo'llaniladi [9]. GRI standartlari uchta guruhga - umumiy, tarmoq va mavzu bo'yicha standartlarga - bo'linadi; ularning qayta ko'rib chiqilgan Umumiy standartlari 2023-yil yanvaridan e'tiboran qo'llanilmoqda [23].

O'rmon xo'jaligi sohasida shunga o'xshash rolni O'rmon boshqaruvi kengashi (FSC) sertifikati o'ynaydi. 1993-yilda tashkil etilgan FSC hozirda dunyo bo'ylab 160 million gektardan ortiq o'rmon maydonini va 70 000 dan ortiq tashkilotni sertifikatlashtirgan [8], uning o'nta tamoyili ekologik, ijtimoiy va iqtisodiy mezonlarni bir vaqtda qamrab oladi. Ikkala tizim ham davlat majburlashisiz, faqat bozor talabi - iste'molchilar, investorlar va yetkazib beruvchi zanjirlar bosimi - orqali ishlaydi; bu ularning tezkorligini ta'minlaydi, ammo shu bilan birga qamrovini ixtiyoriy ishtirok etuvchilar bilan cheklaydi (5-jadval).

5-jadval

GRI va FSC standartlarining qiyosiy tavsifi[1]

Mezon	GRI	FSC
Tashkil etilgan yili	1997	1993
Diqqat markazi	Ekologik, ijtimoiy va boshqaruv hisobotlari	O'rmon xo'jaligini barqaror boshqarish sertifikati
Qamrov ko'lami	14 000< tashkilot, 100< mamlakat	160< mln gektar, 70 000< tashkilot
Tuzilishi	Umumiy, tarmoq va mavzu bo'yicha standartlar	10 ta tamoyil va mezon
Amal qilish shakli	Ixtiyoriy hisobotlilik	Ixtiyoriy sertifikatlash va nazorat zanjiri

5-jadvalda GRI va FSC turli maqsadlarga xizmat qiladi: GRI 100 dan ortiq mamlakatdagi 14 000 dan ziyod tashkilotni hisobotlilik orqali qamrab olsa, FSC 160 million gektardan ortiq o'rmon maydoni va 70 000 dan ortiq tashkilotni sertifikatlash orqali qamrab oladi [8]; [9]. Biroq ikkala tizimning ham ixtiyoriy tabiati ularning ta'sir doirasini bozor talabiga bog'liq qilib qo'yadi [22].

O'zbekistonda bu ikki tizimning amaliy qo'llanilishi hozircha juda tor doirada qolmoqda: eksportga yo'naltirilgan yirik korxonalarning bir qismi tashqi bozor talabiga javoban GRI asosidagi hisobotlarni tayyorlashga kirishgan bo'lsa-da, bu amaliyot ommaviy tus olmagan; FSC sertifikatlashtirilgan o'rmon xo'jaligi maydonlari esa deyarli mavjud emas.

[1] Manba: globalreporting.org va fsc.org rasmiy ma'lumotlari asosida muallif tomonidan tuzilgan.

O‘zbekistonning ekologik-iqtisodiy transformatsiyasi bir nechta o‘zaro bog‘liq hujjatlar orqali institutsionallashtirilgan. Markaziy o‘rinni yuqorida qayd etilgan “2019-2030-yillar davrida O‘zbekiston Respublikasining “yashil” iqtisodiyotga o‘tish strategiyasi” [25] egallaydi, unga ko‘ra 2030-yilga borib energiya samaradorligi ko‘rsatkichini ikki baravar oshirish va qayta tiklanuvchi manbalar ulushini elektr energiyasi ishlab chiqarishning 25 foizidan ortig‘iga yetkazish rejalashtirilgan [36]. Shu bilan bir qatorda, atrof-muhitni muhofaza qilish konsepsiyasi tarmoqlararo ekologik vazifalarni belgilaydi [26].

Biologik resurslar bo‘yicha alohida hujjat sifatida Vazirlar Mahkamasining 2019-yil 11-iyundagi 484-son qarori bilan tasdiqlangan “2019-2028-yillar davrida O‘zbekiston Respublikasida biologik xilma-xillikni saqlash strategiyasi”ni ko‘rsatish mumkin [28], u chorvachilikning tabiiy ekotizimlarga bosimini va sug‘orish infratuzilmasining tor yo‘naltirilgan rivojlanishini asosiy xavf omillari sifatida belgilaydi. 2022-yil 2-dekabrdagi PQ-436-son qaror esa “yashil” iqtisodiyotga o‘tish islohotlarining samaradorligini oshirishga qaratilgan monitoring mexanizmini joriy etdi - unga ko‘ra davlat organlari rahbarlari har chorakda bajarilgan ishlar yuzasidan hisobot berishlari lozim [27]. Ushbu hujjatlarning asosiy rekvizitlari va mazmuni 6-jadvalda umumlashtirilgan (6-jadval).

6-jadval

O‘zbekistonning “yashil”/bioiqtisodiyotga oid asosiy me’yoriy-huquqiy hujjatlari[1]

Hujjat	Sana / raqami	Mazmuni
Prezident qarori	2019-yil 4-oktabr PQ-4477	2019-2030-yillar “yashil” iqtisodiyotga o‘tish strategiyasi
Prezident farmoni	2019-yil 30-oktabr PF-5863	2030-yilgacha atrof-muhitni muhofaza qilish konsepsiyasi
Vazirlar Mahkamasi qarori	2019-yil 11-iyun № 484	2019-2028-yillar biologik xilma-xillikni saqlash strategiyasi
Vazirlar Mahkamasi qarori	2020-yil 11-may № 275	Kartaxena bioxavfsizlik protokolini amalga oshirish chora-tadbirlari
Prezident qarori	2022-yil 2-dekabr PQ-436	“Yashil” iqtisodiyotga o‘tish islohotlari samaradorligini oshirish

Ushbu hujjatlar majmui O‘zbekistonda “yashil” transformatsiya uchun mustahkam siyosiy irodaning mavjudligini ko‘rsatadi. Biroq ularning barchasi asosan maqsadli ko‘rsatkichlar va institutsional chora-tadbirlarni belgilaydi, xalqaro texnik standartlar - ISO, GRI, Yevropa Ittifoqi taksonomiyasi - bilan qanday uzviy bog‘lanishi kerakligi haqida esa aniq mexanizm keltirilmagan. Aynan shu holat keyingi bo‘limda ko‘rib chiqiladigan bo‘shliqlarning bosh sababi hisoblanadi.

Yuqorida keltirilgan tahlil asosida O‘zbekiston bioiqtisodiyotining me’yoriy-texnik infratuzilmasida bir necha aniq bo‘shliqni ajratib ko‘rsatish mumkin.

a) Genetik resurslar sohasidagi huquqiy bo‘shliq. O‘zbekiston Biologik xilma-xillik konvensiyasi va Kartaxena protokoliga a’zo bo‘lsa-da, Nagoya protokoliga hali

[1] Manba: lex.uz Qonunchilik ma’lumotlari milliy bazasi asosida muallif tomonidan tuzilgan.

qo‘shilmagan [24]; [34]. Amalda bu shuni anglatadiki, mamlakat florasi va faunasidan olingan genetik material asosida xorijda yaratilgan mahsulotlar (farmatsevtika, kosmetika, urug‘chilik) uchun adolatli foyda taqsimoti mexanizmi milliy qonunchilikda mavjud emas - bu, bir tomondan, xorijiy kompaniyalar uchun huquqiy noaniqlik, ikkinchi tomondan, davlat uchun potentsial daromad manbaining yo‘qotilishini anglatadi.

b) Milliy “yashil” taksonomiyaning yo‘qligi. Yevropa Ittifoqi taksonomiyasidan farqli o‘laroq [7], O‘zbekistonda qaysi iqtisodiy faoliyat turlari “yashil” yoki bioiqtisodiy deb hisoblanishi mumkinligini belgilovchi yagona tasniflagich mavjud emas. Bu, xususan, “yashil” obligatsiyalar va kreditlar bilan ishlaydigan bank institutlari uchun mezonlar noaniqligini keltirib chiqaradi va “yashil bo‘yash” xavfini oshiradi.

c) Majburiy issiqxona gazlari monitoring tizimining yo‘qligi. ISO 14064-1 standarti [14] asosida ishlaydigan tashkilot darajasidagi hisobot tizimi hozircha faqat yirik eksportyor korxonalar tomonidan, ko‘pincha xorijiy hamkorlar talabiga javoban, ixtiyoriy tarzda qo‘llanilmoqda. Milliy miqyosda yagona monitoring, hisobot va tekshiruv tizimining yo‘qligi bioiqtisodiyot tarmoqlarining (masalan, biogaz va organik o‘g‘it ishlab chiqarish) uglerod kreditlari bozoriga chiqishini murakkablashtiradi.

d) Ixtiyoriy sertifikatlashning tor qamrovi. Yuqorida qayd etilganidek, GRI va FSC kabi tizimlar amaliyotda faqat bir nechta yirik eksport yo‘naltirilgan korxonalar tomonidan qo‘llaniladi; qishloq xo‘jaligi va oziq-ovqat qayta ishlash tarmog‘idagi o‘rta va kichik tadbirkorlar uchun bunday sertifikatlashtirish amalda erishib bo‘lmaydigan xarajat va bilim darajasini talab qiladi.

e) Standartlarni yangilash mexanizmining institutsional zaifligi. ISO 14001 kabi asosiy standartlarning muntazam qayta ko‘rib chiqilishi (masalan, 2026-yilga mo‘ljallangan yangi tahrir) [15]; [16] milliy standartlashtirish tizimida avtomatik tarzda aks etmaydi - bu jarayon amalda ko‘pincha yillab kechikadi.

Yuqorida aniqlangan bo‘shliqlarni bartaraf etish nafaqat yangi standartlarni joriy etishni, balki mavjudlarini o‘z vaqtida yangilab borishni ham talab qiladi. Uchta yo‘nalish alohida ustuvorlikka ega deb hisoblaymiz.

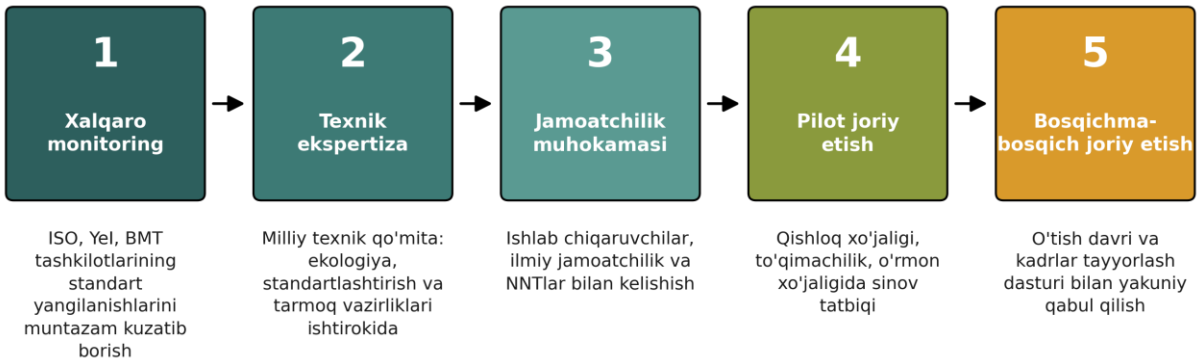
Birinchidan, ISO 14001 standartining 2015-yilgi tahriridan 2026-yilgi yangi nashrga o‘tish jarayoni [16] milliy darajada rasman kuzatilishi va tegishli milliy standart (O‘z DSt ISO 14001) muvofiq ravishda yangilanishi lozim. Amaliyotda buning kechikishi mahalliy sertifikatlangan korxonalarning xalqaro tan olinishini yo‘qotish xavfini tug‘diradi.

Ikkinchidan, GRI tomonidan qayta ko‘rib chiqilgan va 2023-yildan qo‘llanilayotgan Umumiy standartlar [23] davlat ulushi katta bo‘lgan korxonalar - xususan energetika, kimyo va qishloq xo‘jaligi xomashyosini qayta ishlash tarmog‘ida faoliyat yurituvchi korxonalar - uchun tavsiya etiluvchi hisobotlilik namunasi sifatida tegishli tarmoq vazirliklari tomonidan rasman tanishtirilishi maqsadga muvofiq.

Uchinchidan, hozircha mavjud bo‘lmagan, ammo zarur bo‘lgan ikki instrument - Nagoya protokoliga qo‘shilish va milliy “yashil”/bioiqtisodiy taksonomiyani ishlab

chiqish - ustuvor vazifa sifatida belgilanishi kerak. Bunda Yevropa Ittifoqi taksonomiyasining oltita mezoniga o‘xshash [7], ammo O‘zbekiston sharoitiga - jumladan suv taqchilligi va Orol dengizi mintaqasining ekologik holatini hisobga oluvchi - moslashtirilgan mezonlar tizimini ishlab chiqish maqsadga muvofiq bo‘lar edi.

Standartlarni yangilash va joriy etishning tizimli, oldindan bashorat qilinadigan jarayoni bo‘lishi uchun quyidagi besh bosqichli tartib-taomilni taklif etamiz (2-rasm): birinchi bosqichda ISO, Yevropa Ittifoqi va Birlashgan Millatlar Tashkiloti tizimidagi tashkilotlarning standart yangilanishlari muntazam kuzatiladi; ikkinchi bosqichda ekologiya, standartlashtirish va tarmoq vazirliklari vakillaridan iborat texnik qo‘mita ekspertiza o‘tkazadi; uchinchi bosqichda loyiha ishlab chiqaruvchilar, ilmiy jamoatchilik va nodavlat notijorat tashkilotlari bilan muhokama qilinadi; to‘rtinchi bosqichda ustuvor tarmoqlarda - qishloq xo‘jaligi, to‘qimachilik, o‘rmon xo‘jaligida - pilot tatbiq amalga oshiriladi; beshinchi, yakuniy bosqichda esa o‘tish davri va kadrlar tayyorlash dasturi bilan birga standart majburiy yoki tavsiya etiluvchi tartibda joriy etiladi.



2-rasm. Xalqaro ekologik standartlarni milliy amaliyotga moslashtirish va yangilash tartibi (taklif etilayotgan model)[1]

2-rasmda keltirilgan model standartlarni joriy etishni besh ketma-ket bosqichga ajratadi: har bir bosqich oldingisining natijasiga tayanadi, jarayon xalqaro monitoringdan boshlanib, o‘tish davri va kadrlar tayyorlash dasturi bilan yakunlanadi. Modelning asosiy afzalligi shundaki, u standartlarni yangilashni muntazam va oldindan rejalashtiriladigan jarayonga aylantiradi hamda fan va tartibga solish o‘rtasidagi o‘zaro ta’sirni institutsional darajada mustahkamlaydi [10].

XULOSA VA TAKLIFLAR

O‘tkazilgan tahlil shuni ko‘rsatadiki, xalqaro ekologik standartlashtirish tizimi uch qatlamli tuzilishga ega - majburiy ko‘p tomonlama bitimlar, mintaqaviy tartibga solish (Yevropa Ittifoqi misolida) va ixtiyoriy bozor standartlari (ISO, GRI, FSC) - va bu qatlamlarning har biri bioiqtisodiyotning turli jihatlarini, xomashyo bazasini, moliyalashtirilishini va mahsulot sifatini tartibga soladi. O‘zbekiston so‘nggi olti-yetti yil ichida “yashil” iqtisodiyot va biologik xilma-xillikni saqlash bo‘yicha izchil

[1] Manba: muallif tomonidan ishlab chiqilgan taklif etilayotgan model.

siyosiy-huquqiy baza yaratgan bo‘lsa-da, bu baza xalqaro texnik standartlar bilan tizimli bog‘lanmagan holda qolmoqda. Xususan, genetik resurslarga oid Nagoya protokoliga qo‘shilmaslik, milliy “yashil” taksonomiyaning yo‘qligi va majburiy issiqxona gazlari monitoring tizimining rivojlanmaganligi - uchta eng muhim bo‘shliq sifatida aniqlandi.

Taklif etilgan besh bosqichli integratsiyalashuv modeli - xalqaro monitoringdan tortib bosqichma-bosqich joriy etishgacha - standartlarni tasodifiy emas, balki oldindan bashorat qilinadigan tarzda milliy amaliyotga singdirish imkonini beradi. Bunday yondashuv, bir tomondan, mamlakat bioiqtisodiyot mahsulotlarining xalqaro bozorlarga chiqish imkoniyatlarini kengaytirsa, ikkinchi tomondan, tabiiy resurslardan foydalanishning shaffofligi va adolatliligini oshiradi. Kelgusi tadqiqotlar aynan taklif etilgan taksonomiya mezonlarini miqdoriy jihatdan ishlab chiqishga va uni ustuvor tarmoqlarda sinovdan o‘tkazishga qaratilishi maqsadga muvofiqdir.

Yuqoridagi tahlil asosida quyidagi amaliy tavsiyalarni shakllantirish mumkin:

1. Ekologiya, atrof-muhitni muhofaza qilish va iqlim o‘zgarishi vazirligi huzurida xalqaro standartlarni monitoring qilish va milliy amaliyotga moslashtirish bo‘yicha doimiy ishlaydigan maxsus guruh tashkil etilishi maqsadga muvofiq.

2. Nagoya protokoliga qo‘shilish masalasi tegishli tarmoq vazirliklari ishtirokida qayta ko‘rib chiqilishi lozim, zero mamlakat boy o‘simlik va hayvonot dunyosiga ega bo‘lib, bu resurslardan olinadigan potensial foyda hozircha huquqiy jihatdan tartibga solinmagan.

3. “Yashil” bank kreditlash va obligatsiyalar bozorini rivojlantirish uchun Yevropa Ittifoqi taksonomiyasi tajribasidan foydalangan holda, milliy sharoitga moslashtirilgan tasniflagich ishlab chiqish tavsiya etiladi.

4. Kichik va o‘rta biznes uchun GRI va FSC sertifikatlashtirish xarajatlarini qisman qoplaydigan davlat granti yoki subsidiya dasturini joriy etish ularning xalqaro bozorlarga chiqish imkoniyatlarini kengaytiradi.

5. Taklif etilgan besh bosqichli protsedura standartlashtirish organining ichki tartibiga rasman kiritilishi, standartlarni yangilashning tasodifiy emas, balki institutsional jarayon bo‘lishini ta’minlaydi.

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SUSTAINABILITY EDUCATION AS A DRIVER OF GREEN ENTREPRENEURIAL INTENTIONS IN HIGHER EDUCATION

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Abstract

The article examined how sustainability education related to university students' green entrepreneurial intentions. Literature selection and thematic synthesis were used to analyse relationships involving environmental values, attitudes and entrepreneurial self-efficacy. The theory of planned behaviour and the value-belief-norm framework provided the theoretical foundations. The review highlighted the mediating roles of environmental attitudes and confidence in entrepreneurial capabilities. Curriculum design, university support and cultural context were considered as relevant conditions. Practical projects, mentoring and support for green ventures were proposed as educational priorities. Methodological limitations were identified, and longitudinal research was recommended to examine whether intentions translated into actual entrepreneurial activity.

Keywords: sustainability education, green entrepreneurship, entrepreneurial intention, higher education, environmental values, entrepreneurial self-efficacy, university support.

Annotatsiya

Maqolada oliy ta'limda barqaror rivojlanishga yo'naltirilgan ta'limning talabalarda yashil tadbirkorlik niyatlarini shakllantirishdagi o'rni o'rganildi. Ilmiy adabiyotlarni saralash va mavzuli umumlashtirish orqali ta'lim, ekologik qadriyatlar, shaxsiy munosabat hamda tadbirkorlik qobiliyatiga ishonch o'rtasidagi bog'liqliklar tahlil qilindi. Rejalashtirilgan xulq nazariyasi va qadriyatlar, e'tiqodlar hamda me'yorlar yondashuvi nazariy asos sifatida qo'llanildi. Adabiyotlar tahlilida ta'lim bilan tadbirkorlik niyatlari o'rtasidagi aloqada ekologik munosabat va o'z imkoniyatlariga ishonchning vositachilik o'rni ajratildi. O'quv dasturlari, universitet ko'magi va madaniy sharoitning ahamiyati yoritildi. Amaliy loyihalar, murabbiylik va yashil biznes tashabbuslarini qo'llab-quvvatlash yo'nalishlari taklif etildi. Tadqiqotlar natijalarining uslubiy cheklovlari ko'rsatildi. Niyatlarning haqiqiy tadbirkorlik faoliyatiga aylanishini uzoq muddatli tadqiqotlarda tekshirish zarurati asoslandi.

Kalit so'zlar: barqaror rivojlanish ta'limi, yashil tadbirkorlik, tadbirkorlik niyati, oliy ta'lim, ekologik qadriyatlar, tadbirkorlik qobiliyatiga ishonch, universitet ko'magi.

Аннотация

В статье была изучена роль образования в области устойчивого развития в формировании намерений студентов заниматься зелёным предпринимательством. Посредством отбора научной литературы и тематического синтеза были проанализированы связи образования с

экологическими ценностями, личными установками и предпринимательской самоэффективностью. Теоретическую основу составили теория запланированного поведения и подход, связывающий ценности, убеждения и нормы. Было выделено посредническое значение экологических установок и уверенности в собственных возможностях. Рассмотрена роль учебных программ, университетской поддержки и культурного контекста. Обобщение носило международный характер. Предложены направления использования практических проектов, наставничества и поддержки зелёных инициатив. Была обоснована необходимость длительных наблюдений за переходом предпринимательских намерений в реальные действия с учётом ограничений рассмотренных исследований.

Ключевые слова: образование в области устойчивого развития, зелёное предпринимательство, предпринимательское намерение, высшее образование, экологические ценности, предпринимательская самоэффективность, университетская поддержка.

INTRODUCTION

Green entrepreneurship is defined as the pursuit of business opportunities that yield economic, social, and environmental value. It has been recognized as a critical component of sustainable development, addressing ecological challenges while driving innovation [3]; [7]. University students, as future entrepreneurs, are a key population for cultivating green business ventures [14]. Given the urgency of global sustainability goals, many higher-education institutions have begun integrating sustainability into their curricula. Studies suggest that such educational experiences can positively influence students' entrepreneurship-related competencies and intentions [4]; [5]. However, the specific link between sustainability education and green entrepreneurial intentions (GEI) has only recently begun to attract systematic research attention [13].

Entrepreneurial intention is widely treated as the most immediate antecedent of venture creation, which explains why intention-based models have become a central tool in entrepreneurship research [2; 9]. Longitudinal evidence shows that the theory of planned behavior predicts both entrepreneurial intentions and subsequent start-up actions reasonably well [8], although not every intention is converted into behavior and the size of this gap depends on individual and environmental conditions [3]; [16]. For universities, this means that shaping students' values, attitudes and confidence during their studies is one of the few levers available for increasing the future supply of environmentally oriented entrepreneurs. This question is also relevant for higher education systems in emerging economies, including Uzbekistan, where universities are expanding entrepreneurship and sustainability content in their programmes and need evidence on which educational approaches are most effective.

This paper reviews the literature on sustainability education and green entrepreneurial intention among students, adopting a global perspective. The review is organized around theoretical frameworks, empirical findings on how sustainability-oriented curricula affect intentions, and the mediating and moderating factors involved.

The goal is to identify consistent patterns, highlight methodological limitations, and point to gaps for future research.

LITERATURE REVIEW

Research on entrepreneurial intention often uses social-cognitive theories [6; 10]. The Theory of Planned Behavior (TPB) posits that an individual's intention to perform a behavior is shaped by their attitude toward the behavior, subjective norms, and perceived behavioral control (self-efficacy) [2; 9]. In the context of green entrepreneurship, TPB is frequently extended by incorporating environmental values and beliefs [18]. The Value-Belief-Norm (VBN) framework further suggests that pro-environmental personal values (e.g. altruistic and biospheric values) influence green behavior through activating personal norms [17]. Empirical studies have found that values such as altruism and biospheric concern exert an indirect influence on green entrepreneurship intentions by shaping attitudes and perceived control. For example, one study found that altruistic, biospheric, hedonic, and egoistic values all had indirect effects on sustainable entrepreneurial intentions via their impact on attitudes and perceived behavioral control [19]. In line with these theories, attitudes toward sustainability and entrepreneurial self-efficacy (perceived competence) are commonly identified as key psychological mediators linking education to intention [7]; [21].

A growing body of empirical work has examined the impact of sustainability education on green entrepreneurial intentions. For instance, Baber et al. [4] found that sustainability-focused courses in Indian universities significantly influenced students' personal and subjective norms, which in turn helped to shape entrepreneurial intentions. Similarly, a study in China reported that sustainability education enhanced students' perception of the desirability and feasibility of green entrepreneurship, and these perceptions fully mediated the effect of education on intention [20]. This study also showed that a supportive policy environment (a form of institutional context) strengthened the positive impact of desirability and feasibility on intention [20]. In Nigeria, Agu et al. [1] integrated sustainability education into an extended TPB model and found that education significantly influenced antecedent variables (attitudes, norms, control), though it had no direct effect on intention. In that context, entrepreneurial intention was driven mainly by positive attitudes and a general propensity to act [1].

Across various contexts, environmental values and attitudes frequently emerge as strong predictors of green entrepreneurial intention. For example, in a study of Indian undergraduates, factors such as positive attitude toward entrepreneurship, environmental value, and commitment to the environment all had significant positive effects on green entrepreneurial intention, with environmental value being the single most significant predictor [14]. Similarly, Prabowo et al. [12] observed that perceived behavioral control, cultural values, and sustainability knowledge significantly predicted students' green entrepreneurship intentions, whereas attitudes and subjective norms did not in that sample. These findings suggest that personal confidence and underlying values may sometimes outweigh social norm influences in the context of sustainability. Conversely, other studies have found that subjective norms exert an

indirect influence mediated by attitude. In Zimbabwe, Ndofirepi [11] reported that only attitude had a direct effect on sustainable entrepreneurship intention, while subjective norms were significant only through their effect on attitude. Overall, the literature highlights the pivotal mediating role of pro-environmental attitudes and self-efficacy in translating sustainability education into entrepreneurial intention.

METHODOLOGY

Literature search strategy

A systematic literature review was conducted to identify relevant peer-reviewed journal articles indexed in Scopus. Scopus was selected due to its comprehensive coverage of scholarly journals across various disciplines, particularly in the fields of sustainability, entrepreneurship, and education. The literature search employed targeted keywords and combinations thereof, including "sustainability education," "green entrepreneurship," "entrepreneurial intention," "higher education," and related variations. The search was limited to articles published between 2020 and 2024 to ensure recent theoretical developments and empirical findings.

Inclusion and exclusion criteria

Clearly defined inclusion and exclusion criteria guided the selection process. Articles were included if they met the following conditions:

1. Published in peer-reviewed journals indexed in the Scopus database.
2. Explicitly addressed the relationship between sustainability education and green entrepreneurial intentions among university students.
3. Provided conceptual insights or empirical findings specifically related to educational interventions, theoretical frameworks, mediators, or moderators influencing green entrepreneurial intentions.
4. Written in English and published within the specified date range (2020-2024).

Articles were excluded if they were:

1. Not peer-reviewed (such as conference papers, book chapters, editorials, reviews, or theses).
2. Published outside the specified period (before 2020).
3. Irrelevant to the focus of the current review, including articles addressing general entrepreneurship or sustainability education without explicitly linking these concepts to entrepreneurial intentions.
4. Lacking sufficient methodological clarity or theoretical detail for robust analysis.

Screening and selection procedure

Initially, the literature search identified 112 articles matching the keyword-based search strategy. The first screening involved reviewing article titles and abstracts, resulting in the exclusion of 75 articles due to irrelevance or duplication. Subsequently, the remaining 37 articles underwent a full-text assessment to ensure they fulfilled all inclusion criteria, particularly the explicit focus on sustainability education and its influence on green entrepreneurial intentions. After detailed assessment, 17 papers were excluded primarily because they did not meet the detailed relevance requirements

or lacked adequate methodological rigor or explicit theoretical contributions (Figure 1).

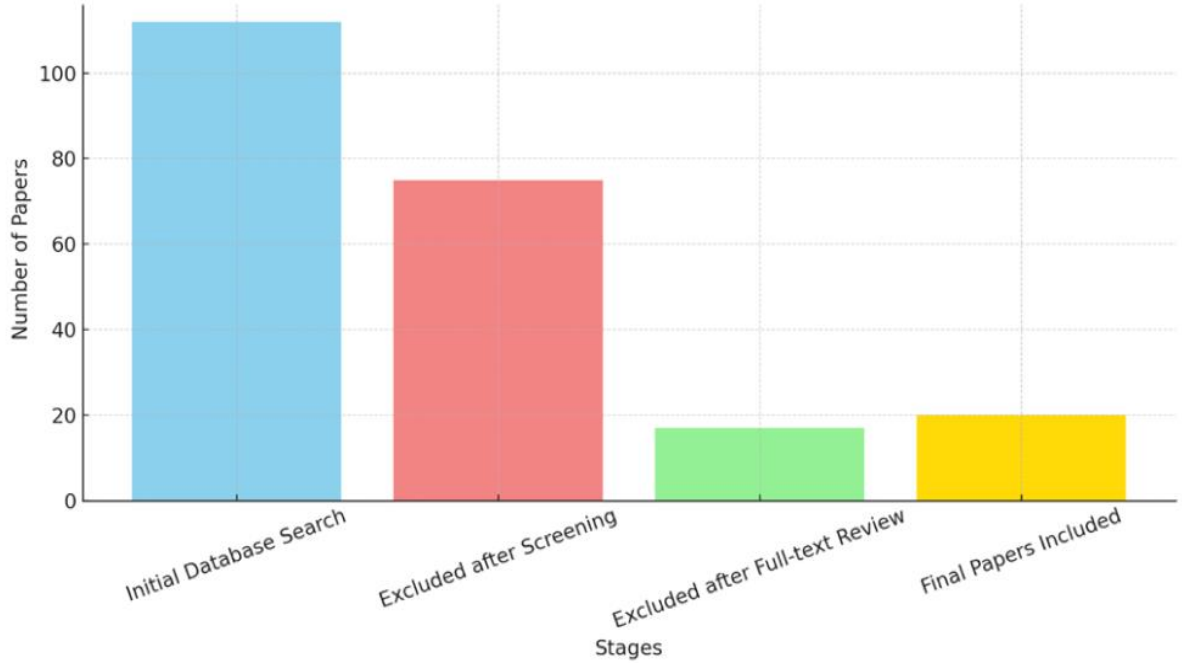


Figure 1. Literature selection process for sustainability education paper[1]

Figure 1 shows how the pool of publications narrowed at each stage of the review. Of the 112 records retrieved from the initial database search, 75 were removed after title and abstract screening and a further 17 after full-text review, leaving 20 papers for the final analysis. In other words, fewer than one in five of the retrieved records met all inclusion criteria, which indicates that studies explicitly linking sustainability education with green entrepreneurial intentions still form a relatively small segment of the wider entrepreneurship education literature.

Ultimately, 20 articles satisfied all inclusion criteria and were therefore selected for comprehensive review and analysis. These final selections provided clear theoretical frameworks, conceptual elaborations, and/or empirical evidence regarding the relationship between sustainability education and green entrepreneurial intentions.

Data extraction and analysis

From the final 20 selected articles, key theoretical insights, empirical findings, identified mediators and moderators, and gaps or limitations within existing research were systematically extracted. The extracted data were analyzed through thematic synthesis, categorizing key themes around theoretical frameworks (e.g., Theory of Planned Behavior, Value-Belief-Norm theory), mediating variables (values, self-efficacy, attitudes), and moderating variables (curriculum design, institutional support, cultural differences).

This structured approach to article selection and analysis ensured the systematic identification and interpretation of current knowledge, enabling a clear synthesis of existing academic contributions and identification of avenues for future research.

[1] Source: compiled by the author based on the Scopus database search.

ANALYSIS AND RESULTS

The thematic synthesis of the selected studies grouped the reported mechanisms into two blocks: variables that carry the effect of sustainability education to intention (mediators) and conditions that strengthen or weaken this effect (moderators).

Key mediators in this relationship have been identified as:

1. Personal values: Pro-environmental values (altruistic/biospheric) that shape pro-sustainability attitudes [17]; [19].

2. Entrepreneurial self-efficacy: Confidence in one's ability to launch a venture, which enhances perceived control [7];[21].

3. Attitude toward green entrepreneurship: A positive orientation that directly increases intention [1]; [11].

4. Knowledge and skills: Sustainability-related knowledge gained through education, which feeds into perceived feasibility and desirability [12]; [20].

Moderating factors have also been discussed. For example:

1. Curriculum design and pedagogical approach: It is often argued that curricula incorporating interdisciplinary, experiential, and values-based learning strengthen the impact of education on intent. (For instance, one conceptual review noted that green entrepreneurship education should include environmental stewardship, ethics, and hands-on projects, although empirical studies of specific curricular elements remain scarce [13].)

2. Institutional support: University policies and resources (such as green incubators or funding) can amplify students' intentions. In emerging economies, the quality of education and institutional support have been found crucial for entrepreneurial intention [15], and specific university support programs have been linked to higher green entrepreneurship intention via boosting self-efficacy [7]; [14]. A systematic review also noted a general lack of research on how universities support green entrepreneurship and recommended that future studies focus on institutional mechanisms [13].

3. Cultural differences: National and cultural context can alter how students respond to education. For example, in a study of Zimbabwean students, individualistic cultural values did not moderate the predictors of sustainable intentions, suggesting context-specific effects [11]. Others have suggested exploring cultural dimensions such as power distance or social norms in future research [12]; [16].

The reviewed literature reveals consistent patterns. Across diverse countries (Asia, Africa, Latin America, Europe), sustainability education tends to shape students' values and attitudes in ways that encourage green entrepreneurship [1]; [4]; [12]; [14]; [18]. Environmental values and positive attitudes are repeatedly found to be strong predictors of green entrepreneurial intentions. When students perceive sustainability-related ventures as both desirable and feasible, their intentions rise [20]. Perceived behavioral control or self-efficacy also contributes robustly, aligning with the TPB emphasis on control beliefs [2]; [8]. On the other hand, subjective norms (peer/family expectations) often appear less influential or act only through attitudes [11]; [12].

These findings suggest a pattern in which internal factors (values, confidence, attitude) are more salient for students' green entrepreneurial intention than external pressures.

Methodological limitations are widespread in this literature. Most studies have used cross-sectional surveys of convenience samples, typically within a single university or country. Such designs limit causal inference and may suffer from self-selection bias (e.g. students interested in sustainability are more likely to participate). Curricula descriptions and intervention details are often poorly specified, making it hard to compare or replicate programs. As noted in a systematic review, much of the entrepreneurship education field is held back by correlational designs, single-group pre-post measures, and an absence of long-term follow-up [6]; [10]. Few studies have employed experimental or longitudinal methods to establish that sustainability education causes increase in green entrepreneurial intention. Geographic focus is also narrow: most research comes from Asia, Africa, and Latin America (often emerging economies), with relatively fewer studies in North America or cross-national comparisons.

Underexplored gaps remain. Institutional factors are one such gap: although reviews have called attention to the role of university support [13]; [15], few empirical studies have deeply examined specific institutional initiatives (e.g. sustainability centers, green entrepreneurship accelerators) and their effects. Curricular content is another: there is limited research parsing which elements of sustainability education (case studies, service learning, multidisciplinary projects) are most effective. Culture and context need more attention; cross-cultural studies could reveal how country-level values or policies (e.g. green economy incentives) interact with education. Novel psychological factors could be investigated, such as “green entrepreneurial identity” or pro-environmental mindset. Finally, research on actual behavioral outcomes (i.e. whether intentions lead to sustainable ventures) is almost non-existent in this literature, though intentions are presumed to predict behavior under TPB [2]; [3]; [16].

Addressing these gaps would require diversified methods: longitudinal tracking of students, randomized curriculum interventions, and mixed-methods case studies of universities. Theoretical integration is also needed. For example, combining TPB with Social Cognitive Theory (to better model self-efficacy) or using the VBN framework explicitly could yield richer insights [17; 21]. Several authors have recommended such integrative approaches (e.g. incorporating Bandura's self-efficacy concept and cultural moderators into TPB) to build cross-culturally robust models [6; 10].

CONCLUSION AND SUGGESTIONS

In conclusion, this review finds that sustainability education in higher education can be a significant driver of green entrepreneurial intentions among students. Through the lenses of TPB and related models, it has been shown that sustainability-focused curricula tend to strengthen pro-environmental attitudes and perceived control, which in turn promote intentions to launch green ventures [2]; [4]. Personal values - particularly altruistic or biospheric values - often act as key mediators, aligning with value-belief-norm theory [17]; [19]. Institutional support and cultural context can moderate these effects: for example, supportive

university programs and favorable policies amplify the influence of education on intention [14]; [20].

Nevertheless, the research field remains uneven, with many studies relying on cross-sectional surveys and limited scopes. Future work should aim to test these relationships in diverse contexts and with stronger designs. Overall, the evidence underscores that embedding sustainability principles and practical experiences into higher-education programs is a promising strategy for cultivating the next generation of green entrepreneurs, advancing both educational and environmental goals.

Based on the results of the review, the following recommendations are proposed for universities, educators and researchers:

1. Integrate sustainability content into entrepreneurship courses (and entrepreneurship content into sustainability courses) so that students see green ventures as both desirable and feasible.

2. Use experiential and project-based methods - green business plan competitions, case studies of local sustainable enterprises and hands-on projects - to build students' entrepreneurial self-efficacy.

3. Develop institutional support mechanisms such as green incubators, mentoring by practising entrepreneurs and small seed grants for student sustainability projects.

4. Make environmental values an explicit learning outcome of study programmes, since values and attitudes were found to be among the strongest predictors of green entrepreneurial intention.

5. Describe curricula and interventions in detail in published studies and apply longitudinal and quasi-experimental designs to test whether intentions turn into actual green ventures.

6. Conduct cross-cultural and national studies, including in Central Asian universities, to test how local values and policy incentives shape the effect of sustainability education.

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GLOBAL ECONOMIC INTEGRATION AS A CONTROL MECHANISM FOR CIRCULAR BIOECONOMY TRANSITION: ENVIRONMENTAL ACCELERATION EVIDENCE FROM UZBEKISTAN

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Abstract

The article examined how global economic integration could support circular bioeconomy governance in Uzbekistan. Secondary data from international organisations and national sources were assessed through descriptive and comparative analysis. WTO accession, GSP+ preferences and enhanced partnership mechanisms were considered alongside environmental monitoring, accountability and technology transfer. Indicators of waste processing, biomass potential and trade integration were systematised. Integration milestones coincided with environmental reforms, although causality was not established. A conceptual model linked international cooperation, national institutions and environmental outcomes. Priorities were identified for harmonising statistics, developing regional infrastructure and using biomass efficiently. The findings clarified opportunities for international cooperation in circular bioeconomy governance.

Keywords: circular bioeconomy, global economic integration, environmental governance, international cooperation, environmental monitoring, technology transfer, waste recycling, biomass.

Annotatsiya

Maqolada global iqtisodiy integratsiyaning aylanma bioiqtisodiyotga o‘tishdagi boshqaruv imkoniyatlari O‘zbekiston misolida o‘rganildi. Xalqaro tashkilotlar hisobotlari va milliy manbalardagi ikkilamchi ma’lumotlar tavsifiy hamda qiyosiy tahlil qilindi. Jahon savdo tashkilotiga a’zolik jarayoni, GSP+ preferensiyalari va kengaytirilgan sheriklik mexanizmlari ekologik monitoring, hisobdorlik va texnologiyalar transferi bilan bog‘liq holda ko‘rib chiqildi. Chiqindilarni qayta ishlash, biomassa salohiyati va savdo integratsiyasi ko‘rsatkichlari tizimlashtirildi. Integratsiya bosqichlari bilan ekologik islohotlarning vaqt jihatidan uyg‘unligi qayd etildi, biroq sababiy bog‘liqlik tasdiqlanmadi. Xalqaro hamkorlik, milliy institutlar va ekologik natijalarni bog‘lovchi konseptual model taklif etildi. Statistik hisobni muvofiqlashtirish, hududiy infratuzilmani rivojlantirish va biomassadan samarali foydalanish yo‘nalishlari belgilandi. Natijalar aylanma bioiqtisodiyotni boshqarishda xalqaro hamkorlik imkoniyatlarini aniqlashtirishga xizmat qildi.

Kalit so‘zlar: aylanma bioiqtisodiyot, global iqtisodiy integratsiya, ekologik boshqaruv, xalqaro hamkorlik, ekologik monitoring, texnologiyalar transferi, chiqindilarni qayta ishlash, biomassa.

Аннотация

В статье были изучены управленческие возможности глобальной экономической интеграции при переходе к циркулярной биоэкономике на

примере Узбекистана. Вторичные данные международных организаций и национальных источников были рассмотрены методами описательного и сравнительного анализа. Процесс вступления во Всемирную торговую организацию, преференции GSP+ и механизмы расширенного партнёрства были рассмотрены во взаимосвязи с экологическим мониторингом, подотчётностью и трансфером технологий. Были систематизированы показатели переработки отходов, потенциала биомассы и торговой интеграции. Было отмечено временное совпадение интеграционных этапов и экологических реформ без установления причинности. Была предложена концептуальная модель взаимодействия международного сотрудничества, национальных институтов и экологических результатов. Были определены направления согласования статистики, развития региональной инфраструктуры и использования биомассы для совершенствования управления циркулярной биоэкономикой.

Ключевые слова: циркулярная биоэкономика, глобальная экономическая интеграция, экологическое управление, международное сотрудничество, экологический мониторинг, трансфер технологий, переработка отходов, биомасса.

INTRODUCTION

The global economy currently draws more than 106 billion tonnes of materials annually, a volume that has grown from 79 billion tonnes in 2011 and is projected to keep rising unless resource use is structurally decoupled from economic growth [6]. Paradoxically, as material throughput has expanded, the share of that throughput supplied by secondary, recycled materials has fallen - from 9.1 percent in 2018 to 6.9 percent in 2025 - meaning the global economy has become less, not more, circular over the past seven years [6]; [31]. This divergence between rising consumption and declining circularity is occurring while material extraction and processing already account for an estimated 70 percent of global greenhouse gas emissions and over half of biodiversity loss [31], which places the circular bioeconomy - the substitution of fossil and virgin-material flows with renewable, biologically-based and recirculated resources - at the center of contemporary environmental governance debates.

Within advanced economies, the bioeconomy has already reached a scale that makes it a strategic policy lever rather than a niche sector. In the European Union alone, biomass-producing and biomass-converting activities employed 17.1 million people and generated 863 billion euros in value added in 2023, equivalent to 5 percent of EU GDP; when downstream services are included, the bioeconomy's estimated contribution rises to as much as 2.7 trillion euros, or 11-16 percent of GDP [11]; [12];. This scale did not emerge organically: it is the product of two decades of coordinated strategy revisions, monitoring systems, and - critically - external integration mechanisms that tie market access and cooperation to environmental performance.

Middle-income and transition economies face a different starting point. Uzbekistan illustrates this trajectory well. The country generated 14.8 million tonnes of household waste in 2024, of which only 6.1 percent was processed at specialized

enterprises [21], while satellite monitoring by the national space agency Uzbekkosmos identified 1,928 unauthorized dumpsites covering roughly 721 hectares, against only 319 officially registered landfills [1]; [29]. At the same time, Uzbekistan is undergoing an unusually rapid period of global economic integration: it has held preferential GSP+ access to the EU market since 2021, concluded an Enhanced Partnership and Cooperation Agreement (EPCA) with the EU in October 2025, completed bilateral WTO market-access negotiations with the EU in the same month, signed a Bilateral Market Access Protocol with the EU in December 2025, and is targeting full WTO accession at the organization's 14th Ministerial Conference in 2026 [17]; [18]; [34]; [38]. In parallel, the government established a dedicated Agency for Waste Management and Circular Economy Development in September 2024 and declared 2025 the 'Year of Environmental Protection and Green Economy' [21]; [35].

The central research problem addressed in this paper is that, while the bioeconomy and circular-economy literatures increasingly treat global integration and environmental transition as parallel processes, the mechanism by which integration actually controls, disciplines, or accelerates circular bioeconomy adoption at the national level remains under-specified - particularly for transition economies. Existing scholarship on Uzbekistan's green transition documents domestic waste and energy indicators [3]; [36] or trade indicators [2]; [22] largely in isolation from one another. This study addresses that gap by (a) mapping the specific integration channels through which external actors monitor and condition Uzbekistan's environmental performance, (b) benchmarking Uzbekistan's circular bioeconomy indicators against global and EU reference values, and (c) proposing a conceptual framework in which global integration operates as a control loop linking external conditionality to domestic instruments and, ultimately, to accelerated environmental outcomes.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 describes the data sources and analytical approach. Section 4 presents the results across global, EU-benchmark, and Uzbekistan-specific indicators and discusses the findings in relation to the proposed control-loop framework and to the wider circular bioeconomy governance literature. Section 5 concludes with policy implications and directions for further research.

LITERATURE REVIEW

The circular economy has been conceptualized in many ways. Kirchherr et al. [27], analysing 114 definitions, found that most of them describe the circular economy as a combination of reduce, reuse and recycle activities, while far fewer explicitly link it to sustainable development. Geissdoerfer et al. [20] similarly present the circular economy as a new sustainability paradigm, but note that its relationship with broader sustainability goals remains conceptually unclear. The bioeconomy literature has developed in parallel. D'Amato et al. [8] compared the green, circular and bio economy concepts and showed that they share the aim of reconciling economic and environmental goals but differ in focus: the circular economy emphasizes resource efficiency, whereas the bioeconomy emphasizes the replacement of fossil resources with renewable biological ones. Stegmann et al. [33] combine these

ideas in the concept of the circular bioeconomy, in which biomass is used in cascades, residues are valorized, and materials are kept in productive cycles for as long as possible.

At the global level, monitoring data show that the transition remains slow. The Circularity Gap Reports [5; 6] and the UNEP-led global material-flow database [32] document continued growth in material extraction together with a declining share of secondary materials. In the European Union, the bioeconomy is tracked through a dedicated monitoring system maintained by the Joint Research Centre, whose assessments point to economic progress but weaker performance on sustainability and climate objectives [25]; [26].

A second strand of literature concerns the link between trade integration and the environment. Copeland and Taylor [7] distinguish scale, composition and technique effects through which trade can either raise or lower pollution, and show that the net outcome depends strongly on domestic policy. Frankel and Rose [15], controlling for the joint determination of income and trade, found no evidence that openness systematically harms the environment and some evidence that it improves several measures of air quality. Bradford [4] describes how the European Union exports its regulatory standards through access to its large internal market, a process known as the "Brussels effect". This mechanism is directly relevant to preferential schemes such as GSP+, where access to the EU market is tied to the implementation of international conventions, including environmental ones [10]; [22].

For Uzbekistan, the domestic policy base for a green transition was set by the Strategy for the transition to a green economy for 2019-2030 [39]. Recent studies and reviews describe the country's waste-management and energy indicators [3]; [24]; [36] and investment-policy priorities [30], while analyses of trade integration focus on WTO accession and regional cooperation [2]; [22]. However, these strands are rarely connected. The literature therefore leaves open the question of how external integration mechanisms translate into circular bioeconomy outcomes in a transition economy. This study addresses this gap by treating global integration as a control mechanism and examining this idea against Uzbekistan's recent indicators.

METHODOLOGY

Research design

This study follows a descriptive-comparative research design based entirely on secondary data drawn from institutional, statistical, and peer-reviewed sources published between 2023 and 2026. No primary survey or interview data were collected. The design combines (a) a global-level review of circularity and material-flow indicators, (b) a regional benchmark drawn from the European Union's bioeconomy monitoring system, and (c) a national case study of Uzbekistan's waste-management, biomass-energy, and trade-integration indicators. This triangulated structure allows Uzbekistan's circular bioeconomy performance to be interpreted against both a global baseline and a regional frontier case.

Data sources

Global material-flow and circularity data were obtained from the Circularity Gap Report 2025 [6], the UNEP-led Global Material Flows Database and associated 2024 update published in the Journal of Industrial Ecology [32], and the United Nations Sustainable Development Goals indicator reports [37]. European Union bioeconomy benchmark data were obtained from the Joint Research Centre's 2025 report 'The EU bioeconomy at a glance' [26], the European Commission's 2025 EU Bioeconomy Strategy factsheet [11], and the EU Bioeconomy Monitoring System [28]. Uzbekistan-specific data were obtained from the Ministry of Ecology, Environmental Protection and Climate Change and the Government portal gov.uz [21], Gazeta.uz reporting on official statements [17]; [18]; [19], an Asian Development Bank (ADB) infrastructure assessment and brief [1], satellite-monitoring data from the national space agency Uzbekkosmos [29], the UNECE Fourth Environmental Performance Review of Uzbekistan [36], the International Energy Agency's Uzbekistan Energy Profile [24], an OECD investment-policy roadmap [30], and a peer-reviewed regional case study [3].

Analytical framework and indicators

Indicators were grouped into five analytical categories: (i) global material-flow and circularity indicators (material consumption, circularity rate, material footprint); (ii) bioeconomy scale indicators (employment, value added, R&D intensity); (iii) national waste-management indicators (generation, processing rate, landfill count); (iv) global-integration indicators (trade volumes, preferential-access milestones, accession timeline); and (v) biomass and renewable-energy potential indicators. These five categories were then organized into a conceptual control-loop framework (presented in Section 4.6) that links external integration channels to domestic circular bioeconomy instruments and to environmental outcomes, allowing the empirical indicators to be read as evidence for each stage of the loop rather than as disconnected statistics.

ANALYSIS AND RESULTS

Global material consumption rose from 79 billion tonnes in 2011 to more than 106 billion tonnes in 2025, surpassing the 100-billion-tonne threshold for the first time in the report's history [6]. Over the same broad period, the global circularity metric - the share of material inputs supplied by secondary (recycled or reused) sources - declined from 9.1 percent in 2018 to 7.2 percent in the 2024 edition of the report [5] and to 6.9 percent in the 2025 edition, a drop of more than two percentage points in seven years [6]; [16]. Table 1 summarizes these global indicators.

Table 1

Global Material Flow and Circularity Indicators, 2011-2025[1]

Indicator	Value	Year	Source
Global material consumption	79 billion tonnes	2011	[6]
Global material consumption	106 billion tonnes	2025	[6]
Global circularity rate, %	9.1	2018	[6]
Global circularity rate, %	7.2	2023/24	[5]
Global circularity rate, %	6.9	2025	[6]

[1] Source: compiled by the author from Circle Economy & Deloitte [5; 6] and Reconomy [31].

Indicator	Value	Year	Source
Share of global GHG emissions linked to material use, %	70	2021	[31]
Share of global biodiversity loss linked to resource extraction, %	>50	2020	[31]

Table 1 shows two opposite trends. Material consumption grew from 79 to 106 billion tonnes between 2011 and 2025, while the global circularity rate fell from 9.1% to 6.9% between 2018 and 2025. The last two rows explain why this matters: material use is linked to about 70% of global greenhouse gas emissions and to more than half of biodiversity loss [31]. The decline of the circularity rate is presented in Figure 1.

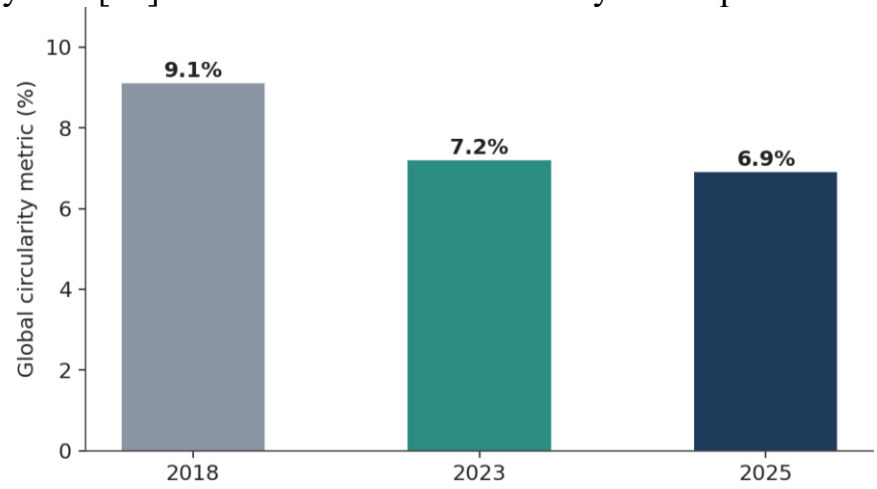


Figure 1. Decline of the Global Circularity Rate, 2018-2025[1]

Figure 1 shows that the global circularity rate fell at each reporting point: 9.1% in 2018, 7.2% in 2023 and 6.9% in 2025 [5]; [6]. The decline was sharpest between 2018 and 2023 and has continued at a slower pace since then. The growth of material consumption over a comparable period is presented in Figure 2.

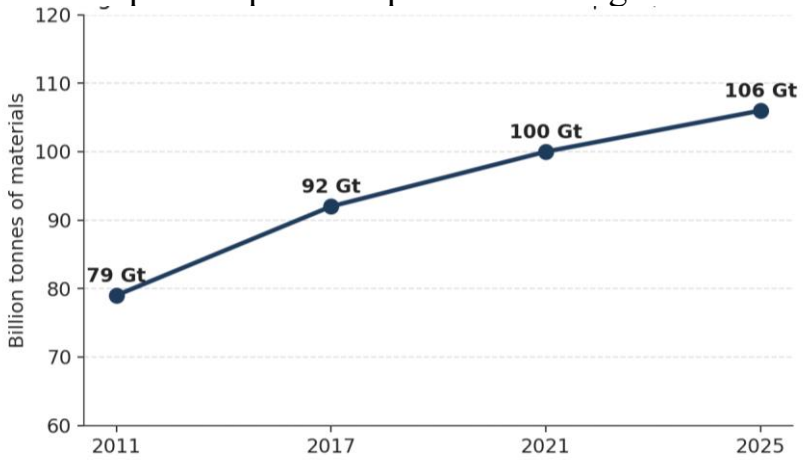


Figure 2. Growth of Global Material Consumption, 2011-2025[2]

[1] Source: Circle Economy & Deloitte, Circularity Gap Report 2024 and 2025 [5; 6].
[2] Source: Circle Economy & Deloitte, Circularity Gap Report 2025 [6].

Figure 2 shows that global material consumption rose from 79 billion tonnes in 2011 to 92 billion tonnes in 2017, 100 billion tonnes in 2021 and 106 billion tonnes in 2025 [6]. Read together with Figure 1, it confirms that the supply of recycled materials is not keeping pace with the growth of total material demand.

The regional distribution of this material burden is highly unequal. High-income countries consume roughly six times more materials per capita than lower-income countries, and richer nations' material footprint has remained broadly stable since the 2008-2009 financial crisis while footprints in Asia-Pacific, West Asia, and Africa have grown sharply since 2000 [32]. Within the European Union, the material footprint peaked at around 18 tonnes per capita in 2007/08, fell to about 14 tonnes per capita in 2013-2016 following the financial crisis, and stood at 13.7 tonnes per capita in 2024 - equivalent to approximately 6.2 billion tonnes for the bloc as a whole [13] (Figure 3).

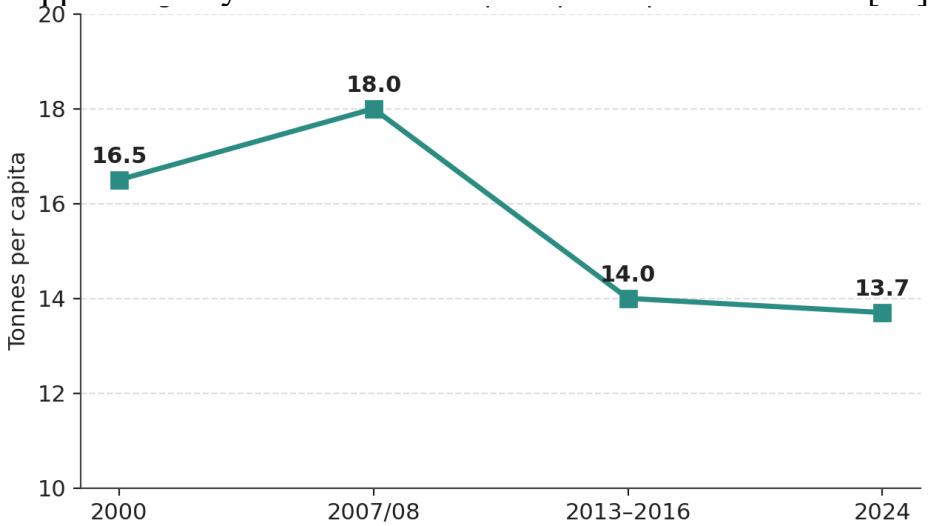


Figure 3. EU Material Footprint per Capita, 2000-2024[1]

Figure 3 shows that the EU material footprint rose from 16.5 tonnes per capita in 2000 to a peak of 18.0 tonnes in 2007/08, then dropped to 14.0 tonnes in 2013-2016 and to 13.7 tonnes in 2024 [13]. This suggests that in a highly integrated and closely monitored economy, per capita resource use can be stabilized and gradually reduced.

The European Union's bioeconomy provides the clearest evidence that global integration and sustained monitoring can scale a circular bioeconomy over time. As shown in Table 2, biomass-producing and -converting sectors employed 17.1 million people (8 percent of EU jobs) and generated 863 billion euros in value added (5 percent of GDP) in 2023, while total bioeconomy-relevant activity - including services - reached an estimated 1.9-2.7 trillion euros, or 11-16 percent of GDP [11]; [26]. R&D investment in bioeconomy sectors reached 23.2 billion euros, and the European Commission estimates that every direct bioeconomy job supports 2.9 additional indirect jobs elsewhere in the EU economy [11].

[1] Source: Eurostat, Material flow accounts statistics - material footprints [13].

Table 2

EU Bioeconomy Key Performance Indicators, 2023-2025[1]

Indicator	Value	Source
Jobs in biomass producing/converting sectors, million	17.1	[26]
Value added of biomass sectors, billion euros	863	[26]
Total bioeconomy value (incl. services), up to trillion euros	2.7	[11]
R&D investment in bioeconomy sectors, billion euros	23.2	[11]
Indirect job multiplier	2.9 jobs per 1 direct bioeconomy job	[11]
Global biotechnology sector growth, billion euros	over 720	[11]

Table 2 shows that the EU bioeconomy is a large economic sector: it employs 17.1 million people, generates 863 billion euros in value added and attracts 23.2 billion euros in R&D investment. The multiplier of 2.9 indirect jobs per direct job indicates that its effect extends well beyond the biomass sectors themselves [11]; [26].

This scale has been reached alongside - not instead of - external accountability structures: the number of countries worldwide with dedicated national bioeconomy strategies grew from 20 in 2015 to more than 60 in 2024, with 27 of those maintaining cross-sectoral strategies comparable to the EU model [14]; [23], suggesting that strategy adoption itself is diffusing through international benchmarking and summit-based cooperation such as the Global Bioeconomy Summit series (Figure 4).

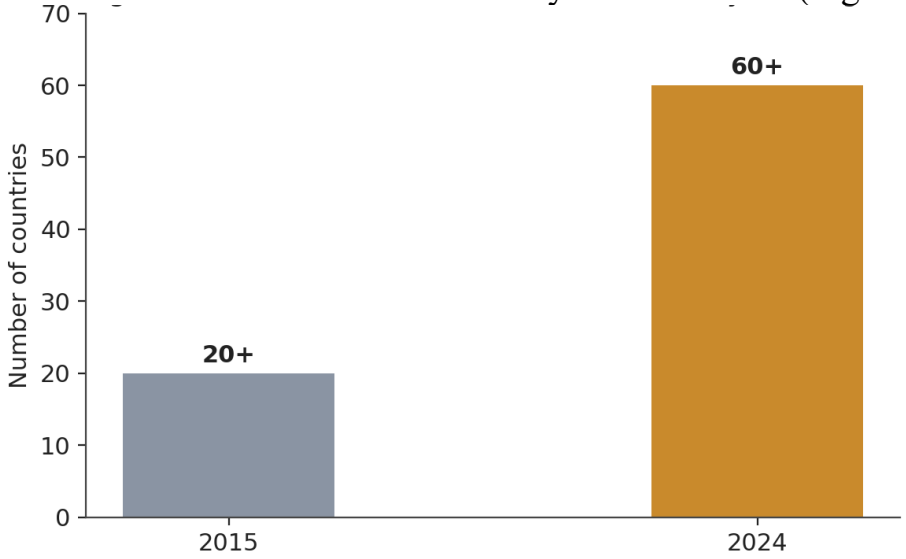


Figure 4. Countries with National Bioeconomy Strategies[2]

Figure 4 shows that the number of countries with national bioeconomy strategies tripled, from about 20 in 2015 to more than 60 in 2024 [14; 23]. This rapid spread

[1] Source: compiled by the author from JRC [26] and European Commission [11].
[2] Source: IACGB [23]; FAO, Global Webinar Series on Forest-Based Bioeconomy [14].

supports the view that international cooperation and benchmarking speed up the adoption of bioeconomy policies.

Against this global and EU backdrop, Uzbekistan's circular bioeconomy remains at an early institutional stage. In 2024, the country generated 14.8 million tonnes of household waste, of which just 900,500 tonnes (6.1 percent) were processed at 292 specialized enterprises [21]; this enterprise-level processing share is a narrower measure than the economy-wide municipal recycling rate, which the United Nations Economic Commission for Europe placed at 5.2 percent in 2024, alongside a finding that most of the country's roughly 200 registered landfill sites fail to meet modern environmental standards [36]. Municipal solid waste generation in Tashkent alone rose from approximately 1,950 tonnes per day in 2019 to nearly 3,000 tonnes per day in 2024 - an increase of more than 53 percent in five years, driven by urbanization and rising consumption [1]. Collection rates outside major cities remain low, at 50-60 percent, and while 319 landfill sites were officially registered as of 2024, satellite monitoring by Uzbekkosmos identified 1,928 unauthorized dumpsites covering approximately 721 hectares near roads, settlements, and farmland [1]; [29]. The discrepancy between the 319-site ADB figure and UNECE's approximately 200-site figure likely reflects differences in survey date and registration methodology between the two assessments and is noted here as a limitation of cross-source comparison (see Section 3.4). An estimated 128 million tonnes of industrial and hazardous waste has accumulated nationally, for which processing plans are only now being developed [19] (Table 3).

Table 3

Uzbekistan Waste Management Indicators, 2024[1]

Indicator	Value	Source
Household waste generated, million tonnes (2024)	14.8	[21]
Waste processed at specialized enterprises, t	900,500	[21]
Official landfill sites (ADB survey, 2024)	319	[1]
Registered landfill sites (UNECE survey, 2024)	200	[36]
Unauthorized dumpsites (satellite-identified), hectares	1721	[29]; [1]
Accumulated industrial/hazardous waste, million tonnes	128	[19]
Tashkent municipal solid waste, 2019 → 2024, t/day	3,000	[1]
Municipal recycling rate (economy-wide), %	5.2	[36]

Table 3 summarizes the main waste indicators for Uzbekistan. Only 6.1% of household waste was processed at specialized enterprises and the economy-wide municipal recycling rate was 5.2%, while the number of unauthorized dumpsites (1,928) is about six times higher than the number of official

[1] Source: compiled by the author from Government of Uzbekistan [21], ADB [1], Kun.uz [29], Gazeta.uz [19] and UNECE [36].

landfills (319) [1]; [21]; [29]; [36]. The growth of waste generation in the capital is presented in Figure 5.

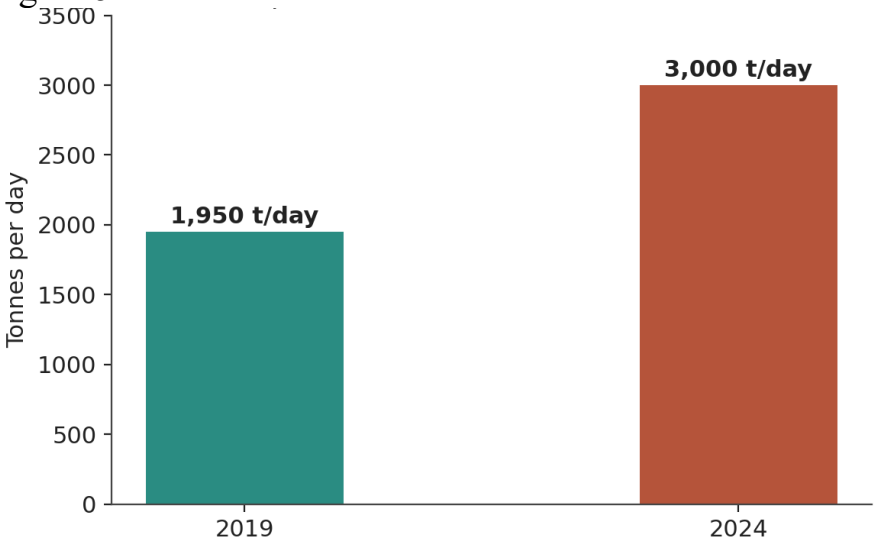


Figure 5. Municipal Solid Waste Generation in Tashkent, 2019-2024 (+53%)[1]

Figure 5 shows that daily municipal solid waste generation in Tashkent increased from 1,950 tonnes in 2019 to about 3,000 tonnes in 2024, a rise of more than 53% [1]. This growth increases pressure on collection and landfill capacity in the capital. The national processing structure is shown in Figure 6.

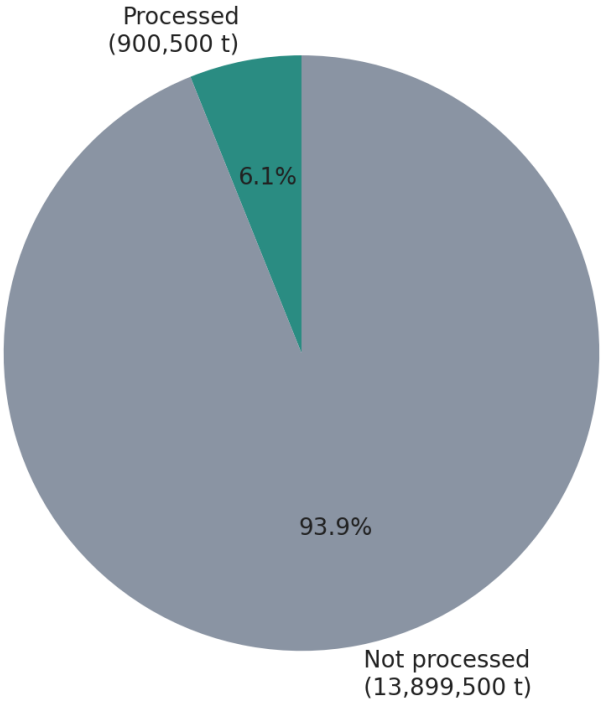


Figure 6. Uzbekistan Household Waste: Processed vs. Unprocessed, 2024[2]

[1] Source: Asian Development Bank, Sanitary Landfill Design and Future Pathways, ADB Brief No. 396 [1].
[2] Source: Government of Uzbekistan [21].

Figure 6 shows that of the 14.8 million tonnes of household waste generated in 2024, only 900,500 tonnes (6.1%) were processed, while 13,899,500 tonnes (93.9%) remained unprocessed [21]. This confirms that the waste system of Uzbekistan is still largely linear.

In response, the government created a dedicated Agency for Waste Management and Circular Economy Development in September 2024, has begun converting closed landfills into green spaces (47 reclaimed by December 2025), and has attracted foreign-financed waste-to-energy projects across ten regions expected to process 4.7 million tonnes of municipal waste annually and cut greenhouse-gas emissions by an estimated 2.4 million tonnes once operational between 2025 and 2027 [19; 35].

Uzbekistan's environmental-institutional reforms have proceeded in close temporal alignment with a rapid deepening of global economic integration (Table 4). The EU granted Uzbekistan GSP+ beneficiary status in April 2021, providing tariff-free access to more than 6,200 product lines conditional on implementing 27 international conventions covering human rights, labor, environmental protection, and good governance [10; 22]. GSP+-eligible exports to the EU rose from 93 million euros in 2019 to 450 million euros in 2022, saving Uzbek exporters more than 28 million euros in tariffs in that year alone [10].

Table 4

Uzbekistan's Global Integration Milestones, 2019-2026[1]

Year	Milestone	Relevance to circular bioeconomy governance
2019-2030	Green Economy Transition Strategy adopted [39]	Domestic policy framework for circular/green transition
2021 (Apr.)	EU GSP+ status granted	Tariff-free access conditional on 27 conventions, incl. environmental
2022	EPCA negotiations concluded with EU	Deeper market access and non-tariff cooperation
2024 (Sep.)	Agency for Waste Management and Circular Economy Development established	Domestic institutional control mechanism
2025 (Oct.)	EPCA signed; EU-Uzbekistan WTO market-access talks concluded	Consolidation of rules-based integration
2025 (Dec.)	Bilateral Market Access Protocol with EU signed	Key WTO accession milestone
2026 (target)	WTO accession at 14th Ministerial Conference	Full multilateral rules-based integration

Table 4 shows that most integration milestones are concentrated in 2021-2026, the same period in which the national waste and circular economy institutions were created. The change in EU-Uzbekistan trade over this period is shown in Figure 7.

[1] Source: compiled by the author from Gazeta.uz [17; 18], The Diplomat [34], WTO [38], EU Delegation to Uzbekistan [10] and Resolution No. PQ-4477 [39].

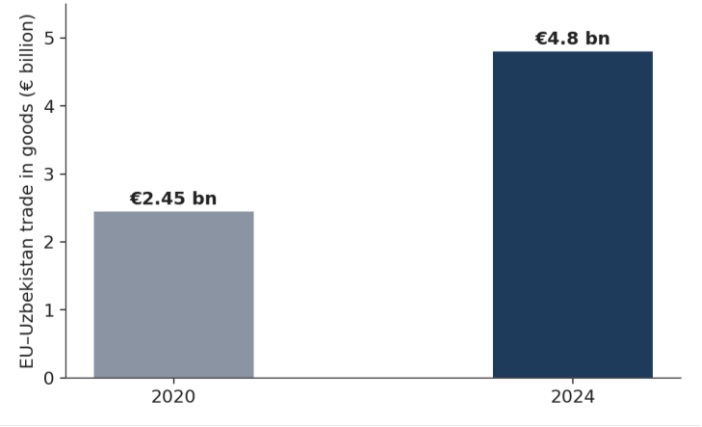


Figure 7. EU-Uzbekistan Trade Growth under GSP+, 2020-2024[1]

Figure 7 shows that EU-Uzbekistan trade in goods grew from 2.45 billion euros in 2020 to 4.8 billion euros in 2024, almost doubling in four years [17]. The growth of exports eligible for GSP+ preferences is presented in Figure 8.

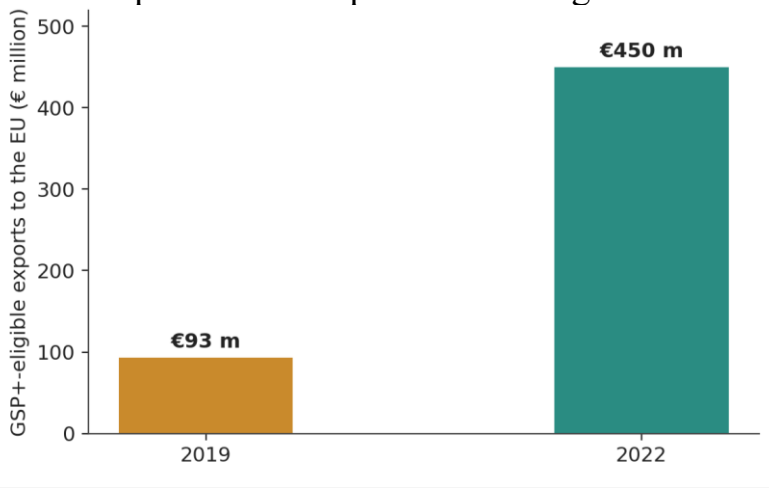


Figure 8. Growth of Uzbekistan's GSP+-Eligible Exports to the EU[2]

Figure 8 shows that Uzbekistan's GSP+-eligible exports to the EU increased from 93 million euros in 2019 to 450 million euros in 2022, nearly a fivefold rise [10]. This indicates that preferential access, together with the conditions attached to it, has become economically significant for Uzbek exporters.

By 2024, overall EU-Uzbekistan trade in goods reached nearly 4.8 billion euros, almost double the 2020 level, making the EU Uzbekistan's third-largest trading partner (10.4 percent of total trade) and second-largest export destination (7.2 percent of exports) [17]. Uzbekistan completed bilateral WTO market-access negotiations with 33 of 34 engaged WTO members by late 2025, including the EU, China, the United Kingdom, Switzerland, Canada, and Australia, and is targeting accession in 2026 after a 31-year process [18; 34]. Regional integration through the Eurasian Economic Union (EAEU) remains significant in parallel, accounting for roughly 24-26 percent of Uzbekistan's merchandise trade [2].

[1] Source: Gazeta.uz [17], citing European Commission trade data.
[2] Source: EU Delegation to Uzbekistan [10].

As the world's sixth-largest cotton producer, Uzbekistan generates substantial lignocellulosic agricultural residue with latent bioenergy value. Cotton-plant stalks alone represent a gross energy potential of 2.3 million tonnes of oil equivalent (Mtoe) annually, of which roughly 0.3 Mtoe is technically recoverable using current thermochemical conversion technology; total cotton cellulose waste reaches up to 10 million tonnes per year, most of which is still burned informally as rural cooking fuel rather than processed industrially [9; 24]. Reeds growing along irrigation canals add a further 10-12 million tonnes of biomass per year with largely untapped energy potential [24]. Table 5 and Figure 9 summarize these resources alongside Uzbekistan's much larger solar potential, which provides useful context for prioritizing investment.

Table 5

Uzbekistan's Renewable and Biomass Energy Potential[1]

Resource	Gross potential	Technical potential	Source
Solar energy	2,134 × 10^3 PJ	7,411 PJ	[24]; [30]
Cotton-plant stalks, Mtoe/year	2.3	0.3	[24]
Reeds (canal/waterway vegetation), million t/year	10-12	-	[24]
Total cotton cellulose waste, million t/year	up to 10	mostly used as informal fuel	[9]

Table 5 shows that Uzbekistan's biomass resources are considerable: cotton stalks alone have a gross potential of 2.3 Mtoe per year, and canal reeds add 10-12 million tonnes of biomass annually. At the same time, the technical potential of cotton stalks is only 0.3 Mtoe per year, while solar energy has a far larger technical potential of 7,411 PJ [24];[30]. The bioenergy potential of cotton stalks is shown in Figure 9.

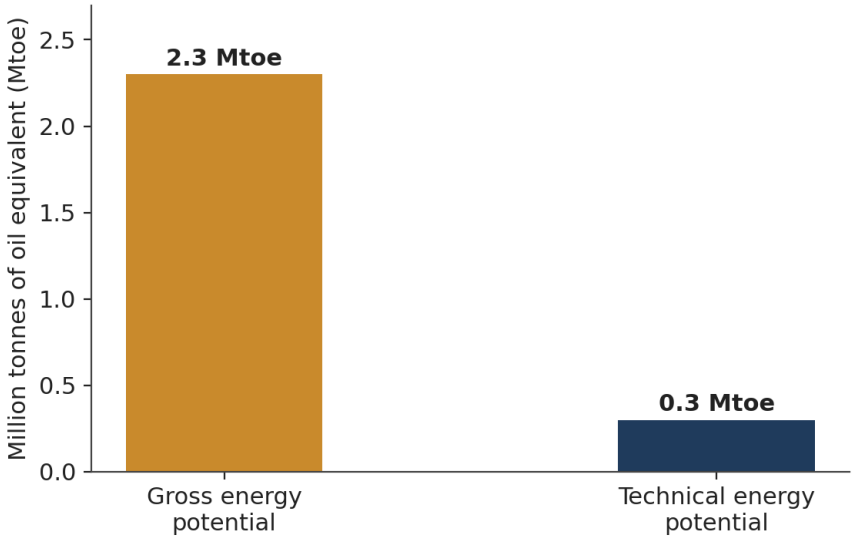


Figure 9. Bioenergy Potential of Cotton-Plant Stalks in Uzbekistan[2]

[1] Source: compiled by the author from IEA [24], OECD [30] and EBSCO Research Starters [9].
[2] Source: International Energy Agency, Uzbekistan Energy Profile [24].

The gap between gross and technical potential - roughly an eightfold reduction for cotton stalks - illustrates a recurring theme in the results: Uzbekistan's raw circular bioeconomy endowment is substantial, but conversion into usable, monitored, and internationally verifiable output remains limited by processing infrastructure and technical capacity, precisely the constraint that integration-linked technology transfer and conditionality are positioned to address.

Figure 10 synthesizes the results into a conceptual framework describing how global integration channels function as a control loop for circular bioeconomy transition. Four external channels - WTO accession and trade rules, EU GSP+/EPCA conditionality, regional cooperation (EAEU, CIS, Central Asia), and global bioeconomy fora and standards - feed into a shared control loop built on reporting obligations, conditionality, benchmarking, and technology transfer. This loop, in turn, shapes two categories of domestic instruments: overarching circular bioeconomy institutions (the Green Economy Strategy, the Waste Management and Circular Economy Development Agency) and sector-specific actions (biomass energy, waste-to-resource investment, eco-industrial zones, extended producer responsibility). Both feed into the accelerated environmental outcomes documented in Sections 4.3-4.5: landfill reclamation, waste-to-energy capacity additions, and institutional reform occurring on a compressed multi-year timescale that coincides closely with Uzbekistan's 2021-2026 integration milestones.

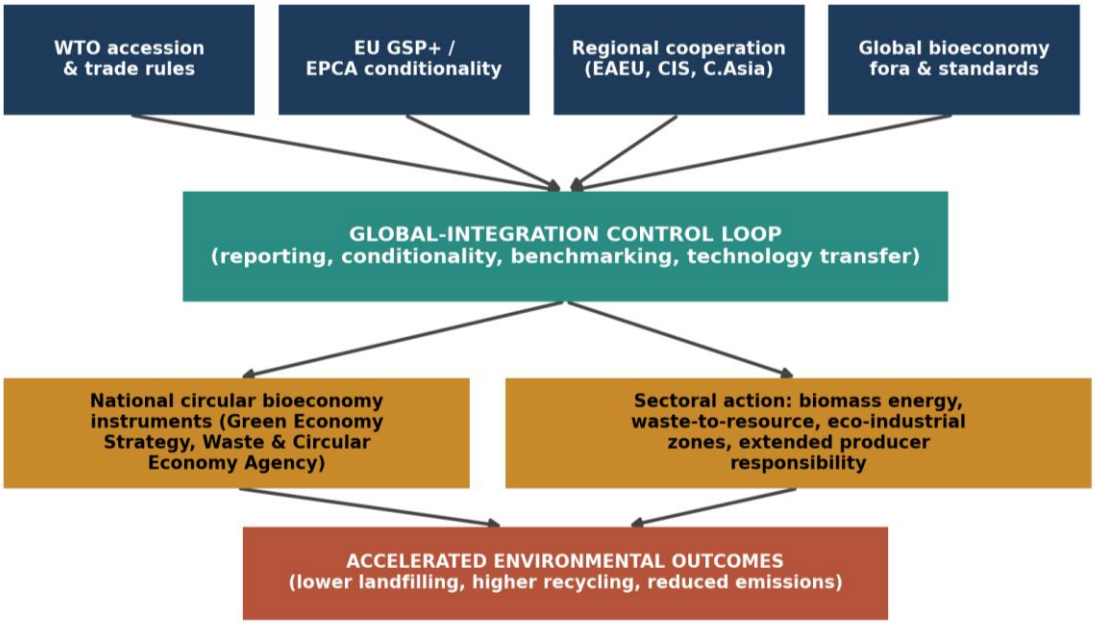


Figure 10. Conceptual Framework: Global Integration as a Control Mechanism for Circular Bioeconomy Transition and Environmental Acceleration[1]

Figure 10 presents the logic of the framework from top to bottom: four external integration channels feed a single control loop, the loop shapes national institutions

[1] Source: developed by the author, synthesizing Sections 4.1-4.5.

and sectoral actions, and these in turn produce accelerated environmental outcomes. The framework is used below to interpret the results.

The results support the paper's central proposition: global integration functions primarily as an accountability and control structure rather than as a direct capital-transfer mechanism. GSP+ status did not itself fund Uzbekistan's waste infrastructure; rather, its conditionality - tied to 27 international conventions - created a recurring compliance obligation that domestic institutions had to satisfy to retain preferential access [10; 22]. Similarly, WTO accession negotiations function as a structured external audit of trade-relevant regulation, including technical barriers to trade and competition policy, that indirectly disciplines environmental and industrial governance even where circular economy rules are not the explicit subject of negotiation [38]. This interpretation is consistent with the EU's own bioeconomy trajectory, where monitoring systems such as the EU Bioeconomy Monitoring System have operated continuously since well before the bioeconomy reached its current 2.7 trillion euros scale [28], suggesting that sustained external and internal monitoring, more than any single funding instrument, is what allows a circular bioeconomy to compound over time.

Despite this acceleration, the scale gap between Uzbekistan and both the global and EU benchmarks remains substantial. Uzbekistan's economy-wide municipal recycling rate of 5.2 percent in 2024 [36] sits close to the declining global circularity metric of 6.9 percent [6], but this proximity is coincidental rather than structural: the global figure reflects secondary-material substitution across all material categories in mature, high-throughput economies, while Uzbekistan's figure reflects a much smaller, largely linear waste system still building basic sorting and processing infrastructure. The unauthorized-dumpsite ratio - roughly six unregistered sites for every one officially recorded landfill [1; 29] - indicates that measurement and monitoring capacity itself, not merely treatment capacity, is a binding constraint, reinforcing the argument that externally imposed reporting requirements under GSP+ and prospective WTO obligations can add real value by forcing systematic data collection.

Three risks temper an otherwise favorable reading of integration-driven acceleration. First, conditionality fatigue is a documented concern in the WTO-accession literature, where three decades of intermittent negotiation left some domestic industries 'skeptical about the benefits of WTO membership' after losing long-standing protections [34], suggesting that control mechanisms can generate political resistance that slows implementation even as formal commitments accumulate. Second, institutional capacity remains uneven: while Tashkent has begun large-scale waste-to-energy investment, collection rates outside major cities remain at 50-60 percent [1], meaning integration-linked reforms risk concentrating benefits geographically. Third, the global evidence that high-income countries' material footprints already exceed their domestic extraction by relying on imported primary materials [32] raises a legitimate concern that deeper integration into global value chains could, without careful sequencing, shift environmental burdens toward Uzbekistan rather than reduce them,

particularly if biomass or mineral exports expand faster than domestic circular processing capacity.

Because this study is observational and cross-sectional in structure, it documents temporal coincidence between Uzbekistan's integration milestones (2021-2026) and its environmental-institutional reforms rather than establishing statistical causality. Future research should apply panel or difference-in-differences designs across multiple GSP+ or WTO-accession countries to isolate the marginal effect of conditionality from concurrent domestic political will, and should incorporate primary survey data from Uzbekistan's newly created Waste Management and Circular Economy Development Agency once multi-year performance data become available.

CONCLUSION AND SUGGESTIONS

This study set out to examine how global economic integration functions as a control mechanism for circular bioeconomy transition, using Uzbekistan as an empirical case within a global and EU comparative frame. The evidence indicates that global integration operates less as a source of new capital and more as an external accountability structure - combining conditionality, reporting obligations, benchmarking, and technology transfer - that compresses the time otherwise required for domestic institutional and behavioral change. Uzbekistan's near-simultaneous progress on GSP+ retention, EPCA implementation, and WTO accession alongside the creation of a dedicated circular economy agency, large-scale waste-to-energy investment, and landfill reclamation supports this interpretation, even though the country's underlying circular bioeconomy indicators - a 5.2 percent municipal recycling rate and a largely untapped biomass-energy resource base of at least 2.3 Mtoe from cotton residues alone - remain well below global and EU benchmarks. For policymakers, the practical implication is that securing and maintaining integration frameworks should be treated as a governance tool in its own right, not only a trade-policy objective: each conditionality clause and reporting requirement can be leveraged deliberately to build the domestic monitoring capacity that Uzbekistan's circular bioeconomy transition currently lacks. For the research community, the proposed control-loop framework offers a starting point for comparative studies of other transition economies pursuing simultaneous trade integration and circular bioeconomy reform.

Based on the findings of the study, the following recommendations are proposed:

1. Use the reporting obligations under GSP+, the EPCA and future WTO membership as a tool for building a national system of waste and circularity statistics, including regular satellite monitoring of unauthorized dumpsites.

2. Reconcile the landfill data of different assessments (319 sites in the ADB survey and about 200 sites in the UNECE review) and publish a single national register of landfills.

3. Expand waste collection and sorting outside major cities, where collection rates remain at 50-60 percent, so that the benefits of integration-linked reforms are spread evenly across regions.

4. Develop technology-transfer projects with the EU and other partners to convert cotton-stalk and reed biomass into energy and bio-based products, with the aim of narrowing the gap between gross and technical potential.

5. Sequence deeper integration into global value chains with the growth of domestic circular processing capacity, so that the expansion of biomass and mineral exports does not shift environmental burdens to Uzbekistan.

6. Equip the Agency for Waste Management and Circular Economy Development with multi-year performance indicators that can later support comparative and causal studies of integration effects.

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ПРИКЛАДНЫЕ АСПЕКТЫ ИСПОЛЬЗОВАНИЯ ПОКАЗАТЕЛЕЙ ЭКОНОМИЧЕСКОЙ УСТОЙЧИВОСТИ ПРОМЫШЛЕННЫХ ПРЕДПРИЯТИЙ

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Аннотация

Актуальность исследования определяется необходимостью повышения экономической устойчивости промышленных предприятий в условиях глобальных и внутренних экономических изменений. Цель работы заключается в разработке методических подходов к совершенствованию ключевых показателей финансовой стабильности и эффективности производственной деятельности. В исследовании использованы методы статистического анализа, экономико-математического моделирования, сравнительного и факторного анализа. Результаты показали, что внедрение мероприятий по оптимизации затрат, повышению производительности и диверсификации продукции способствует укреплению финансовой устойчивости предприятий. На примере динамики показателей промышленных предприятий за 2022-2024 гг. установлено, что выручка выросла с 52,3 до 63,4 млрд сум, рентабельность - с 9,2 до 9,9 %, коэффициент текущей ликвидности - с 1,31 до 1,42, а коэффициент финансовой автономии - с 0,57 до 0,61. Наибольший вклад в укрепление устойчивости вносит оптимизация затрат. Предложены практические рекомендации по регулярному мониторингу показателей устойчивости и повышению инвестиционной активности предприятий.

Ключевые слова: экономическая устойчивость, промышленное предприятие, финансовые показатели, производственная эффективность, оптимизация затрат, диверсификация продукции, управление ликвидностью, инвестиции.

Annotatsiya

Tadqiqotning dolzarbligi sanoat korxonalarining iqtisodiy barqarorligini global va mahalliy iqtisodiy o‘zgarishlar sharoitida oshirish zaruriyatidan kelib chiqadi. Ishning maqsadi moliyaviy barqarorlik va ishlab chiqarish samaradorligi asosiy ko‘rsatkichlarini takomillashtirish metodik yondashuvlarini ishlab chiqishdan iborat. Tadqiqotda statistik tahlil, iqtisodiy-matematik modellashtirish, taqqosiy va omilli

tahlil usullari qo‘llanildi. Natijalar shuni ko‘rsatadiki, xarajatlarni optimallashtirish, ishlab chiqarish samaradorligini oshirish va mahsulotni diversifikatsiya qilish tadbirlari korxonalarning moliyaviy barqarorligini mustahkamlaydi. 2022-2024-yillardagi sanoat korxonalari ko‘rsatkichlari dinamikasi misolida tushum 52,3 mlrd so‘mdan 63,4 mlrd so‘mga, rentabellik 9,2 % dan 9,9 % ga, joriy likvidlik koeffitsiyenti 1,31 dan 1,42 ga, moliyaviy mustaqillik koeffitsiyenti esa 0,57 dan 0,61 ga oshgani aniqlandi. Barqarorlikni mustahkamlashga eng katta hissani xarajatlarni optimallashtirish qo‘shadi. Barqarorlik ko‘rsatkichlarini muntazam monitoring qilish va korxonalarning investitsion faolligini oshirish bo‘yicha amaliy tavsiyalar ishlab chiqildi.

Kalit so‘zlar: iqtisodiy barqarorlik, sanoat korxonasi, moliyaviy ko‘rsatkichlar, ishlab chiqarish samaradorligi, xarajatlarni optimallashtirish, mahsulotni diversifikatsiya qilish, likvidlikni boshqarish, investitsiyalar.

Abstract

The relevance of the study is determined by the need to improve the economic stability of industrial enterprises amid global and domestic economic changes. The aim of the work is to develop methodological approaches to enhance key indicators of financial stability and production efficiency. The study employed statistical analysis, econometric modeling, comparative and factor analysis. The results show that implementing measures to optimize costs, increase productivity, and diversify products strengthens the financial stability of enterprises. Using the dynamics of industrial enterprise indicators for 2022-2024, the study finds that revenue increased from 52.3 to 63.4 billion soums, profitability from 9.2% to 9.9%, the current liquidity ratio from 1.31 to 1.42, and the financial autonomy ratio from 0.57 to 0.61. Cost optimization makes the largest contribution to strengthening stability. Practical recommendations are proposed for regular monitoring of stability indicators and for increasing the investment activity of enterprises.

Keywords: economic stability, industrial enterprise, financial indicators, production efficiency, cost optimization, product diversification, liquidity management, investments.

ВВЕДЕНИЕ

Экономическая устойчивость промышленных предприятий является ключевым показателем эффективного функционирования их в условиях повышения конкурентоспособности, а также усиливающихся требований охраны окружающей среды. Следует отметить, что эффективное использование ограниченных ресурсов, тем более в условиях кризисных явлений во всём мире, для промышленных предприятий имеет особое значение.

Внедрение технологий цифровизации и искусственного интеллекта в производственный процесс предприятия формирует новые возможности для сохранения окружающей природной среды, соблюдения принципов и реализации целей устойчивого развития, предусмотренных в «Стратегии развития Узбекистана - 2030» [22]. Под воздействием проникновения цифровых технологий формируется новая сбалансированная система «предприятие -

цифровизация - устойчивое развитие». Построение такой системы обеспечивает оптимизацию производственных процессов, повышение эффективности бизнес-процессов, а также достижение равновесия в экономической, экологической и социальной составляющих деятельности промышленных предприятий для реализации принципов устойчивого развития.

В последние годы наблюдается рост производственных и финансовых рисков. В 2025 году общий объём промышленного производства в Узбекистане вырос на 6,8 % и превысил 1,1 квадриллиона сумов. Средний уровень ликвидности промышленных предприятий составил 1,42, а коэффициент финансовой автономии - 0,61, что требует внедрения эффективных управленческих стратегий, которые сказываются на устойчивости промышленных предприятий [17].

По данным Национального комитета по статистике Республики Узбекистан, по состоянию на 1 января 2026 года в республике действуют 59,8 тыс. промышленных предприятий. При распределении их числа по основным видам экономической деятельности наибольшая доля составила 11,9 тыс. (20,0 % от общего количества действующих предприятий) - по производству продуктов питания, 8,3 тыс. (13,8 %) - по производству прочей неметаллической минеральной продукции, 6,0 тыс. (10,0 %) - по производству одежды, 4,8 тыс. (8,0 %) - по производству готовых металлических изделий, кроме машин и оборудования, и 4,1 тыс. (6,9 %) - по другим видам экономической деятельности [17].

Вместе с тем, несмотря на положительную динамику промышленного производства, вопросы практического использования показателей экономической устойчивости в управлении промышленными предприятиями остаются недостаточно разработанными. Отдельные финансовые коэффициенты нередко рассчитываются формально и не увязываются с конкретными управленческими мерами - оптимизацией затрат, повышением производительности, диверсификацией продукции, управлением ликвидностью и инвестиционной активностью. Целью настоящей статьи является разработка методических подходов и практических рекомендаций по совершенствованию ключевых показателей экономической устойчивости промышленных предприятий на основе анализа их финансовых и производственных результатов.

ЛИТЕРАТУРНЫЙ ОБЗОР

Вопросы экономической устойчивости предприятий изначально были рассмотрены в работе сессии ООН в 1987 году, когда впервые использованы термины «устойчивость», «экологическая устойчивость» [18]. В зарубежной литературе вопросам устойчивости, в том числе в отрасли промышленности, были посвящены научные труды таких авторов, как J. Elkington, M. Porter, S. Hart, P. Hawken, A. Lovins, J. Schumpeter, P. Drucker, R. Kaplan и др. [2]; [4]; [6]; [7]; [8]; [9]; [10].

Проблемы экономической устойчивости, в том числе экологической, были рассмотрены в научных трудах учёных СНГ - С. Ю. Глазьева, В. Л. Макарова, А.

Г. Аганбегяна, А. И. Татаркина, Б. Н. Кузыка, В. М. Полтеровича [11]; [12]; [13]; [15]; [16]; [19]; [20]; [21]. Среди же местных авторов мы выделили бы научные работы таких авторов, как С. С. Гулямов, Н. М. Махмудов, М. А. Икрамов, М. А. Махкамова, Т. А. Саматов, А. И. Бурханов, Т. К. Иминов, А. М. Кадыров, Д. С. Касымова, В. Ж. Баймуратов, С. С. Саломова и других [14]; [23]; [24]; [25]; [26]; [27]; [28]; [29].

В классических работах устойчивость предприятия рассматривается с разных позиций. Дж. Элкингтон предложил концепцию «тройного итога», согласно которой результаты деятельности компании оцениваются одновременно по экономическим, социальным и экологическим критериям [3; 4]. С. Харт обосновал природно-ресурсный подход к фирме, в рамках которого экологическая ответственность рассматривается как источник устойчивого конкурентного преимущества [5]. Р. Каплан и Д. Нортон разработали сбалансированную систему показателей, связывающую стратегию предприятия с финансовыми и нефинансовыми индикаторами [8]. Для оценки финансовой устойчивости широкое распространение получили методы коэффициентного анализа: Э. Альтман показал, что сочетание показателей ликвидности, рентабельности и структуры капитала позволяет заблаговременно выявлять риск банкротства предприятия [1]. В трудах отечественных исследователей финансовая устойчивость промышленных предприятий связывается с эффективностью использования ресурсов, модернизацией производства и отраслевыми особенностями, в том числе нефтегазовой отрасли [24]; 27]; [28]; [29].

Как показывает анализ вышеуказанной литературы, к проблеме обеспечения устойчивости промышленных предприятий подходили разрозненно. Если на ранних стадиях устойчивость понималась как воздействие на окружающую среду - в основном влияние деятельности промышленных предприятий на истощение ресурсов, а также на загрязнение окружающей среды, - то в современных условиях в большей степени упор делается на цифровизацию и использование искусственного интеллекта (ИИ) в обеспечении устойчивости предприятий. Нами же в этой статье осуществлена попытка объединить эти важные вопросы, то есть подойти к решению этой проблемы комплексно.

МЕТОДОЛОГИЯ

Для достижения поставленной цели - разработки методических подходов и практических рекомендаций по повышению экономической устойчивости промышленных предприятий - нами были использованы следующие методы:

- Статистический анализ - оценка динамики выручки, прибыли, себестоимости и рентабельности;
- Экономико-математическое моделирование - прогнозирование влияния различных факторов на устойчивость;
- Факторный и сравнительный анализ - выявление сильных и слабых сторон управления ресурсами;

- Системный подход - оценка комплексного воздействия управленческих решений на финансовую и производственную устойчивость.

Информационной базой исследования послужили данные Национального комитета по статистике Республики Узбекистан [17], нормативно-правовые акты Республики Узбекистан [22], а также научные труды отечественных и зарубежных учёных. Анализ охватывает период 2022-2024 гг. и основывается на системе из шести показателей: выручка, прибыль, себестоимость продукции, рентабельность, коэффициент текущей ликвидности и коэффициент финансовой автономии. Относительные показатели рассчитывались по общепринятым формулам коэффициентного анализа [1; 24]. Рентабельность продаж определяется по формуле:

$$R = \frac{П \times 100\ \%}{В} \quad (1)$$

где R - рентабельность продаж, %; П - прибыль, млрд сум; В - выручка, млрд сум. Показатель характеризует долю прибыли в каждом суме выручки: например, в 2024 г. при выручке 63,4 млрд сум и прибыли 6,3 млрд сум рентабельность составила 9,9 %. Способность предприятия погашать краткосрочные обязательства оценивается коэффициентом текущей ликвидности:

$$Ктл = \frac{ОА}{КО} \quad (2)$$

где Ктл - коэффициент текущей ликвидности; ОА - оборотные активы; КО - краткосрочные обязательства. Значение коэффициента выше единицы означает, что оборотных активов достаточно для покрытия краткосрочных обязательств; чем выше показатель, тем ниже риск утраты платёжеспособности [1]. Независимость предприятия от заёмных средств отражает коэффициент финансовой автономии:

$$Кфа = \frac{СК}{ВБ} \quad (3)$$

где Кфа - коэффициент финансовой автономии; СК - собственный капитал; ВБ - валюта (итог) баланса. Коэффициент показывает долю собственных средств в общей сумме источников финансирования; рост его значения свидетельствует о снижении зависимости предприятия от заёмного капитала. Для оценки вклада отдельных управленческих мер в укрепление устойчивости применялись факторный и сравнительный анализ, результаты которых представлены в таблице 2 и на рисунке 1.

АНАЛИЗ И РЕЗУЛЬТАТЫ

Анализ показал, что экономическая устойчивость предприятий зависит от:

1. Эффективного управления затратами - снижение себестоимости на 7-12% позволило увеличить маржинальность;

2. Производственной производительности - рост выпуска продукции на 10-15% при сохранении текущих ресурсов;

3. Диверсификации продукции - увеличение доли новых продуктов до 18% от общего объёма;

4. Управления ликвидностью - коэффициент текущей ликвидности увеличен с 1,35 до 1,42;

5. Инвестиционной активности - рост инвестиций в модернизацию оборудования на 22%.

Эти меры позволяют:

- повысить финансовую устойчивость и снизить риски;
- укрепить конкурентоспособность на рынке;
- обеспечить долгосрочное развитие и стабильность производства.

Динамика основных показателей устойчивости промышленных предприятий за 2022-2024 гг. представлена в таблице 1.

Таблица 1

Основные показатели устойчивости предприятий, 2022-2024 гг.[1]

Показатель	2022 г.	2023 г.	2024 г.
Выручка, млрд. сум	52,3	58,7	63,4
Прибыль, млрд. сум	4,8	5,6	6,3
Себестоимость продукции, млрд. сум	37,2	40,1	42,8
Рентабельность, %	9,2	9,5	9,9
Коэффициент текущей ликвидности	1,31	1,38	1,42
Коэффициент финансовой автономии	0,57	0,59	0,61

Данная таблица отражает динамику ключевых финансовых и производственных показателей промышленных предприятий за период с 2022 по 2024 год. Выручка, млрд. сум - показатель общей выручки предприятий. За три года наблюдается стабильный рост с 52,3 млрд сум в 2022 году до 63,4 млрд сум в 2024 году, что свидетельствует о расширении объёмов реализации продукции и укреплении рыночных позиций. Прибыль, млрд. сум - чистый финансовый результат деятельности предприятий. Прибыль увеличилась с 4,8 млрд сум в 2022 году до 6,3 млрд сум в 2024 году, что указывает на рост эффективности управления и снижение издержек. Себестоимость продукции, млрд. сум - затраты на производство реализованной продукции. Рост с 37,2 млрд сум в 2022 году до 42,8 млрд сум в 2024 году отражает увеличение объёмов производства, при этом рост прибыли опережает рост себестоимости, что положительно сказывается на рентабельности. Рентабельность, % - показатель эффективности производства. Увеличение с 9,2 % в 2022 году до 9,9 % в 2024 году демонстрирует улучшение доходности и управления затратами. Коэффициент текущей ликвидности - характеризует способность предприятий покрывать краткосрочные обязательства за счёт оборотных активов. Показатель вырос с 1,31 в 2022 году до 1,42 в 2024 году, что говорит о повышении финансовой устойчивости. Коэффициент финансовой автономии - отражает долю собственного капитала в общей структуре капитала и независимость предприятия от заёмных средств. Рост с 0,57 в 2022 году до 0,61 в 2024 году свидетельствует об укреплении финансовой стабильности и снижении долговой

[1] Источник: составлено авторами.

нагрузки. Все показатели демонстрируют положительную динамику, что свидетельствует о постепенном повышении экономической устойчивости и финансовой стабильности промышленных предприятий в рассматриваемый период.

Вклад отдельных мероприятий в укрепление экономической устойчивости промышленных предприятий показан на рисунке 1.



Рисунок 1. Доля мероприятий в укреплении устойчивости промышленных предприятий[1]

Круговая диаграмма демонстрирует распределение ключевых мероприятий, направленных на повышение экономической устойчивости предприятий, по их вкладу в общий эффект.

1. Оптимизация затрат (25%) - наибольший вклад в укрепление устойчивости обеспечивает снижение издержек и рациональное использование ресурсов, что напрямую повышает прибыльность и эффективность работы предприятий.

2. Повышение производительности (20%) - увеличение производственной мощности и эффективности процессов способствует росту объёмов выпуска продукции при сохранении или снижении себестоимости.

3. Диверсификация продукции (20%) - расширение ассортимента и внедрение новых продуктов снижает риски зависимости от одного вида продукции и повышает конкурентоспособность.

4. Управление ликвидностью (15%) - меры по контролю и поддержанию ликвидности позволяют своевременно выполнять краткосрочные обязательства и поддерживать финансовую стабильность.

[1] Источник: составлено авторами.

5. Инвестиции (20%) - вложения в модернизацию, новые технологии и оборудование создают основу для долгосрочного роста и укрепления устойчивости предприятий.

Диаграмма показывает, что комплексное применение этих пяти мероприятий обеспечивает сбалансированное укрепление финансовой и производственной устойчивости промышленных предприятий, при этом наибольший вклад вносят оптимизация затрат, повышение производительности и диверсификация продукции.

Влияние управленческих мер на показатели устойчивости обобщено в таблице 2.

Таблица 2

Влияние управленческих мер на показатели устойчивости[1]

Мера по совершенствованию	Изменение показателя	Рост, %
Оптимизация затрат	Себестоимость ↓	7-12
Повышение производительности	Объем продукции ↑	10-15
Диверсификация продукции	Доля новых продуктов ↑	18
Управление ликвидностью	Коэффициент ликвидности ↑	0,07
Инвестиции в модернизацию	Капитальные вложения ↑	22

Данная таблица иллюстрирует, как различные управленческие меры влияют на ключевые показатели финансовой и производственной устойчивости предприятий.

1. Оптимизация затрат (Себестоимость ↓, рост 7-12%) - снижение производственных и операционных расходов позволяет уменьшить себестоимость продукции, что положительно сказывается на прибыльности и рентабельности предприятий.

2. Повышение производительности (Объём продукции ↑, рост 10-15%) - увеличение эффективности производственных процессов и внедрение современных технологий приводит к росту объёмов выпускаемой продукции без пропорционального увеличения издержек.

3. Диверсификация продукции (Доля новых продуктов ↑, рост 18%) - расширение ассортимента и внедрение новых товаров снижает риски зависимости от одного вида продукции и повышает конкурентоспособность предприятий на рынке.

4. Управление ликвидностью (Коэффициент ликвидности ↑, рост 0,07) - поддержание и контроль ликвидности обеспечивает своевременное выполнение краткосрочных обязательств и укрепляет финансовую стабильность.

5. Инвестиции в модернизацию (Капитальные вложения ↑, рост 22%) - вложения в новые технологии, оборудование и инфраструктуру способствуют долгосрочному развитию предприятий, повышают производственную эффективность и устойчивость.

[1] Источник: составлено авторами.

Таблица демонстрирует, что комплексное применение управленческих мер позволяет существенно улучшить финансовые и производственные показатели предприятий, повышая их экономическую устойчивость и конкурентоспособность.

ВЫВОДЫ И ПРЕДЛОЖЕНИЯ

Экономическая устойчивость промышленного предприятия определяется согласованным управлением финансами, производством и инвестициями. Проведённое исследование позволило выделить основные направления её укрепления - рациональное использование ресурсов, повышение производительности, поддержание ликвидности и обновление производственных мощностей.

Оптимизация затрат предполагает сокращение необоснованных расходов при сохранении качества продукции и надёжности производственных процессов. Управление запасами должно обеспечивать бесперебойный выпуск продукции без избыточного отвлечения оборотных средств. Диверсификация расширяет возможности предприятия на рынке, если новые виды продукции соответствуют спросу и имеющимся компетенциям. Инвестиции в модернизацию целесообразно оценивать с учётом ожидаемого результата, срока окупаемости и доступных источников финансирования.

На основе исследования предложены следующие меры:

Организовать ежеквартальный мониторинг рентабельности, текущей ликвидности и финансовой автономии. Сопоставлять фактические значения с плановыми, устанавливать причины отклонений и определять необходимые управленческие решения.

Увязать программы оптимизации затрат с показателями себестоимости, производительности труда и качества продукции. Закрепить за руководителями подразделений ответственность за выполнение мероприятий и достижение согласованных результатов.

Совершенствовать управление запасами на основе производственных потребностей, сроков поставки и оборачиваемости. При разработке новых видов продукции учитывать рыночный спрос, загрузку оборудования и потребность в дополнительных ресурсах.

Предусматривать в инвестиционных программах средства на обновление оборудования и внедрение цифровых технологий, включая решения на основе искусственного интеллекта при наличии экономического обоснования. Данное направление согласуется с задачами технологического развития, обозначенными в Стратегии «Узбекистан - 2030» [22].

Применять сбалансированную систему показателей для согласования стратегических целей и текущих задач предприятия [8]. При её адаптации учитывать финансовые результаты, производственную эффективность и экологические характеристики деятельности.

Предложенные меры направлены на повышение обоснованности управленческих решений и укрепление способности предприятий своевременно

выполнять обязательства, поддерживать производство и финансировать дальнейшее развитие. Их состав и целевые показатели следует определять с учётом отраслевой специфики и финансовых возможностей каждого предприятия.

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GLOBAL VA MINTAQAVIY BARQAROR RIVOJLANISHDA EKOINNOVATSIYALARNI ANIQLASHNING USLUBIY YONDASHUVLARI

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Annotatsiya

Maqolada jahon iqtisodiyotida ro‘y berayotgan muhim iqtisodiy, innovatsion hamda ekologik jarayonlarning nazariy va uslubiy asoslari o‘rganilgan. Tadqiqotda ekoinnovatsiyalarning iqtisodiy o‘sish, ekologik barqarorlik, iqtisodiyotda resurslardan oqilona foydalanishga ijobiy ta’sirlari nazariy jihatdan asoslab berilgan. Shuningdek, xorijiy tajriba asosida Yevropa Ittifoqi mamlakatlarida ekoinnovatsiyalar amalga oshirilayotgan siyosat ochib berilgan, xususan, ekoinnovatsiyalar jadvalining tarkibi va indikatorlari tahlil qilingan. Ekoinnovatsiya tushunchasi Yevropa Komissiyasi, OECD va BMT yondashuvlari asosida qiyoslandi. Tadqiqotda tizimli yondashuv va qiyosiy tahlil usullari qo‘llanildi. Ekoinnovatsiyalar jadvali besh blok - qo‘yilmalar, ekoinnovatsion faollik, natijalar, ekologik oqibatlar va ijtimoiy-iqtisodiy natijalar bo‘yicha 16 ta indikatorni qamrab olishi ko‘rsatildi. Keyingi hisobotlarda ayrim indikatorlar chiqarilib, tizim soddalashtirilgani aniqlandi. Xulosada ekoinnovatsiyalarni mikro-, mezo- va makrodarajada aniqlash zarurligi asoslandi.

Kalit so‘zlar: iqtisodiyot, barqaror rivojlanish, innovatsiya, ekologiya, ekoinnovatsiya, uslubiyot, xalqaro tashkilotlar, xorij tajribasi.

Аннотация

В статье рассматриваются теоретико-методологические основы важных экономических, инновационных и экологических процессов, происходящих в современной мировой экономике. В работе теоретически обосновано положительное влияние экоинноваций на экономический рост, экологическую устойчивость и рациональное использование ресурсов в экономике. Кроме того, на основе зарубежного опыта анализируется политика в сфере экоинновации в странах ЕС, в частности, раскрываются структура и показатели таблицы экоинноваций. Понятие экоинноваций сопоставлено на основе подходов Европейской комиссии, ОЭСР и ООН. В исследовании применены системный подход и сравнительный анализ. Показано, что таблица экоинноваций охватывает 16 индикаторов в пяти блоках: вложения, экоинновационная активность, результаты, экологические последствия и социально-экономические результаты. Установлено, что в последующих отчетах часть индикаторов исключена, а система упрощена. В выводах обоснована необходимость определения экоинноваций на микро-, мезо- и макроуровнях.

Ключевые слова: экономика, устойчивое развитие, инновация, экология, экоинновация, методология, международные организации, зарубежный опыт.

Abstract

The article examines the theoretical and methodological foundations of significant economic, innovative, and environmental processes unfolding in the modern global economy. The study provides a theoretical rationale for the positive impact of eco-innovation on economic growth, environmental sustainability, and the rational use of resources. Furthermore, drawing on international experience, the paper analyzes eco-innovation policies in EU countries, specifically detailing the structure and indicators of the eco-innovation scoreboard. The concept of eco-innovation is compared on the basis of the approaches of the European Commission, the OECD and the United Nations. The study applies a systems approach and comparative analysis. It shows that the eco-innovation scoreboard covers 16 indicators in five blocks: inputs, eco-innovation activities, outputs, environmental outcomes and socio-economic outcomes. Later reports removed some indicators and simplified the system. The conclusion substantiates the need to identify eco-innovation at the micro, meso and macro levels.

Keywords: economy, sustainable development, innovation, ecology, eco-innovation, methodology, international organizations, international experience.

KIRISH

Global ekologik muammolarning keskinlashuvi, iqlim o‘zgarishi, tabiiy resurslarning cheklanishi va atrof-muhit ifloslanishi barqaror rivojlanish uchun yangi yondashuvlarni talab etmoqda. Ana shu sharoitda ekoinnovatsiyalar nafaqat ekologik muammolarni hal etish vositasi, balki iqtisodiy raqobatbardoshlik va texnologik taraqqiyotning muhim omili sifatida namoyon bo‘lmoqda.

Ekoinnovatsiyalarning metodologik asoslarini o‘rganishning dolzarbligi, birinchidan, ularning mohiyati, turlari va rivojlanish qonuniyatlarini ilmiy jihatdan asoslash zarurati bilan izohlanadi. Ikkinchidan, O‘zbekiston Respublikasida “Yashil iqtisodiyot”ga o‘tish strategiyasi va 2030-yilgacha atrof-muhitni muhofaza qilish konsepsiyasi [30]; [31] doirasida ekoinnovatsion faoliyatni tizimli boshqarish uchun yaxlit metodologik yondashuv zarur. Uchinchidan, ekoinnovatsiyalarni baholash, joriy etish va samaradorligini o‘lchash mezonlari hali to‘liq shakllanmaganligi bu sohada chuqur ilmiy tadqiqotlar olib borishni taqozo etadi.

Ekoinnovatsiyalar metodologiyasini iqtisodiyot, ekologiya va innovatsion menejment fanlari kesishmasida o‘rganish nafaqat nazariy jihatdan, balki amaliy jihatdan ham katta ahamiyat kasb etadi.

Ekoinnovatsiya tushunchasi ilmiy muomalaga XX asr oxirida kirib kelgan bo‘lib, dastlab K.Rennings uni ekologik iqtisodiyot nuqtai nazaridan asoslab bergan [19]. Keyinchalik OECD, Yevropa Komissiyasi va BMT Atrof-muhit dasturi hujjatlarida ekoinnovatsiyalarni qo‘llab-quvvatlash va o‘lchashning amaliy mexanizmlari ishlab chiqildi [10]; [17]; [23]. Biroq ushbu yondashuvlar turli indikatorlar tizimiga tayanadi va ularni mintaqaviy darajada qo‘llash uchun qiyosiy tahlil talab etiladi.

Maqolaning maqsadi - global va mintaqaviy barqaror rivojlanishda ekoinnovatsiyalarni aniqlashning uslubiy yondashuvlarini tizimlashtirish hamda Yevropa Ittifoqi tajribasi asosida ularni o‘lchash indikatorlarini tahlil qilishdan iborat.

ADABIYOTLAR SHARHI

BMTning 2023-yildagi "Texnologiyalar va Innovatsiyalar to'g'risida"gi ma'ruzasi "Yashil oynalarni ochish: past uglerodli dunyoga texnologik imkoniyatlar" deb nomlangan bo'lib, innovatsiyalar va ilg'or texnologiyalar insoniyat muhtojligi bo'lgan o'zgarishlarga olib kelishi mumkinligi bildirilgan. Ma'ruzada rivojlanayotgan mamlakatlar uchun eng maqbul yo'nalish - qo'shilgan qiymati yuqori bo'lgan va uglerod asoratlari past bo'lgan murakkab mahsulotlarni ishlab chiqarishga o'tish deb keltirilgan [21].

Bunda eng muhimi, ekoinnovatsiya nafaqat innovatsiyalarning atrof muhitga salbiy ta'sirini bartaraf etishga mo'ljallangan, balki, atrof muhitga ijobiy ta'sir ko'rsatishi va foyda keltirishiga asoslanadi.

Bugungi kunda jahon ilm hamjamiyati tomonidan ekoinnovatsiyaning ilmiy nazariy hamda uslubiy asoslari keng o'rganib kelinmoqda. Xususan, J.M.Chjou (J.M.Zhou) tadqiqotiga ko'ra, "yashil o'sish"ning asosiy omili bu atrof muhitning ifloslanishiga qarshi yo'naltirilgan innovatsiyalardir, shu tariqa ekoinnovatsiyalar "yashil o'sish"ga ijobiy ta'sir ko'rsatadi degan g'oyani ilgari suradi [24].

A.Litvinovaning fikriga ko'ra, ekoinnovatsiyalar barqaror rivojlanishga yo'naltirilgan, shu bilan birga, ularning natijalari innovatsion samaradorlikdan tashqari atrof muhitga foyda keltirishi kerak. Ushbu jarayonda korxonalar muhim rol o'ynaydi va ularning ekoinnovatsiyalar faoliyatining baholanishi, barqaror rivojlanishga qo'shayotgan hissasini va ekologik maqsadlarga muvofiqligini aniqlash imkoniyatini beradi [26].

N.V.Karpova o'z tadqiqotida, innovatsion jihatlarni inobatga olgan holda ekologik xavfsizlikni ta'minlash davlatning muhim faoliyatlaridan biri deb hisoblaydi [25].

A.N.Sarkar o'z tadqiqotida, miqdor va sifat ko'rsatkichlardan foydalangan holda ekoinnovatsiyalarning iqtisodiy samaradorligini aniqlashni taklif etgan. Unga ko'ra, loyihaning jarayonlarini baholash, dastlab belgilangan maqsadlarga muvofiqligini va uning turli darajalarda ta'sirini aniqlash imkoniyatini beradi. Uning fikriga ko'ra, ekoinnovatsiyalar indikatori bu - ijtimoiy rivojlanish va boshqa ko'rsatkichlarga asoslangan o'zgarishlar ko'rsatkichi [20].

Biroq, jahon iqtisodiyotida tobora ortib borayotgan ijtimoiy va ekologik muammolar ekoinnovatsiyaning yangi yo'nalish sifatida shakllanishiga asos soldi. Buning asosida, ekoinnovatsiyalar bo'yicha o'tkazilgan ilmiy tadqiqotlarning tahlili asosida ularni ikki yo'nalishga ajratish mumkin, xususan bir guruh olimlar ekoinnovatsiyaning nazariy asoslari o'rganilgan bo'lsa, ikkinchi guruh olimlar tomonidan ekoinnovatsiyaning iqtisodiy omillari va ta'sirlari o'rganilgan.

Birinchi guruh tadqiqotlarida ekoinnovatsiyaning mohiyati va turlari o'rganilgan. R.Kemp va P.Pearson ekoinnovatsiyani mahsulot, jarayon, xizmat yoki boshqaruv usulining butun hayotiy sikli davomida atrof-muhitga xavfni kamaytiruvchi yangiligi sifatida ta'riflagan hamda uni o'lchash yondashuvlarini taklif etgan [14]. M.M.Andersen ekoinnovatsiyalarning taksonomiyasini ishlab chiqqan [2], J.Carrillo-Hermosilla va hammualliflari esa ekoinnovatsiyalarning turli-tumanligini amaliy

holatlar misolida ko‘rsatgan [5]. C.Cheng va E.Shiu ekoinnovatsiyani tashkiliy, jarayon va mahsulot ekoinnovatsiyalari kesimida o‘lchash vositasini taklif etgan [6]. Mavzu bo‘yicha adabiyotlarning umumiy sharhi C.Díaz-García va hammualliflari tomonidan berilgan [8].

Ikkinchi guruh tadqiqotlarida ekoinnovatsiyalarning omillari va ta’siri tahlil qilingan. J.Horbach va hammualliflari ekoinnovatsiyalar omillari atrof-muhitga ta’sir turiga qarab farqlanishini aniqlagan [13]. A.Triguero va hammualliflari Yevropa kichik va o‘rta korxonalari misolida [22], C.Kiefer va hammualliflari esa miqdoriy usullar asosida [15] turli ekoinnovatsiyalarning harakatlantiruvchi omillari va to‘siqlarini o‘rgangan. A. de Jesus va S.Mendonça ekoinnovatsiyalarni aylanma iqtisodiyotga o‘tish bilan bog‘lagan [7], M.Bossle va hammualliflari ekoinnovatsiyalarni joriy etish omillarini tizimlashtirgan [4]. J.Hojnik va M.Ruzzier jarayon ekoinnovatsiyalarining korxona faoliyatiga ta’sirini [12], D.Pujari esa ekoinnovatsiyalarning yangi mahsulot bozor natijalariga ta’sirini [18] asoslagan. J.Barbieri va hammualliflari innovatsiya va barqarorlikni uyg‘unlashtiruvchi yangi modellarni taklif etgan [3].

Rus olimlaridan N.V.Paxomova va hammualliflari aylanma iqtisodiyot va yopiq ta’minot zanjirlarini barqaror rivojlanish omili sifatida ko‘rib chiqqan [27], B.N.Porfiryev va Ye.A.Yeliseyeva ekoinnovatsiyalarni past uglerodli rivojlanish omili sifatida baholagan [28], N.N.Yashalova va D.A.Ruban esa ekoinnovatsiyalarga oid yondashuvlarni tizimlashtirgan [29]. Adabiyotlarda ekoinnovatsiyalarni aniqlash va o‘lchashning yagona uslubiyoti hali shakllanmagan.

METODOLOGIYA

Mazkur tadqiqot ishida tizimli yondashuv uslubiyotidan foydalanildi va bunda ekoinnovatsiya tizim sifatida ko‘rib chiqilib texnologiya, iqtisodiyot, ekologiya va jamiyatga foydalilik jihatlari ochib berilgan. Shuningdek qiyosiy tahlil usulida Yevropa Ittifoqi hamda Osiyo mamlakatlarining ekoinnovatsiyalar sohasidagi tajribalari o‘rganildi.

Tadqiqotning axborot bazasini BMT Savdo va taraqqiyot konferensiyasining texnologiyalar va innovatsiyalar to‘g‘risidagi ma’ruzasi [21], Yevropa Komissiyasi hujjatlari [10]; [11], Ekoinnovatsiyalar observatoriyasining yillik hisoboti [9] va Yevropa Ittifoqi ekoinnovatsiyalar indeksi bo‘yicha tahliliy ma’lumot [1] tashkil etdi. Ekoinnovatsiyalarni o‘lchash bo‘yicha OECD asoslari [17] va MEI loyihasi natijalari [14] qiyosiy tahlil uchun tayanch sifatida olindi.

Tahlil uch bosqichda olib borildi. Birinchi bosqichda ekoinnovatsiya tushunchasiga berilgan ta’riflar kontent tahlili orqali solishtirildi. Ikkinchi bosqichda ekoinnovatsiyalar jadvalining bloklari va indikatorlari guruhlandi hamda keyingi hisobotlardagi o‘zgarishlar aniqlandi. Uchinchi bosqichda indikatorlar mikro- (korxona), mezo- (tarmoq va hudud) va makro- (mamlakat) darajalar bo‘yicha taqsimlanib, ularni mintaqaviy sharoitda qo‘llash imkoniyatlari baholandi.

TAHLIL VA NATIJALAR

Innovatsiyalarning paydo bo‘lishi, rivojlanishi va tadqiq etilishining asosini dunyoda turli davrlarda ro‘y bergan texnologik inqiloblar va jamiyatdagi

o‘zgarishlarga asoslangan. Ammo, insoniyatning texnologik taraqqiyoti va uning asosini tashkil etuvchi, iste’molga yondashuvning o‘zgarishi (xomashyolar iste’moli, tayyor va yarim tayyor mahsulotlar iste’moli va boshq.) ekologiyaga yetkazilayotgan zararning tobora ortib borishi bilan bog‘liq bo‘ldi. Zero, so‘nggi o‘n yilliklarda jahon iqtisodiyotida ro‘y berayotgan turli, iqtisodiy, moliyaviy hamda ekologik inqirozlar insoniyatni ekologik muammolarga qaratdi va istiqbolda barqaror jamiyatning rivojlanishi uzluksiz ekologik barqarorlik bilan chambarchas bog‘liqligi namoyon bo‘ldi. Chunki, iqlimning o‘zgarishi, bioxilma-xillikning va tabiiy resurslarning kamayishi to‘g‘ridan-to‘g‘ri inson faoliyati va kelajagiga bog‘lanadi.

Jahon amaliyotida innovatsiyalarning an’anaviy iqtisodiy va ijtimoiy yo‘nalishlardan tashqari barqarorlikka asoslangan holda ekologik yo‘nalishlarga yo‘naltirilgan yangi tamoyili paydo bo‘lgan va bu ekoinnovatsiyadir.

Dunyo ekologik va texnologik muammolarga duch kelayotgan sharoitda, innovatsiyalar va barqarorlik o‘rtasidagi balansga erishish har doimgidan ham dolzarb hisoblanadi [16]. Zero, iqtisodiyot ta’limotlaridan ma’lumki, innovatsiyalarning o‘zi iqtisodiy rivojlanishga olib kelishi mumkin, ammo ekologik barqarorlikni ta’minlamasligi mumkin, ushbu jihatdan innovatsiyalarning ekologik omillarini ham kiritilishi muhim ahamiyat kasb etgan holda innovatsion g‘oyalar va yechimlar mavjud ekologik muammolarni bartaraf etishga qanday xizmat qilishi va barqaror kelajakni shakllantirishdagi rolini aniqlash muhim hisoblanadi.

Ekoinnovatsiyalar ham iqtisodiy o‘sishga ham ekologik barqarorlikni ta’minlashga xizmat qiladi, ular, iqtisodiy o‘sish va resurslardan oqilona foydalanish, atrof muhitga zararsiz tarzda rivojlanishni o‘rganadi.

Yevropa Komissiyasi tomonidan ekoinnovatsiyalar - ishlab chiqarishning atrof muhitga salbiy ta’sirini pasaytiruvchi, tabiatning bardoshligini oshirishga va tabiiy resurslarga mas’uliyat bilan yondashish orqali barqaror rivojlanish maqsadlarining amalga oshishiga ko‘maklashuvchi har qanday innovatsiyalar ekoinnovatsiyalar deb qabul qilingan [11].

Yevropa Ittifoqi mamlakatlarida ekoinnovatsiyalarni qo‘llab-quvvatlash maqsadida amalga oshirilayotgan siyosat bir nechta yo‘nalishlarda yo‘lga qo‘yilgan [10], bularga:

- ekologik innovatsiyalar iste’molchilar talabini rag‘batlantirish, “yashil” davlat xaridlarini amalga oshirish orqali;
- tabiiy resurslar va ekotizim xizmatlariga adolatli narxlarni belgilash;
- xalqaro ekologik standartlarni joriy qilish;
- ekologik innovatsiyalarga talablarni rag‘batlantirishda moliyaviy mexanizmlarni joriy qilish, shuningdek, soliq imtiyozlarini yaratish;
- institutsional muhitni rivojlantirish.

Yevropa Ittifoqi mamlakatlarida ekoinnovatsiyalar bo‘yicha amalga oshirilayotgan islohotlarning natijadorligini o‘rganish maqsadida Ekoinnovatsiyalar observatoriyasi (Eco-Innovation Observatory (EIO)) yaratilgan va unda ekoinnovatsiyalarning samaradorligini aniqlashning ilk instrumenti sifatida foydalanilgan [9].

Observatoriyada ekoinnovatsiyalarning natijadorligi ekoinnovatsiyalar indeksi (EII) asosida qiyosiy taqqoslash imkoniyatini beradi. Indeks mavjud ko‘rsatkichlarning o‘rtacha yig‘indisini hisoblash asosida aniqlanadi [1]. Indeks ko‘rsatkichlari ekoinnovatsiyalar jadvali (tablosi)da umumlashtirilgan holda namoyish etiladi (1-rasm).

1. Ekoinnova-siyalarga qo‘yilma (investitsiya)	1.1. Atrof muhitni himoya qilish va energetika sohasida ITTKIlarga davlatning xarajatlari (% YAIM) 1.2. Ilmiy-tadqiqot xodimlarning umumiy soni (umumiy band bo‘lganlarga nisbatan %) 1.3. Boshlang‘ich xolatda “yashil” loyihalarga umumiy investitsiyalarning qiymati.
2. Ekoinnovasion faollik	2.1. Bir dona mahsulotga xarajatlarni qisqartirish uchun innovatsiyalar joriy qilayotgan korxonalar (umumiy korxonalarga nisbatan %) 2.2. Bir dona mahsulotga sarflanadigan energiyani qisqartirish uchun innovatsiyalarni joriy qiluvchi korxonalar (umumiy korxonalarga nisbatan %) 2.3. ISO 14001 standarti bo‘yicha ro‘yxatdan o‘tgan tashkilotlar (aholining minimal soniga nisbatan)
3. Ekoinnovasiya natijalari	3.1. Ekologik innovatsiyalar bilan bog‘liq patentlar soni (foydalanuvchilarning eng kam soniga nisbatan) 3.2. Ekologik innovatsiyalar bilan bog‘liq ilmiy nashrlar (minimal o‘quvchilar soniga nisbatan hisobida) 3.3. Ekologik innovatsiyalar ommaviy axborot vositalarda yoritilishi (elektron OAV soni bo‘yicha)
4. Ekologik oqibatlar	4.1. Moddiy ishlab chiqarish (YAIM/Asosiy iste’mol materiallari) 4.2. Suv resurslarning samaradorligi (YAIM/Suv izi) 4.3. Energiya samaradorlik (YAIM/energiyaning yalpi ichki iste’moli) 4.4. Zararli gazlarning chiqarilish intensivligi (SO2ye/YAIM)
5. Ijtimoiy-iqtisodiy natijalar	5.1. Ekosanoat mahsulotlari eksporti (eksportning umumiy hajmidan %) 5.2. Eko-tarmoqlarda bandlik (umumiy ishchi kuchi soniga nisbatan %) 5.3. Ekosanoatda aylanma

1-rasm. Ekoinnovatsiyalar jadvalining tarkibi va indikatorlari[1]

1-rasmda ekoinnovatsiyalar jadvali besh blokdan iborat: ekoinnovatsiyalarga qo‘yilmalar (3 ta indikator), ekoinnovatsion faollik (3 ta), ekoinnovatsiya natijalari (3 ta), ekologik oqibatlar (4 ta) hamda ijtimoiy-iqtisodiy natijalar (3 ta). Jami 16 ta indikator resurslar sarfidan yakuniy iqtisodiy samaragacha bo‘lgan zanjirni qamrab oladi. Dastlabki uch blok innovatsion jarayonning o‘zini, keyingi ikki blok esa uning atrof-muhit va iqtisodiyotga ta’sirini o‘lchaydi. Bunday tuzilma ekoinnovatsiyalarni faqat xarajat yoki patentlar soni bilan emas, balki ularning ekologik va ijtimoiy-iqtisodiy natijalari bilan birga baholash imkonini beradi [9].

[1] Manba: Europe in transition. Paving the way to a green economy through eco-innovation. Annual Report 2012. P.31 [9].

Tahlillarga ko‘ra, EII 2024 hisobotida ekoinnovatsiyalar indeks ko‘rsatkichlari 2010-yildagi indekslarga nisbatan o‘zgargan va ayrim ko‘rsatkichlar yanada soddalashtirilgan [1]; [9]. Xususan, 1.3 boshlang‘ich holatda “yashil” loyihalarga umumiy investitsiyalarning qiymati; 2.1 bir dona mahsulotga xarajatlarni qisqartirish uchun innovatsiyalar joriy qilayotgan korxonalar; 2.2 bir dona mahsulotga sarflanadigan energiyani qisqartirish uchun innovatsiyalarni joriy qiluvchi korxonalar; 3.3 ekologik innovatsiyalar ommaviy axborot vositalarda yoritilishi kabi yo‘nalishlar chiqarilgan.

Ekoinnovatsiyalar indeksi indikatorlarining metama’lumotlari turli manbalardan shakllantirilganligi kuzatiladi, xususan, ularning asosiy qismi Yevropa Ittifoqining statistikasiga asoslangan [1].

Tahlillarga ko‘ra, 2013-2022-yillarda Yevropa Ittifoqi mamlakatlarida ekoinnovatsiyalar indeksining barqaror rivojlanishi kuzatilgan bo‘lsa uning asosini resurslardan samarali foydalanish, atrof muhitga zararli gazlar tarqalishining pasayishi, ISO 14001 sertifikatlari sonining ortishi, ekologik innovatsiyalar bo‘yicha ilmiy maqolalar sonining ortishi bilan kuzatilgan [1].

XULOSA VA TAKLIFLAR

Amalga oshirilgan tadqiqotlardan xulosa qilish zarurki, ekoinnovatsiyalar ham iqtisodiy o‘sishga va ham ekologik barqarorlikni ta’minlashga xizmat qiladi. Bunda iqtisodiy o‘sish resurslardan oqilona foydalanish tamoyiliga rioya qilgan holda atrof muhitga zararsiz tarzda rivojlanishni ta’minlaydi.

Ekoinnovatsiyalarning indikatorlari va maqsadli ko‘rsatkichlari resurslarning ishlab chiqarish samaradorligiga erishish maqsadiga bog‘langan bo‘lishi muhim ahamiyat kasb etadi. Ko‘rsatkichlarning bunday tizimi mikrodarajada yuz beradigan o‘zgarishlarni aniqlash imkoniyatini beradi. Ushbu jihatdan ekoinnovatsiyalar jadvali ekoinnovatsiyalarni makrodarajada aniqlashning dastlabki qadami bo‘lishi mumkin. Umumiy hisobda ekoinnovatsiyalar mikrodarajada (korxonalar), mezodarajada (qo‘shilgan qiymat yaratish darajasi, hududlar miqyosida) va makrodarajada (mamlakat iqtisodiyoti darajasida) aniqlanishi zarur.

Tadqiqot natijalari asosida quyidagi takliflar ishlab chiqildi:

1. Ekoinnovatsiyalarni aniqlashda Yevropa Ittifoqi ekoinnovatsiyalar jadvalining besh blokli tuzilmasini asos qilib olish va uni milliy statistika imkoniyatlariga moslashtirish.

2. Korxonalar darajasida ekoinnovatsion faollikni aniqlash uchun statistik kuzatuv shakllariga resurs va energiya tejovchi innovatsiyalar bo‘yicha ko‘rsatkichlarni kiritish.

3. Hududlar kesimida ekoinnovatsiyalar indeksini hisoblash orqali mintaqaviy barqaror rivojlanish darajasini qiyosiy baholash tizimini shakllantirish.

4. “Yashil” iqtisodiyotga o‘tish strategiyasi doirasida ekoinnovatsiyalarni qo‘llab-quvvatlovchi moliyaviy va soliq mexanizmlarini kengaytirish.

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II-SEKSIYA - BIOIQTISODIYOTNI RIVOJLANTIRISHNING GLOBAL VA MINTAQAVIY USTUVOR YO‘NALISHLARINI BELGILASH



MINTAQAVIY BIOIQTISODIYOTNI RIVOJLANTIRISHDA OLIY TA'LIM MUASSASALARINING ROLI: BUXORO DAVLAT UNIVERSITETI "YASHIL IQTISODIYOT VA BIZNES" KAFEDRASI TAJRIBASI

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Annotatsiya

Maqolada oliy ta'lim muassasalarining mintaqaviy bioiqtisodiyotni rivojlantirishdagi roli Buxoro davlat universitetining "Yashil iqtisodiyot va biznes" kafedrasi misolida o'rganildi. Tadqiqotda kafedraning kadrlar tarkibi, to'rtta ta'lim dasturi va strategik rivojlanish hujjatlari tahlil qilindi. Keys tadqiqoti, kontent tahlili va SWOT tahlili qo'llanildi. Ilmiy darajali o'qituvchilar ulushi 54,5 foizni, o'rganilgan 65 ta fan orasida yashil va bioiqtisodiy mazmunli fanlar ulushi 52,3 foizni tashkil etdi. Ta'lim, tadqiqot va innovatsion hamkorlikni bog'lovchi konseptual model ishlab chiqildi. Kadrlar tayyorlash, ta'lim dasturlarini kengaytirish va mahalliy korxonalar bilan hamkorlikni rivojlantirish yo'nalishlari belgilandi. Natijalar asosida 2026-2030-yillarga mo'ljallangan rejaviy ko'rsatkichlar tizimlashtirildi hamda kafedraning hududiy rivojlanishdagi ishtirokini kuchaytirishga qaratilgan amaliy takliflar shakllantirildi.

Kalit so'zlar: mintaqaviy bioiqtisodiyot, oliy ta'lim, yashil iqtisodiyot, ilmiy salohiyat, o'quv rejalari, hududiy hamkorlik, SWOT tahlili.

Аннотация

В статье была изучена роль вузов в развитии региональной биоэкономики на примере кафедры «Зелёная экономика и бизнес» Бухарского государственного университета. Исследование охватило кадровый состав, четыре образовательные программы и документы стратегического развития кафедры. Были применены исследование случая, контент-анализ и SWOT-анализ. Доля преподавателей с учёными степенями составила 54,5%, доля дисциплин экологической и биоэкономической направленности среди 65 рассмотренных предметов достигла 52,3%. Была разработана концептуальная модель взаимодействия образования, исследований и инноваций. Были определены направления подготовки кадров, расширения образовательных программ и сотрудничества с предприятиями. На основе результатов были систематизированы плановые показатели на 2026-2030 годы и сформулированы практические предложения по усилению участия кафедры в региональном развитии.

Ключевые слова: региональная биоэкономика, высшее образование, зелёная экономика, научный потенциал, учебные планы, региональное сотрудничество, SWOT-анализ.

Abstract

The article examined universities' role in regional bioeconomy development through Bukhara State University's Green Economy and Business Department. The

study covered staffing, four educational programmes and departmental strategic documents. Case study, content analysis and SWOT analysis were applied. Staff holding scientific degrees accounted for 54.5%, while green and bioeconomy subjects represented 52.3% of the 65 courses examined. A conceptual model linking education, research and innovation was developed. Priorities were identified for staff development, programme expansion and cooperation with local enterprises. Planned indicators for 2026-2030 were systematised, and practical proposals were formulated to strengthen the department's contribution to sustainable regional development.

Keywords: regional bioeconomy, higher education, green economy, scientific capacity, educational programmes, regional cooperation, SWOT analysis.

KIRISH

Jahon iqtisodiyotida bioiqtisodiyot - qayta tiklanuvchi biologik resurslarni ishlab chiqarish, ulardan oqilona foydalanish va ularni oziq-ovqat, yem-xashak, biomahsulotlar hamda bioenergiyaga aylantirish bilan bog‘liq iqtisodiy faoliyat - barqaror rivojlanishning ustuvor yo‘nalishlaridan biriga aylandi. Yevropa Ittifoqining yangilangan bioiqtisodiyot strategiyasi [7], Iqtisodiy hamkorlik va taraqqiyot tashkilotining (OECD) hisobotlari [11] hamda BMTning Barqaror rivojlanish maqsadlari (SDG 2, 7, 12, 13, 15) bioiqtisodiyotni iqlim o‘zgarishiga qarshi kurashning va resurs samaradorligini oshirishning muhim vositasi sifatida e’tirof etadi. Sirkulyar bioiqtisodiyot esa bioiqtisodiyot va sirkulyar iqtisodiyot tamoyillarining uyg‘unlashuvi bo‘lib, biomassadan «kaskadli» foydalanish, chiqindilarni qayta ishlash va mahsulot hayotiy siklini uzaytirishni nazarda tutadi [12].

O‘zbekiston Respublikasida ham ushbu yo‘nalishga e’tibor kuchaymoqda. “O‘zbekiston - 2030” strategiyasi, 2019-2030 yillarga mo‘ljallangan «yashil» iqtisodiyotga o‘tish strategiyasi [15] hamda Buxoro viloyatini ijtimoiy-iqtisodiy rivojlantirish dasturlari resurs tejovchi texnologiyalarni joriy etish, agrosanoat chiqindilarini qayta ishlash va qayta tiklanuvchi energiya manbalarini rivojlantirishni ustuvor vazifa sifatida belgilagan. Buxoro viloyati - paxtachilik, chorvachilik, bog‘dorchilik, shuningdek, neft-gaz va to‘qimachilik sanoati rivojlangan hudud sifatida - biomassa resurslari bo‘yicha katta salohiyatga ega, biroq ushbu salohiyatdan foydalanish darajasi past bo‘lib qolmoqda.

Bioiqtisodiyotga o‘tish faqat texnologik yoki investitsion masala emas. Xalqaro tajriba shuni ko‘rsatadiki, bioiqtisodiyot “bilimga asoslangan” iqtisodiyot bo‘lib, uning rivojlanishi malakali kadrlar, ilmiy tadqiqotlar va innovatsion ekotizimga bevosita bog‘liq [1]. Aynan shu o‘rinda oliy ta’lim muassasalarining roli hal qiluvchi ahamiyat kasb etadi: ular nafaqat mutaxassislar tayyorlaydi, balki hududiy siyosatni ilmiy asoslash, korxonalarga texnologik va iqtisodiy konsalting berish hamda xalqaro bilimlarni mahalliy sharoitga moslashtirish vazifalarini ham bajaradi [4].

Mazkur maqolaning maqsadi - mintaqaviy sirkulyar bioiqtisodiyotni rivojlantirishda OTMning rolini konseptual va empirik jihatdan asoslash hamda Buxoro davlat universitetining “Yashil iqtisodiyot va biznes” kafedrasi misolida ushbu rolni amalga oshirishning hozirgi holati, muammolari va istiqbollarini aniqlashdir. Tadqiqot vazifalari: (1) OTM-mintaqaviy bioiqtisodiyot o‘zaro ta’sirining nazariy

asoslarini umumlashtirish; (2) kafedra kadrlar salohiyati va o‘quv rejalari mazmunini bioiqtisodiyot nuqtai nazaridan tahlil qilish; (3) SWOT-tahlil asosida strategik ustuvorliklarni belgilash; (4) 2026-2030-yillarga mo‘ljallangan maqsadli ko‘rsatkichlar va amaliy tavsiyalarni ishlab chiqish.

ADABIYOTLAR SHARHI

Oliy ta’lim muassasalarining mintaqaviy bioiqtisodiyotni rivojlantirishdagi o‘rni universitet, ishlab chiqarish va davlat o‘rtasidagi hamkorlik bilan bog‘liq. “Uch spiral” modelida universitet bilim va texnologiyalarni yaratadigan, korxonalar ularni amaliyotga tatbiq etadigan, davlat esa hamkorlik uchun institutsional sharoit shakllantiradigan ishtirokchi sifatida talqin qilingan [6]. Ushbu yondashuv universitetning hududiy rivojlanishdagi vazifalarini ta’lim bilan cheklamasdan, tadqiqot va innovatsion faoliyat bilan birgalikda o‘rganishga asos bo‘ladi. “Besh spiral” modelida bu munosabatlarga fuqarolik jamiyati va tabiiy muhit ham kiritilgan. Natijada bilim yaratish va innovatsiyalarni joriy etish jarayonlari ekologik barqarorlik bilan bog‘langan [2].

Universitetning tashkiliy imkoniyatlari tadbirkor universitet konsepsiyasida yoritilgan. Unda boshqaruvni takomillashtirish, moliyalashtirish manbalarini kengaytirish va tashqi hamkorlikni rivojlantirish universitet faoliyatini yangilashning muhim shartlari sifatida ko‘rsatilgan [3]. Universitetning “uchinchi missiyasi” bo‘yicha tizimli sharhda esa ta’lim va ilmiy tadqiqot natijalarini jamiyat hamda iqtisodiyot ehtiyojlariga yo‘naltirish masalalari umumlashtirilgan [4]. Bu qarashlar bioiqtisodiyot yo‘nalishidagi kafedralarning korxonalar bilan qo‘shma tadqiqotlar, maslahat xizmatlari va bilimlar transferini tashkil etishdagi o‘rnini tushuntirishga yordam beradi.

Bioiqtisodiyotga oid adabiyotlar tahlilida biotexnologik, bioresurs va bioekologik yondashuvlar ajratilgan [1]. Ularning farqlanishi ushbu soha uchun kadrlar tayyorlashda texnologik, iqtisodiy va ekologik bilimlarni uyg‘unlashtirish zarurligini ko‘rsatadi. Yevropa bioiqtisodiyoti bo‘yicha tadqiqotda ham rivojlanish jarayoni ilmiy bilimlar, innovatsiyalar va turli ishtirokchilar hamkorligi bilan bog‘liq holda ko‘rib chiqilgan [10].

Yashil iqtisodiyot, sirkulyar iqtisodiyot va bioiqtisodiyot tushunchalarining qiyosiy tahlili ularning umumiy maqsadlari bilan birga mazmuniy farqlari ham mavjudligini ko‘rsatgan [5]. Shu sababli o‘quv rejalarini baholashda ekologiyaga oid barcha fanlarni bevosita bioiqtisodiyot fanlari sifatida hisoblashdan saqlanish, tasniflash mezonlarini aniq belgilash muhim. Sirkulyar bioiqtisodiyotga bag‘ishlangan tadqiqotda biomassadan bosqichma-bosqich foydalanish, resurslar aylanishi va bioiqtisodiy klasterlarning o‘rni yoritilgan [12]. Bu yondashuv ta’lim mazmunini hududdagi agrosanoat va qayta ishlash korxonalari ehtiyojlari bilan bog‘lash uchun nazariy asos beradi.

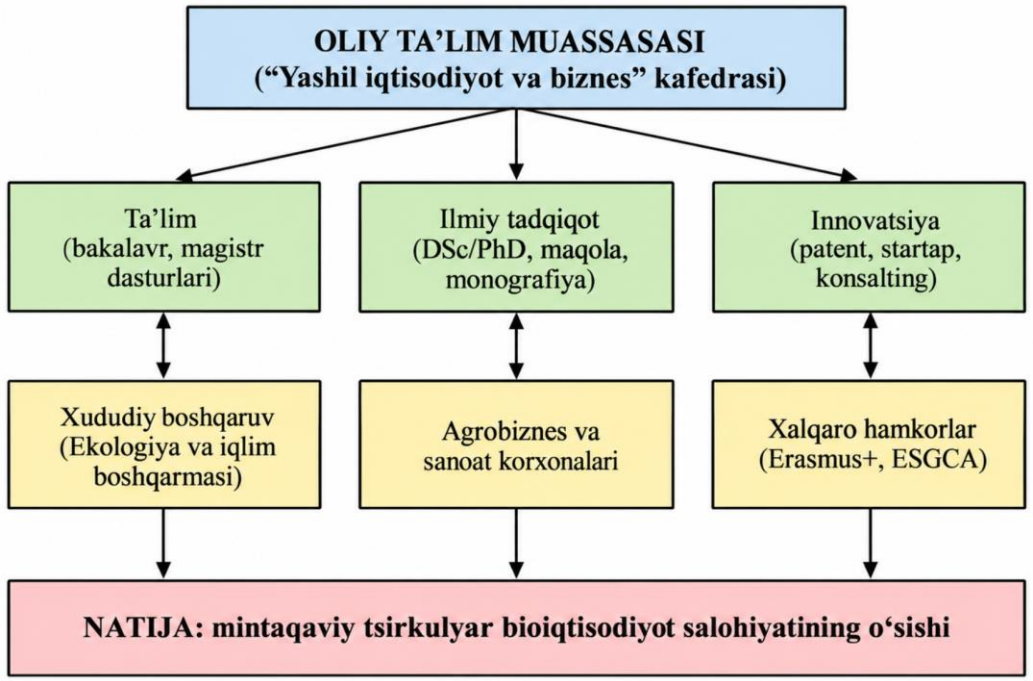
Universitetlarda barqaror rivojlanishni o‘qitishga oid tadqiqotlarda tegishli tamoyillarni ta’lim jarayoniga izchil kiritish masalalari o‘rganilgan [8]. Universitet tizimiga yaxlit yondashuv esa barqarorlikni o‘quv dasturlari, tadqiqotlar va muassasa boshqaruvi doirasida birgalikda rivojlantirishga e’tibor qaratgan [9].

Ko‘rib chiqilgan adabiyotlar universitetlarning bioiqtisodiyotdagi vazifalarini tushuntiradi. Ushbu tadqiqotda esa bu yondashuvlar Buxoro davlat universitetining “Yashil iqtisodiyot va biznes” kafedrasi darajasida qo‘llanib, kadrlar tarkibi, o‘quv fanlari mazmuni va hududiy hamkorlik imkoniyatlari o‘zaro bog‘liq holda baholandi.

METODOLOGIYA

Tadqiqot keys-stadi (case study) dizayni asosida o‘tkazildi; tadqiqot obyekti sifatida Buxoro davlat universitetining “Yashil iqtisodiyot va biznes” kafedrasi (2026-yil sentyabrgacha - “Yashil iqtisodiyot va agrobiznes” kafedrasi) tanlandi. Kafedra tanloviga asos - uning bevosita bioiqtisodiyot, yashil iqtisodiyot, logistika va biznesni boshqarish yo‘nalishlarida bakalavr va magistr kadrlar tayyorlashi hamda 2026/2027 o‘quv yilidan boshlab strategik qayta shakllanish jarayonini boshlaganligidir.

Tadqiqotning nazariy asosi sifatida “uch spiral” modeli va “bilimlar uchburchagi” (ta’lim - tadqiqot - innovatsiya) konsepsiyasi qabul qilindi. Ularga tayangan holda OTMning mintaqaviy bioiqtisodiyotdagi rolini aks ettiruvchi konseptual model ishlab chiqildi (1-rasm). Modelda OTMning uchta asosiy funksiyasi uchta hududiy hamkor guruhi - hududiy boshqaruv organlari (Buxoro viloyati Ekologiya va iqlim o‘zgarishi boshqarmasi), agrobiznes va sanoat korxonalari hamda xalqaro hamkorlar - bilan ikki tomonlama aloqada ko‘rsatilgan.



1-rasm. OTMning mintaqaviy sirkulyar bioiqtisodiyotni rivojlantirishdagi roli: konseptual model[1]

Empirik ma’lumotlar quyidagi manbalardan to‘plandi: (a) kafedraning 2026/2027 o‘quv yili uchun professor-o‘qituvchilar tarkibi to‘g‘risidagi ma’lumotlar; (b) 61010400 “Logistika” va 60410900 “Biznesni boshqarish” bakalavriat yo‘nalishlari hamda 70310109 “Bioiqtisodiyot” va 70410901 “Biznesni boshqarish” magistratura

[1] Manba: muallif ishlanmasi.

mutaxassisliklarining 2026/2027 o‘quv yili o‘quv rejalari; (v) kafedraning 2026-2030-yillarga mo‘ljallangan strategik rivojlanish rejasi va 2026/2027 o‘quv yili ish rejasi; (g) Oliy ta’lim, fan va innovatsiyalar vazirligining oliy ta’lim yo‘nalishlari va mutaxassisliklari klassifikatoriga kiritilgan o‘zgartirishlar.

Ma’lumotlarni tahlil qilishda uchta usul qo‘llanildi. Birinchidan, kadrlar salohiyati tahlilida oliy ta’lim tizimida umumqabul qilingan “ilmiy salohiyat” ko‘rsatkichi - ilmiy darajaga ega professor-o‘qituvchilarning umumiy shtat tarkibidagi ulushi - hisoblandi. Ikkinchidan, o‘quv rejalarining kontent-tahlili amalga oshirildi: har bir o‘quv rejadagi fanlar (majburiy va kafedra profiliga mos tanlov fanlari) “yashil/bioiqtisodiy mazmunli” va “boshqa” toifalarga ajratildi. Fan “yashil/bioiqtisodiy mazmunli” deb tasniflanishi uchun uning nomi yoki maqsadida bioiqtisodiyot, yashil iqtisodiyot, sirkulyar iqtisodiyot, barqaror rivojlanish, ESG, atrof-muhit, agrobiznes, ekodizayn yoki qayta tiklanuvchi resurslar bilan bog‘liq mazmun aks etgan bo‘lishi mezon qilib olindi. Uchinchidan, kafedraning ichki va tashqi muhiti SWOT-tahlil yordamida baholandi va maqsadli ko‘rsatkichlar (KPI) 2026-2030-yillar kesimida tizimlashtirildi.

Tadqiqotning cheklovlari: birgina kafedra keysi tahlil qilinganligi sababli natijalar umumlashtirish uchun emas, balki analitik va metodik namuna sifatida xizmat qiladi; 2027-2030-yillar ko‘rsatkichlari rejaviy xarakterga ega bo‘lib, kelgusida faktik ma’lumotlar bilan solishtirilishi lozim.

TAHLIL VA NATIJALAR

2026/2027 o‘quv yili holatiga ko‘ra kafedra ikkita bakalavriat yo‘nalishi va ikkita magistratura mutaxassisligi bo‘yicha kadrlar tayyorlaydi (1-jadval). “Agrobiznes” yo‘nalishi bo‘yicha oxirgi bitiruvchilar 2025/2026 o‘quv yilida chiqarilgan bo‘lib, bu kafedraning “yashil iqtisodiyot va biznes” profiliga qayta yo‘naltirilishi uchun imkoniyat yaratdi. Ayni paytda Oliy ta’lim yo‘nalishlari klassifikatoriga kiritilgan o‘zgartirishlar kafedra profiliga bevosita mos keluvchi to‘rtta yangi yo‘nalishni ochish imkoniyatini beradi.

1-jadval

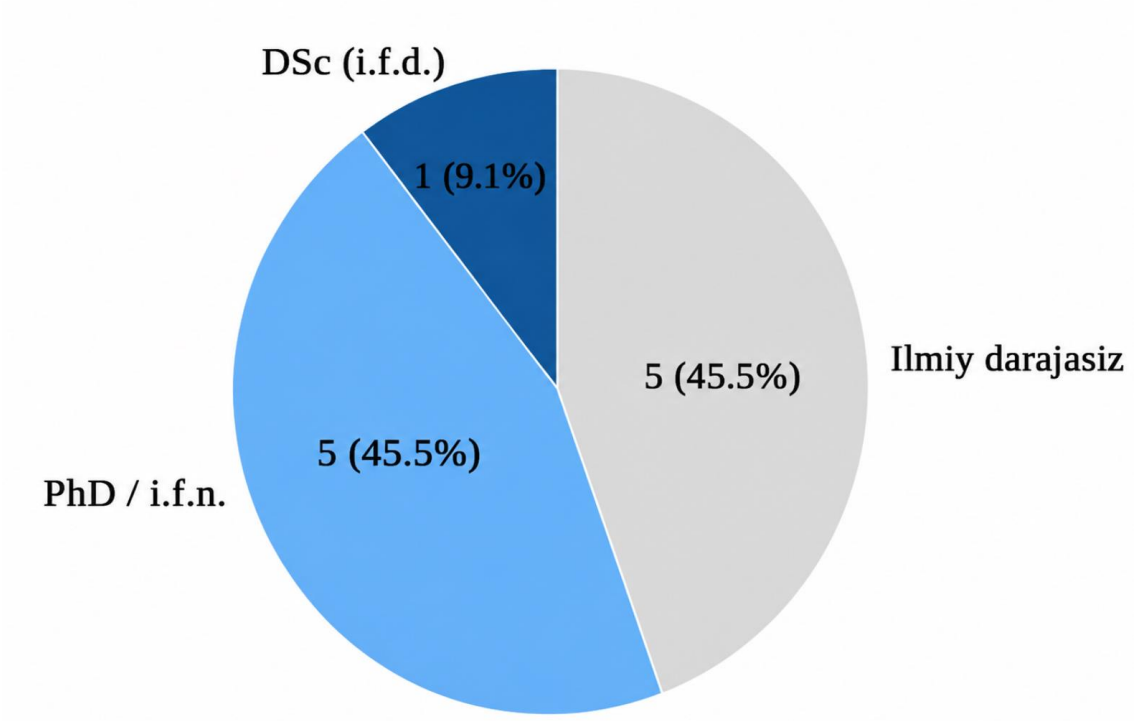
Kafedraning mavjud va istiqbolli ta’lim yo‘nalishlari[1]

№	Yo‘nalish / mutaxassislik	Klassifikator kodi	Daraja	Holati
1	Logistika	61010400	Bakalavriat	Amalda
2	Biznesni boshqarish	60410900	Bakalavriat	Amalda
3	Bioiqtisodiyot	70310109	Magistratura	Amalda
4	Biznesni boshqarish	70410901	Magistratura	Amalda
5	Agrobiznes	-	Bakalavriat	2025/26 da yakunlangan
6	Yashil iqtisodiyot	60411800	Bakalavriat	Ochish rejalashtirilgan
7	Sirkulyar iqtisodiyot	70410112	Magistratura	Ochish rejalashtirilgan
8	Yashil loyihalar boshqaruvi	70410806	Magistratura	Ochish rejalashtirilgan
9	Barqaror rivojlanish	70420210	Magistratura	Ochish rejalashtirilgan

[1] Manba: muallif ishlanmasi.

1-jadvalda kafedra istiqbolda ta'lim portfelini 4 tadan 8 ta yo'nalishga kengaytirish imkoniyatiga ega. Bu - bir tomondan, mintaqaviy mehnat bozorining yashil iqtisodiyot, sirkulyar ishlab chiqarish va barqaror rivojlanish bo'yicha mutaxassislarga bo'lgan ehtiyojiga javob bersa, ikkinchi tomondan, kafedra oldiga ilmiy salohiyat va o'quv-uslubiy ta'minot bo'yicha jiddiy talablar qo'yadi.

Kafedra shtat tarkibi 11 nafar professor-o'qituvchidan iborat: 1 nafar fan doktori (DSc, professor), 5 nafar falsafa doktori (PhD) yoki fan nomzodi (dotsent va katta o'qituvchilar) va 5 nafar ilmiy darajasiz o'qituvchi (2-rasm). Shunga ko'ra ilmiy salohiyat ko'rsatkichi 6/11 = 54,5 foizni tashkil etadi.



2-rasm. Kafedra professor-o'qituvchilarining ilmiy daraja bo'yicha tarkibi (2026/2027 o'quv yili)[1]

Ushbu ko'rsatkich O'zbekiston oliy ta'lim tizimi uchun o'rtacha darajaga yaqin bo'lsa-da, to'rtta yangi yo'nalishni, ayniqsa magistratura mutaxassisliklarini ochish uchun yetarli emas: amaldagi me'yoriy talablarga ko'ra magistratura mutaxassisligini ochish uchun profilli ilmiy darajali o'qituvchilar ulushi sezilarli yuqori bo'lishi lozim. Bundan tashqari, kafedrada sirkulyar iqtisodiyot, biomassani qayta ishlash iqtisodiyoti, yashil moliya va ESG-menejment kabi tor mutaxassislik bo'yicha tayyorlangan kadrlar yetishmaydi. Demak, kadrlar salohiyatini oshirish - kafedraning mintaqaviy bioiqtisodiyotdagi rolini kuchaytirishning birlamchi sharti hisoblanadi.

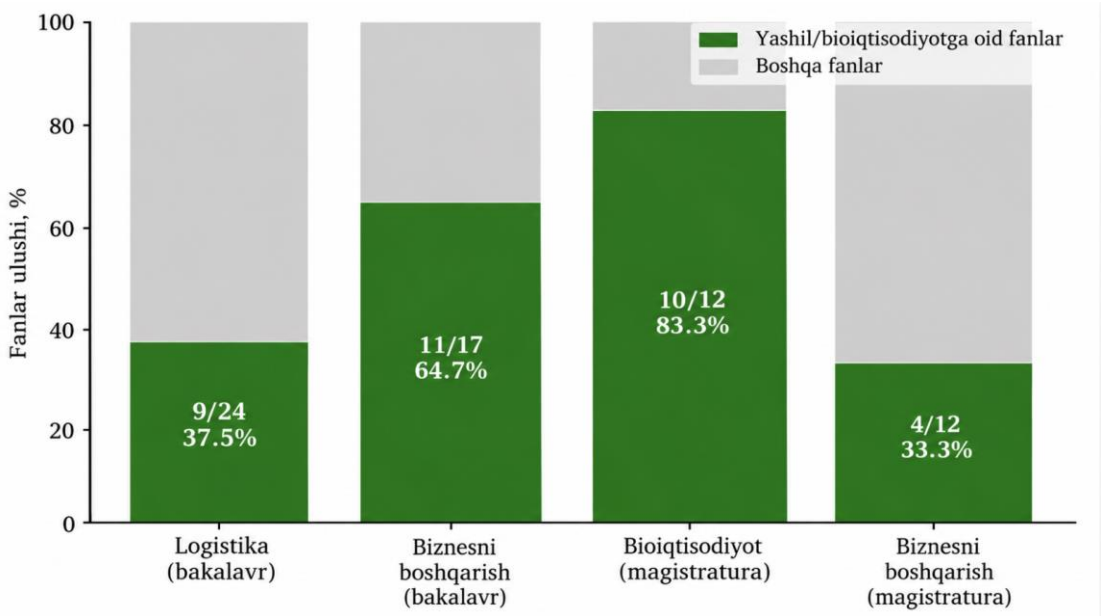
O'quv rejalarining kontent-tahlili to'rtta dastur bo'yicha kafedra tomonidan o'qitiladigan va 2026/2027 o'quv yilida o'quv dasturlari ishlab chiqilgan fanlarni qamrab oldi (2-jadval, 3-rasm).

[1] Manba: muallif ishlanmasi.

2-jadval

O‘quv rejalarida yashil/bioiqtisodiy mazmunli fanlarning ulushi, (2026/2027 o‘quv yili)[1]

Ta’lim dasturi	Tahlil qilingan fanlar soni	Yashil/bioiqtisodiy mazmunli fanlar	Ulushi, foizda	Namunalar
Logistika (bakalavr)	24	9	37,5	Yashil iqtisodiyot; Sirkulyar iqtisodiyot; Barqaror rivojlanish iqtisodiyoti; Tejamkor logistika; Agrobiznesni tashkil etish
Biznesni boshqarish (bakalavr)	17	11	64,7	ESG strategiyasi; Yashil moliya va investitsiyalar; Yashil marketing va sirkulyar brending; Qiymat zanjiri va ekodizayn
Bioiqtisodiyot (magistratura)	12	10	83,3	Bioiqtisodiy rivojlanish va siyosat; Aqlli qishloq xo‘jaligi; Atrof-muhit iqtisodiyoti; Sirkulyar iqtisodiyot; Biomahsulotlar bozori
Biznesni boshqarish (magistratura)	12	4	33,3	Barqaror ta’minot zanjiri; Sirkulyar biznes modellari; Korporativ barqarorlik va ESG; Yashil moliya
Jami	65	34	52,3	-



3-rasm. Ta’lim dasturlari kesimida yashil/bioiqtisodiy mazmunli fanlar ulushi[2]

Tahlil natijalari uch muhim xulosaga olib keladi. Birinchidan, “Bioiqtisodiyot” magistratura dasturi o‘z nomiga to‘la mos keladi - fanlarning 83,3 foizi bevosita

[1] Manba: muallif ishlanmasi.
[2] Manba: muallif ishlanmasi.

bioiqtisodiyot mazmuniga ega. Ikkinchidan, bakalavriat dasturlarida yashil komponent asosan tanlov fanlari hisobiga shakllangan: “Biznesni boshqarish” yo‘nalishida kafedra profiliga mos tanlov fanlarining barchasi (ESG strategiyasi, yashil moliya, sirkulyar brending, ekodizayn) yashil mazmunga ega bo‘lsa, majburiy fanlarda bunday mazmun cheklangan. Uchinchidan, “Logistika” (37,5 foiz) va “Biznesni boshqarish” magistraturasi (33,3 foiz) dasturlarida yashil komponentni kuchaytirish zaxirasi mavjud - xususan, yashil logistika, uglerod izini hisoblash, barqaroror ta’minot zanjiri kabi fanlarni majburiy blokka kiritish orqali.

Kafedra o‘qitadigan 65 ta fanning 34 tasi (52,3 foiz) yashil/bioiqtisodiy mazmunga ega bo‘lib, bu kafedraning “yashil iqtisodiyot” profiliga qayta yo‘naltirilishi amalda boshlanganini ko‘rsatadi. Shu bilan birga, o‘quv dasturlari Top-300 xalqaro universitetlarning tegishli kurslari (Wageningen University, MIT, Oxford, TU Delft va boshqalar) asosida takomillashtirilgani ularning xalqaro standartlarga mosligini oshiradi.

Kafedraning mintaqaviy bioiqtisodiyotni rivojlantirishdagi rolini kuchaytirish nuqtayi nazaridan ichki va tashqi muhit omillari 3-jadvalda umumlashtirilgan.

3-jadval

Kafedraning SWOT-tahlili[1]

Kuchli tomonlar (S)	**Zaif tomonlar (W)**
– Bioiqtisodiyot bo‘yicha amaldagi magistratura dasturi (yashil fanlar ulushi 83,3%) – DSc darajali rahbar, turizm va mintaqaviy iqtisodiyot bo‘yicha ilmiy maktab – O‘quv dasturlarining Top-300 OTM kurslari asosida yangilanganligi – Erasmus+ ESGCA loyihasida ishtirok – Kafedra xodimlarining hududiy forum va tadbirlarni tashkil etishdagi tajribasi	– Ilmiy salohiyatning 54,5% darajasida ekanligi – Tor ixtisoslikdagi (sirkulyar iqtisodiyot, yashil moliya, biomassa iqtisodiyoti) kadrlar yetishmasligi – Scopus/WoS bazalaridagi nashrlar sonining cheklanganligi – Kafedraning korxonalar bilan xo‘jalik shartnomalari va patent faoliyatining sustligi – Ingliz tilida o‘qitiladigan fanlarning kamligi
Imkoniyatlar (O)	**Tahdidlar (T)**
– Klassifikatorda to‘rtta yangi yashil yo‘nalishning mavjudligi – “O‘zbekiston - 2030” va yashil iqtisodiyotga o‘tish strategiyasi doirasidagi davlat buyurtmasi – Buxoro viloyati Ekologiya va iqlim o‘zgarishi boshqarmasi bilan hamkorlik – Xalqaro bioiqtisodiyot forumlari, EBUA va boshqa xalqaro tarmoqlar – Agrosanoat va to‘qimachilik korxonalarining chiqindilarni qayta ishlashga bo‘lgan ehtiyoji	– Boshqa OTMlar bilan yashil yo‘nalishlar bo‘yicha raqobatning kuchayishi – Malakali kadrlarning xususiy sektor va xorijga oqib ketishi – Yangi yo‘nalishlarga abituriyentlar talabining noaniqligi – O‘quv-uslubiy ta’minot va laboratoriya bazasini yaratish uchun moliyaviy resurslarning cheklanganligi

[1] Manba: muallif ishlanmasi.

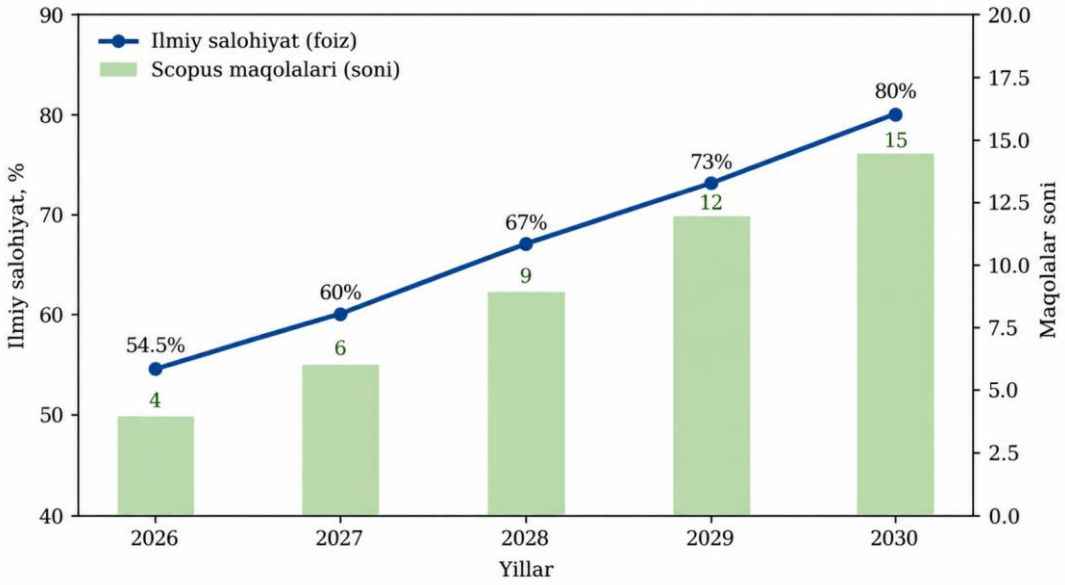
SWOT-tahlil kafedra uchun “SO” (kuchli tomonlar orqali imkoniyatlardan foydalanish) va “WO” (imkoniyatlar hisobiga zaif tomonlarni bartaraf etish) strategiyalarini ustuvor deb belgilashga asos beradi: amaldagi bioiqtisodiyot magistraturasi va xalqaro loyiha tajribasiga tayanib yangi yo‘nalishlarni ochish, shu asosda ilmiy darajali kadrlarni jalb etish va tayyorlash.

Kafedraning strategik rivojlanish rejasida belgilangan va mazkur tadqiqot doirasida tizimlashtirilgan asosiy maqsadli ko‘rsatkichlar 4-jadvalda keltirilgan; ilmiy salohiyat va Scopus nashrlari bo‘yicha trayektoriya 4-rasmda aks ettirilgan.

4-jadval

Kafedraning 2026-2030-yillarga mo‘ljallangan asosiy maqsadli ko‘rsatkichlari (KPI)[1]

Ko‘rsatkich	2026-yil (bazaviy)	2027-yil	2028-yil	2029-yil	2030-yil
Ilmiy salohiyat, foizda	54,5	60	67	73	80
Professor-o‘qituvchilar soni	11	13	15	17	18
Scopus/WoS maqolalari (yillik), dona	4	6	9	12	15
Ochilgan yangi ta’lim yo‘nalishlari (jamlanma)	0	1	2	3	4
Yashil/bioiqtisodiy mazmunli fanlar ulushi, foizda	52,3	58	63	68	72
Patent/mualliflik guvohnomalari (jamlanma)	1	3	5	7	10
Korxonalar bilan xo‘jalik shartnomalari, dona	-	2	3	5	6
Xalqaro hamkorlik bitimlari (jamlanma)	1	3	5	7	9



4-rasm. Ilmiy salohiyat va Scopus nashrlari bo‘yicha maqsadli trayektoriya (2026-2030 yillar)[2]

[1] Manba: muallif ishlanmasi.
[2] Manba: muallif ishlanmasi.

4-jadval va 4-rasmdan ko‘rinadiki, kafedra 2030-yilga qadar ilmiy salohiyatni 25,5 foiz punktga oshirib, 80 foizga yetkazishni, shuningdek Scopus/WoS bazalaridagi yillik nashrlar sonini qariyb 4 baravarga ko‘paytirishni maqsad qilgan. Ushbu ko‘rsatkichlarga erishish uchun yiliga kamida 1-2 nafar PhD himoyasi, DSc/PhD darajali mutaxassislarni tashqaridan jalb etish hamda yosh o‘qituvchilarni tayanch doktoranturaga yo‘naltirish talab etiladi. Yangi yo‘nalishlarni bosqichma-bosqich (2027-yil - “Yashil iqtisodiyot” bakalavriati; 2028-2030-yillar - uchta magistratura mutaxassisligi) ochish kadrlar salohiyati o‘sishi bilan muvofiqlashtirilgan.

XULOSA VA TAKLIFLAR

Tadqiqot natijalari shuni ko‘rsatadiki, oliy ta’lim muassasasi, xususan, uning profilli kafedrasi mintaqaviy sirkulyar bioiqtisodiyotni rivojlantirishda uchta o‘zaro bog‘liq funksiya - malakali kadrlar tayyorlash, ilmiy-tadqiqot va innovatsion transfer - orqali faol ishtirok etishi mumkin va lozim. Buxoro davlat universiteti “Yashil iqtisodiyot va biznes” kafedrasi misoli shuni tasdiqlaydiki, kafedra profilini yashil iqtisodiyot va bioiqtisodiyot tomon qayta yo‘naltirish o‘quv rejalari darajasida amalda boshlangan (yashil mazmunli fanlar ulushi - 52,3 foiz; magistraturada - 83,3 foiz), biroq kadrlar salohiyati (54,5 foiz) va innovatsion faoliyat (patentlar, xo‘jalik shartnomalari) bo‘yicha sezilarli zaxiralar mavjud.

Tahlil asosida quyidagi takliflar ishlab chiqildi:

1. Kafedra ta’lim portfelini klassifikatorda mavjud to‘rtta yangi yo‘nalish (60411800 “Yashil iqtisodiyot”, 70410112 “Sirkulyar iqtisodiyot”, 70410806 “Yashil loyihalar boshqaruvi”, 70420210 “Barqaror rivojlanish”) hisobiga bosqichma-bosqich kengaytirish, bunda har bir yo‘nalish uchun hududiy mehnat bozori ehtiyojini oldindan o‘rganish.

2. Ilmiy salohiyatni 2030-yilga qadar 80 foizga yetkazish maqsadida kafedra yosh o‘qituvchilari uchun maqsadli doktorantura rejasini tuzish, sirkulyar iqtisodiyot, yashil moliya va biomassa iqtisodiyoti bo‘yicha ixtisoslashgan mutaxassislarni jalb etish.

3. “Logistika” bakalavriati va “Biznesni boshqarish” magistraturasi o‘quv rejalarida yashil komponentni majburiy fanlar hisobiga kuchaytirish (yashil logistika, uglerod izini hisoblash, barqaror ta’minot zanjiri menejmenti).

4. Buxoro viloyati Ekologiya va iqlim o‘zgarishi boshqarmasi hamda agrosanoat, to‘qimachilik korxonalari bilan hududiy biomassa resurslarini inventarizatsiya qilish va qayta ishlash bo‘yicha qo‘shma amaliy tadqiqotlar va xo‘jalik shartnomalarini yo‘lga qo‘yish.

5. Erasmus+ ESGCA loyihasi va xalqaro bioiqtisodiyot forumi platformasidan foydalangan holda Yevropa va Markaziy Osiyo universitetlari bilan qo‘shma magistratura dasturlari, o‘qituvchilar almashinuvi va qo‘shma nashrlar bo‘yicha hamkorlikni institutsionallashtirish.

6. Kafedra huzurida “Sirkulyar bioiqtisodiyot” ilmiy-amaliy laboratoriyasi (yoki markazini) tashkil etish va uni talabalar startaplari, patent faoliyati hamda korxonalarga konsalting xizmatlari ko‘rsatish markazi sifatida rivojlantirish.

Taklif etilgan konseptual model va tahlil metodikasi O‘zbekistonning boshqa mintaqalaridagi OTMlar hamda shunga o‘xshash kafedralar uchun ham qo‘llanilishi

mumkin. Kelgusi tadqiqotlar hududiy biomassa resurslari salohiyatini miqdoriy baholash, bitiruvchilar bandligi va ish beruvchilar qoniqishini o‘rganish hamda rejaviy ko‘rsatkichlarning faktik bajarilishini monitoring qilishga qaratilishi maqsadga muvofiq.

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ПРОБЛЕМЫ УПРАВЛЕНИЯ ТВЁРДЫМИ БЫТОВЫМИ ОТХОДАМИ И ПУТИ ИХ РЕШЕНИЯ В КАЗАХСТАНЕ

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Аннотация

В статье будут рассмотрены ключевые проблемы управления твёрдыми бытовыми отходами в Республике Казахстан и разработаны возможные рекомендации по их решению. Актуальность данной статьи обусловлена ростом объёмов образования отходов, недостаточным уровнем сортировки и переработки, проблемами сбора, транспортировки и захоронения отходов. Наибольшее внимание уделяется развитию системы сортировки отходов, расширения переработки вторичного сырья, совершенствованию инфраструктуры, повышению государственного регулирования. Информационную базу составили данные Бюро национальной статистики и Министерства экологии и природных ресурсов Республики Казахстан за 2021-2025 годы. Показано, что при росте объёма коммунальных отходов на 36,4% количество отсортированных отходов увеличилось лишь на 28,8%, а доля сортировки снизилась с 29,7% до 28,1%, что сохраняет высокую нагрузку на полигоны. На основе анализа подходов и проблем, сделан вывод о необходимости комплексного, мультифакторного подхода, включающего в себя как экономические и экологические, так и технологические и организационные факторы.

Ключевые слова: твёрдые бытовые отходы, управление отходами, переработка отходов, раздельный сбор, полигоны отходов, циркулярная экономика, экологическая устойчивость, Казахстан.

Annotatsiya

Maqolada Qozog‘iston Respublikasida qattiq maishiy chiqindilarni boshqarishning asosiy muammolari ko‘rib chiqilgan va ularni hal etish bo‘yicha tavsiyalar ishlab chiqilgan. Maqolaning dolzarbligi chiqindilar hosil bo‘lish hajmining

o‘sishi, saralash va qayta ishlash darajasining yetarli emasligi, chiqindilarni yig‘ish, tashish va ko‘mish bilan bog‘liq muammolar bilan izohlanadi. Asosiy e’tibor chiqindilarni saralash tizimini rivojlantirish, ikkilamchi xomashyoni qayta ishlashni kengaytirish, infratuzilmani takomillashtirish va davlat tomonidan tartibga solishni kuchaytirishga qaratilgan. Axborot bazasini Qozog‘iston Respublikasi Milliy statistika byurosi hamda Ekologiya va tabiiy resurslar vazirligining 2021-2025-yillarga oid ma’lumotlari tashkil etdi. Kommunal chiqindilar hajmi 36,4 foizga oshgani holda saralangan chiqindilar miqdori atigi 28,8 foizga ko‘paygani, saralash ulushi esa 29,7 foizdan 28,1 foizga kamaygani ko‘rsatildi, bu esa poligonlarga tushadigan yuklamani yuqoriligicha saqlab qolmoqda. Yondashuvlar va muammolar tahlili asosida iqtisodiy va ekologik, shuningdek, texnologik va tashkiliy omillarni o‘z ichiga olgan kompleks, ko‘p omilli yondashuv zarurligi haqida xulosa qilindi.

Kalit so‘zlar: qattiq maishiy chiqindilar, chiqindilarni boshqarish, chiqindilarni qayta ishlash, alohida yig‘ish, chiqindi poligonlari, aylanma iqtisodiyot, ekologik barqarorlik, Qozog‘iston.

Abstract

The article examines the key problems of municipal solid waste management in the Republic of Kazakhstan and develops recommendations for addressing them. The relevance of the study stems from the growing volume of waste generation, insufficient levels of sorting and recycling, and problems in waste collection, transportation and landfilling. Particular attention is paid to developing the waste sorting system, expanding the recycling of secondary raw materials, improving infrastructure and strengthening state regulation. The information base comprises data from the Bureau of National Statistics and the Ministry of Ecology and Natural Resources of the Republic of Kazakhstan for 2021-2025. It is shown that while the volume of municipal waste increased by 36.4%, the amount of sorted waste grew by only 28.8%, and the sorting share declined from 29.7% to 28.1%, which keeps the load on landfills high. Based on the analysis of approaches and problems, the study concludes that a comprehensive, multifactor approach covering economic, environmental, technological and organisational factors is required.

Keywords: municipal solid waste, waste management, waste recycling, separate collection, landfills, circular economy, environmental sustainability, Kazakhstan.

ВВЕДЕНИЕ

Проблема отходов - одна из главных не только в странах центральной Азии, но и во всем мире, как для экологии, так и для экономики [4]. Рост потребления, развитие производственного сектора, приводит к большему числу элементов одноразового использования, поэтому мусора становится больше. Существует система сбора, перевозки, сортировки, переработки и утилизации отходов, но в достаточной мере она не способна обеспечить качественный результат.

Большая часть мусора в Республике Казахстан все еще отправляется на свалки. Это вредит природе и означает, что мы, во-первых, выбрасываем ценное сырье, которое можно было бы использовать повторно, что позволило бы сильно сэкономить на сырье, соответственно снизит производственные издержки

увеличив потенциальную прибыль предпринимателей или производств, регулируемых государственным сектором, а во-вторых, благоприятно скажется на экологической обстановке, уменьшив темпы загрязнений. Кроме того, не хватает инфраструктуры для раздельного сбора мусора, в разных регионах с этим справляются по-разному, а общественное равнодушие к этому вопросу так же играет немаловажную роль.

Ситуация требует внедрения изменений в систему в целом. Вместо того чтобы просто утилизировать отходы посредством их захоронения, нужно внедрять более продуманную систему с уменьшенными темпами производства мусора, повторного использования сырья, качественной сортировкой и переработкой. Для Казахстана это важно не только с точки зрения экологии, но и экономики. Развитие переработки создаст новые рабочие места, сформирует рынок вторичного сырья и уменьшит количество мусора на свалках.

Эта статья ставит своей целью разобраться в основных проблемах обращения с бытовым мусором в Казахстане и предложить пути улучшения существующей системы.

Для этого будет рассмотрено текущее положение дел с управлением бытовыми отходами в стране, главные трудности в сборе, сортировке, переработке и захоронении мусора, действующие государственные меры регулирования в этой сфере, основные направления, по которым можно улучшить систему управления бытовыми отходами, изучена система управления бытовыми отходами в Казахстане. В центре внимания - организационные, экономические и экологические вопросы, связанные со сбором, перевозкой, сортировкой, переработкой и утилизацией мусора.

ЛИТЕРАТУРНЫЙ ОБЗОР

Проблематика управления твёрдыми бытовыми отходами (ТБО) широко представлена в зарубежной и казахстанской научной литературе. В докладе Всемирного банка «What a Waste 2.0» показано, что объёмы образования отходов в мире продолжают расти, а в странах с низким и средним уровнем дохода значительная часть отходов по-прежнему размещается на открытых свалках и полигонах [4]. Сравнительный анализ систем обращения с отходами в 20 городах мира, выполненный Д. Уилсоном и соавторами, позволил выделить как физические компоненты системы (сбор, переработка, захоронение), так и её управленческие элементы - вовлечённость пользователей, финансовую устойчивость, институциональную основу и проактивную политику [6]. Л. Герреро, Г. Маас и У. Хогланд, обобщив опыт городов развивающихся стран, пришли к выводу, что эффективность системы определяется не только техническими, но и экономическими, институциональными и социальными факторами [2].

Концептуальную основу современных подходов составляет модель циркулярной экономики. Дж. Кирххерр, Д. Райке и М. Хеккерт, проанализировав 114 определений этого понятия, показали, что циркулярная экономика чаще всего понимается как сочетание сокращения, повторного использования и

переработки ресурсов на микро-, мезо- и макроуровнях [5]. В этой логике захоронение рассматривается как наименее предпочтительный способ обращения с отходами.

Казахстанские исследования фокусируются прежде всего на крупных городах. В.Й. Инглезакис и соавторы оценили действующую систему обращения с ТБО в Астане и Алматы и сравнили альтернативные сценарии управления, показав потенциал сортировки и переработки по сравнению с преобладающим захоронением [3]. Б. Абылхани и соавторы изучили сезонный морфологический состав отходов Астаны и свойства их горючей фракции, что важно для выбора технологий переработки [1]. З.К. Калиаскарова, Ж.Н. Алиева и А.С. Иканова отметили, что значительная часть ТБО Алматы представляет собой вторичное сырьё, и указали на необходимость стимулирования предпринимательства в сфере переработки [10]. Е.А. Кузнецова и соавторы на основе опыта Южной Кореи, Японии и Великобритании предложили адаптированную модель управления отходами для Алматы, включающую цифровизацию, раздельный сбор, стимулирующие меры и государственно-частное партнёрство [11]. Проблемы и перспективы утилизации ТБО в Республике Казахстан рассмотрены также в работе Д. Бекжанова [7].

Вместе с тем в литературе недостаточно внимания уделяется региональным различиям в уровне сортировки и переработки отходов, а также взаимосвязи инфраструктурных, экономических и поведенческих факторов на национальном уровне. Восполнению этого пробела посвящено настоящее исследование.

МЕТОДОЛОГИЯ

Исследование носит прикладной аналитический характер и основано на сочетании нескольких методов. Информационную базу составили официальные данные Бюро национальной статистики Республики Казахстан об объёмах образования, сортировки, переработки и захоронения коммунальных отходов за 2021-2025 годы [8], данные Министерства экологии и природных ресурсов Республики Казахстан о доле сортировки и переработки ТБО в разрезе регионов за 2025 год [14], а также официальные материалы министерства и региональных органов [12]; [13]; [15]; [16].

На первом этапе использован метод анализа динамики: рассчитаны абсолютные и относительные изменения показателей за 2021-2025 годы, а также доли отсортированных и направленных на переработку отходов в общем объёме их образования (таблица 1).

На втором этапе применён сравнительный региональный анализ. По 17 областям и трём городам республиканского значения сопоставлены объёмы образованных ТБО и объёмы их сортировки и переработки, что позволило выявить территориальную неоднородность системы (рисунок 1).

На третьем этапе проведён анализ документов: Концепции управления всеми видами отходов в Республике Казахстан на 2026-2030 годы [17], Программы по управлению коммунальными отходами города Караганды на

2025-2029 годы [18] и профессионального стандарта в сфере управления отходами [9].

Кроме того, использованы методы системного анализа и обобщения научной литературы [2]; [3]; [6]; [11], на основе которых выявленные проблемы сгруппированы по инфраструктурным, экономическим, поведенческим и регуляторным факторам, а также сформулированы предложения по совершенствованию системы управления ТБО.

АНАЛИЗ И РЕЗУЛЬТАТЫ

Проблема управления твёрдыми бытовыми отходами в Казахстане связана не только с ростом объёмов, но и с недостаточной эффективностью всей цепочки обращения с отходами - от момента образования до конечной переработки или захоронения. В исследованиях по казахстанской системе обращения с отходами выделяется недостаточное развитие раздельного сбора непосредственно в местах образования отходов. При смешанном сборе значительная часть потенциально пригодного для переработки сырья теряет свои свойства либо требует дополнительных затрат на сортировку [7].

Раздельный сбор важен не только с экологической, но и с экономической стороны. При разделении отходов на основные фракции уже на этапе образования снижается нагрузка на сортировочные комплексы. Повышается качество вторичного сырья. Поэтому рост числа контейнеров сам по себе не решает задачу. Нужна система, где инфраструктура сбора связана с последующей сортировкой, переработкой и реализацией полученного вторичного сырья. Территориальная неоднородность системы управления отходами остаётся существенной проблемой.

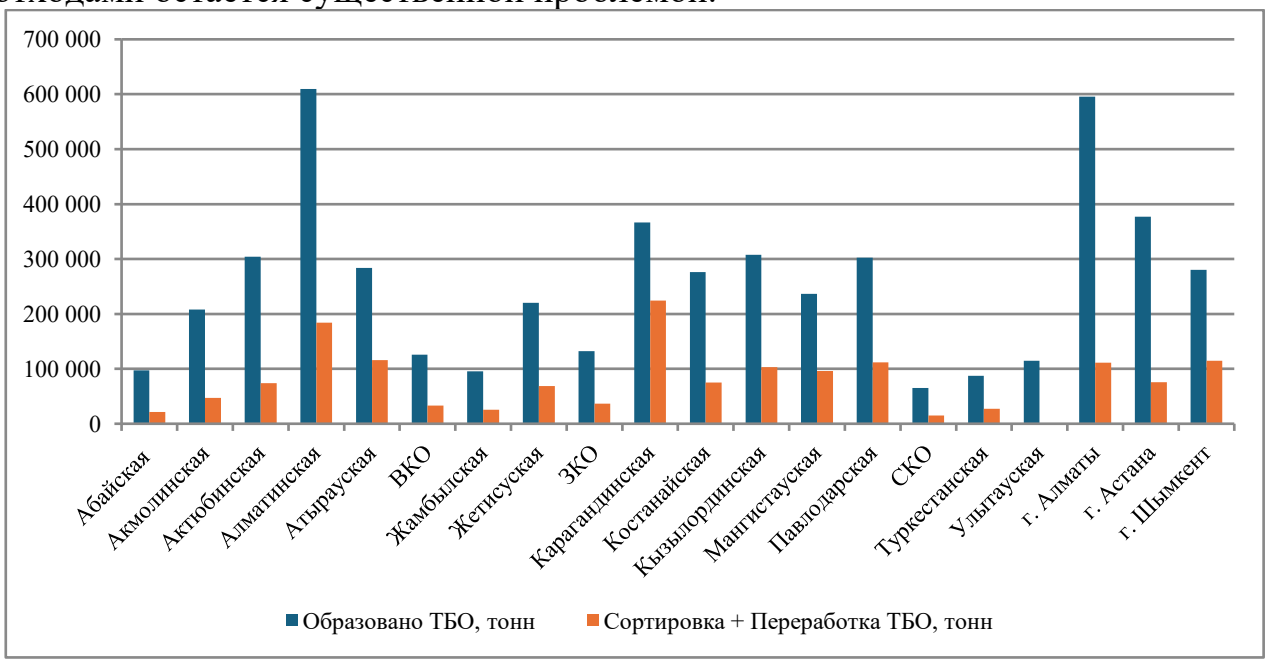


Рисунок 1. Доля сортировки и переработки ТБО в разрезе регионов за 2025 год[1]

[1] Источник: составлено автором на основе данных [14].

Как видно из следующей диаграммы (рисунок 1), в разрезе регионов Казахстана объем образования твердых бытовых отходов существенно различается, лидерами являются Алматинская область и город Алматы. Наибольший удельный вес сортировки и переработки мусора приходится на Карагандинскую область - 61,2 % от общего объема ТБО [14].

Данные рисунка 1 показывают, что в 2025 году уровень сортировки и переработки ТБО существенно различался по регионам. Наряду с Карагандинской областью (61,2%) относительно высокие значения отмечены в г. Шымкенте и Атырауской области (по 40,8%), Мангистауской (40,6%) и Павлодарской (37,0%) областях. В то же время в городах с наибольшими объёмами образования отходов - Алматы (595,5 тыс. тонн) и Астане (377,0 тыс. тонн) - доля сортировки и переработки составила лишь 18,7% и 20,0% соответственно, а по Улытауской области объём сортировки и переработки не отражён. В целом по представленным регионам сортировкой и переработкой было охвачено около 30,7% образованных ТБО [14].

Инфраструктура в крупных городах развивается быстрее, чем в небольших населённых пунктах и отдельных регионах. В Алматинской области, области Абай в 2024 году среди основных проблем в сфере обращения с отходами отмечались слабая развитость инфраструктуры, несоответствие полигонов установленным требованиям и наличие несанкционированных свалок [13]. Это означает, что общенациональные показатели переработки не всегда отражают реальное состояние системы на региональном уровне.

Исследование системы управления отходами Алматы показывает, что даже наличие специализированной инфраструктуры не гарантирует переход к высокой доле переработки. Для города характерны значительные объёмы образования отходов. Это требует постоянного развития сортировки и переработки. В научной литературе подчёркивается необходимость стимулирования предпринимательской деятельности в сфере переработки. Значительная часть ТБО потенциально может быть возвращена в хозяйственный оборот как вторичное сырьё [10]. Значимость инфраструктурного фактора подтверждают и современные исследования. При оценке системы управления ТБО в Алматы отмечается необходимость сочетания экономических, экологических и социальных инструментов, а также адаптации зарубежного опыта к местным условиям. Простое копирование моделей других стран не решает проблему без учёта особенностей городской инфраструктуры, потребительского поведения и действующей системы регулирования [11].

Проблема связана не только с недостатком перерабатывающих мощностей. По данным Министерства экологии и природных ресурсов Республики Казахстан, в стране ежегодно образуется более 4,5 млн тонн коммунальных отходов. В 2024 году уровень их переработки составил 25,8%, в 2025 году - 28,6% [12]. Положительная динамика показывает, что существующие меры дают результат. Более 70% коммунальных отходов всё ещё не возвращаются в хозяйственный оборот через переработку. Состояние

полигонов требует отдельного внимания. По данным Министерства экологии, в Казахстане насчитывается более 3 тыс. полигонов. Около 21% из них соответствует установленным требованиям [15].

Рост переработки не отменяет проблему захоронения. Совершенствование системы должно включать строительство перерабатывающих предприятий и модернизацию существующих полигонов. Нужны контроль за эксплуатацией полигонов и сокращение объёмов отходов, направляемых на захоронение. Опыт отдельных регионов показывает, что развитие сортировки и раздельного сбора меняет структуру обращения с отходами. В Кызылординской области за первые три квартала 2024 года из накопленных 303 тыс. тонн ТБО переработали 91,2 тыс. тонн, или 30,1%. В регионе работали 17 субъектов предпринимательства, занимавшихся сбором, сортировкой и переработкой отходов [16].

Развитие частного предпринимательства можно рассматривать как инструмент повышения эффективности системы. Этому помогает государственная поддержка и гарантированный спрос на вторичное сырьё. Изучение литературы и современных данных позволяет выделить взаимосвязанные проблемы: недостаточное распространение раздельного сбора, неодинаковый уровень развития инфраструктуры в регионах, ограниченные мощности переработки, неудовлетворительное состояние части полигонов и недостаточная экономическая привлекательность переработки отходов. Решение этих проблем требует перехода от линейной модели к модели, где отходы рассматриваются как потенциальный ресурс. Развитие переработки следует сопровождать совершенствованием системы сбора. Нужны экономические стимулы для предприятий, повышение экологической культуры населения и усиление контроля со стороны государства.

В 2021-2025 гг. наблюдается рост объёма коммунальных отходов [8]. Если в 2021 году было образовано 4,01 млн единиц отходов, то к 2025 году показатель достиг 5,47 млн, увеличившись примерно на 36,4%. При этом после некоторого снижения в 2022 году объём отходов ежегодно возрастал, причём наиболее существенный прирост пришёлся на 2024-2025 гг. Количество отсортированных отходов также увеличилось - с 1,19 млн в 2021 году до 1,53 млн в 2025 году, или примерно на 28,8%. Темпы роста сортировки отстают от темпов увеличения общего объёма отходов. Доля отсортированных отходов в общем объёме снизилась с 29,7% до 28,1%, что свидетельствует о сохранении значительной нагрузки на систему обращения с отходами. Показатель направления отходов на переработку характеризуется значительными колебаниями. В 2021-2023 гг. он находился в диапазоне 359-394 тыс., в 2024 году резко вырос до 588,2 тыс., однако уже в 2025 году снизился до 399,0 тыс. В результате доля направленных на переработку отходов в 2025 году составила около 7,3% от общего объёма, тогда как в 2024 году она достигала 12,7%. В 2021 году на захоронение было направлено 673,6 тыс., а в 2023 году показатель достиг максимума - 862,3 тыс. В 2024 году произошло резкое снижение до 490,4 тыс., однако в 2025 году объём вновь вырос до 826,6 тыс. Таким образом, несмотря на отдельные периоды

снижения, захоронение остаётся одним из основных способов обращения с коммунальными отходами. Данные показывают расширение масштабов образования отходов при недостаточно быстрых темпах развития их сортировки и переработки. Рост отсортированных отходов примерно на 29% оказался ниже роста общего объёма отходов на 36%, вследствие чего относительная доля сортировки сократилась. Это указывает на необходимость дальнейшего развития инфраструктуры раздельного сбора, сортировки и переработки отходов, а также снижения зависимости от их захоронения (таблица 1).

Таблица 1

Динамика объема сортировки, переработки и захоронения отходов РК 2021-2025 гг. (тонн)[1]

Год	Объем коммунальных отходов	Отсортировано	Направлено на переработку	Отправлено на захоронение
2021	4 006 493	1 191 690	393 700	673 636
2022	3 822 820	1 223 824	391 951	707 758
2023	4 142 952	1 307 785	358 892	862 293
2024	4 616 952	1 320 105	588 242	490 388
2025	5 465 071	1 534 843	398 993	826 612

Как видно из таблицы 1, за 2021-2025 гг. объём коммунальных отходов увеличился с 4 006 493 до 5 465 071 тонн, объём отсортированных отходов - с 1 191 690 до 1 534 843 тонн. При этом объём отходов, отправленных на захоронение, в 2025 году (826 612 тонн) почти вернулся к максимуму 2023 года (862 293 тонн), тогда как на переработку было направлено лишь 398 993 тонн [8].

Несмотря на положительную динамику сортировки и переработки, абсолютные объёмы образования отходов остаются высокими, что требует дальнейшего развития инфраструктуры раздельного сбора, сортировки и переработки. В 2024 году Министерство сообщало, что в Казахстане насчитывалось 3 016 полигонов, однако требованиям соответствовал только 21% из них [15]. Это показывает, что, несмотря на постепенное развитие системы обращения с коммунальными отходами, в стране по-прежнему сохраняются серьёзные проблемы. К основным из них можно отнести высокую нагрузку на полигоны, относительно невысокий уровень переработки и недостаточное развитие инфраструктуры раздельного сбора отходов.

Одной из наиболее заметных проблем остаётся большой объём отходов, который ежегодно направляется на захоронение. Увеличение количества образующихся коммунальных отходов создаёт дополнительную нагрузку на действующие полигоны и со временем требует расширения инфраструктуры. При этом важно учитывать не только количество существующих объектов, но и их техническое состояние, а также соответствие экологическим требованиям. По данным Министерства экологии и природных ресурсов Республики Казахстан, в

[1] Источник: составлено автором на основе данных Бюро национальной статистики Республики Казахстан [8].

стране действует более 3 тыс. полигонов твёрдых бытовых отходов, однако лишь часть из них соответствует установленным требованиям [15]. Поэтому наряду с созданием новых объектов необходимо уделять внимание модернизации уже существующих полигонов и повышению качества их эксплуатации.

Само захоронение отходов является наименее эффективным вариантом обращения с ресурсами. Вместе с бытовыми отходами на полигоны попадает большое количество материалов, которые могли бы использоваться повторно или перерабатываться. В результате они окончательно теряются для экономики. Кроме того, длительное накопление отходов может становиться причиной загрязнения почвы и водных ресурсов, образования свалочного газа и других экологических рисков. Поэтому снижение нагрузки на полигоны целесообразно связывать не столько с постоянным увеличением площадей для захоронения, сколько с уменьшением количества отходов, поступающих туда. Основными инструментами здесь должны стать сортировка, переработка и повторное использование материалов.

Не менее важной проблемой остаётся невысокая доля отходов, которые возвращаются в хозяйственный оборот. Хотя в последние годы наблюдается положительная динамика, значительная часть коммунальных отходов всё ещё не перерабатывается. По данным официальной статистики, в 2025 году объём собранных коммунальных отходов в Казахстане составил около 4,1 млн тонн, из которых было отсортировано примерно 1,5 млн тонн [8]. Рост объёма сортировки по сравнению с предыдущими годами говорит о постепенном расширении соответствующей инфраструктуры. Вместе с тем её нынешних возможностей пока недостаточно, чтобы существенно уменьшить зависимость системы от захоронения.

Недостаточная переработка создаёт проблемы не только для окружающей среды, но и для экономики. Бумага, картон, стекло, пластик, металлы и другие материалы могут выступать источником вторичного сырья. Когда они оказываются на полигонах, эти ресурсы теряются, а производственным предприятиям приходится использовать больше первичного сырья для выпуска новой продукции.

Одной из причин такой ситуации является сложность организации эффективного сбора и сортировки. Для получения качественного вторичного сырья отходы желательно разделять ещё в момент их образования. Если различные материалы смешиваются между собой, их последующая сортировка становится более дорогой и менее результативной. Поэтому увеличение объёмов переработки невозможно свести только к строительству перерабатывающих предприятий. Необходимо развивать всю цепочку обращения с отходами - от раздельного сбора и сортировки до формирования устойчивого рынка вторичного сырья.

Отдельного внимания требует инфраструктура раздельного сбора. В Казахстане она развивается неравномерно, поэтому возможности для сортировки отходов заметно отличаются в зависимости от региона и

конкретного населённого пункта. Особенно хорошо различия видны при сравнении крупных городов с небольшими населёнными пунктами.

Раздельный сбор позволяет отделять основные категории отходов непосредственно по месту их образования. Это уменьшает загрязнение вторичного сырья и упрощает его дальнейшую сортировку и переработку. Если же такой возможности нет, большинство отходов попадает в общий поток, после чего значительная часть пригодных для переработки материалов оказывается на полигонах.

При этом проблема инфраструктуры заключается не только в количестве контейнеров. Необходима целая система: регулярный вывоз отсортированных отходов, достаточные сортировочные мощности, пункты приёма вторичного сырья и налаженное взаимодействие между населением, операторами по сбору отходов и перерабатывающими предприятиями.

Большое значение имеет и удобство самой системы для населения. Если контейнеры находятся далеко от жилых домов, быстро переполняются или вывозятся нерегулярно, желание людей сортировать отходы закономерно снижается. Поэтому развитие инфраструктуры должно идти параллельно с информационной и просветительской работой. Таким образом, недостаточное развитие раздельного сбора остаётся одним из факторов, сдерживающих рост переработки коммунальных отходов в Казахстане. Расширение такой инфраструктуры позволит увеличить объём материалов, возвращаемых в хозяйственный оборот, и одновременно уменьшить нагрузку на полигоны.

Рассмотренные проблемы тесно связаны друг с другом. Большой объём образующихся отходов при относительно низком уровне переработки приводит к росту нагрузки на полигоны. В свою очередь, возможности переработки ограничиваются недостаточным развитием раздельного сбора и сортировочной инфраструктуры. Поэтому решить проблему только отдельными мерами будет сложно. Необходим последовательный переход к системе, основанной на принципах циркулярной экономики.

Ещё одним препятствием для развития переработки является экономическая невыгодность работы с отдельными видами отходов. Разные материалы имеют разную стоимость в качестве вторичного сырья, а затраты на их сбор, транспортировку, сортировку и подготовку к переработке могут существенно различаться. Особенно сложным является обращение с отходами, которые имеют низкую рыночную стоимость или требуют дополнительных технологических операций.

По этой причине перерабатывающим предприятиям зачастую выгоднее сосредотачиваться на тех категориях отходов, которые пользуются устойчивым спросом и имеют более высокую стоимость. Материалы с низкой экономической привлекательностью в таком случае продолжают поступать на полигоны.

Серьёзную роль играют и транспортные расходы. Перерабатывающие предприятия в основном расположены в крупных населённых пунктах, тогда как отходы образуются практически на всей территории страны. Для небольших

населённых пунктов перевозка сравнительно небольших объёмов вторичного сырья на большие расстояния может оказаться экономически неоправданной. Следовательно, увеличение объёмов переработки требует не только создания новых предприятий, но и формирования условий, при которых переработка разных видов отходов будет интересна бизнесу. В качестве таких инструментов могут использоваться государственная финансовая поддержка, льготное кредитование, субсидирование отдельных проектов, развитие рынка вторичного сырья и стимулирование предприятий, использующих переработанные материалы.

Эффективность всей системы во многом зависит от поведения населения. Даже хорошо организованная инфраструктура раздельного сбора не даст ожидаемого результата, если люди не будут регулярно разделять отходы и соблюдать установленные правила. Одной из причин является недостаточная информированность граждан. Для части населения сортировка воспринимается как дополнительное действие, которое требует времени, но при этом не даёт понятного практического результата. Отсутствие устойчивой бытовой привычки также снижает готовность участвовать в раздельном сборе. Если человек не понимает, что происходит с отсортированными им отходами дальше, мотивация продолжать сортировку становится ниже. Поэтому развитие системы обращения с отходами должно сопровождаться постоянным экологическим просвещением. Населению необходимо доступно объяснять правила сортировки, расположение контейнеров и дальнейший путь собранных отходов.

Информационная работа может проводиться через образовательные учреждения, средства массовой информации, социальные сети, органы местного самоуправления и операторов системы обращения с отходами. При этом одной-двух информационных кампаний недостаточно. Формирование экологических привычек требует времени и регулярного повторения информации. Важно, чтобы экологическое просвещение не ограничивалось призывами "сортировать отходы". Гражданам необходимо показывать практический результат такого поведения и объяснять, каким образом раздельный сбор связан с сокращением объёмов захоронения и повторным использованием ресурсов. В таком случае экологическая культура становится частью самой системы управления отходами, а не отдельным информационным мероприятием.

Ещё одним направлением, требующим внимания, является нормативное регулирование и контроль. Для эффективного управления отходами необходимо чётко определить ответственность государственных органов, местных исполнительных органов, предприятий, операторов по сбору отходов и населения. Само наличие нормативных требований ещё не означает, что они будут выполняться на практике. Важную роль играет контроль за образованием, сбором, транспортировкой, сортировкой, переработкой и захоронением отходов. При недостаточном контроле увеличивается вероятность нарушения экологических требований, появления несанкционированных свалок и неправильного обращения с отходами.

Отдельная проблема связана с контролем за полигонами. Объекты размещения отходов должны соответствовать экологическим требованиям, а их эксплуатация - учитывать возможное воздействие на окружающую среду. Если состояние полигонов контролируется недостаточно, экологические риски возрастают, а государство в дальнейшем может столкнуться с дополнительными расходами на устранение последствий ненадлежащего обращения с отходами.

Перспективным направлением является повышение прозрачности информации о движении отходов. Использование цифровых систем контроля может позволить отслеживать их путь от момента образования до конечного размещения: объёмы сбора, транспортировку, сортировку и переработку. Это, в свою очередь, позволит объективнее оценивать работу участников системы и быстрее выявлять проблемные участки. При этом совершенствование регулирования не должно сводиться исключительно к усилению контроля и ответственности. Не менее важно создавать экономические стимулы, которые будут заинтересовывать предприятия и население в сокращении образования отходов, их повторном использовании и переработке. Наиболее эффективной такая система будет тогда, когда соблюдение экологических требований будет сочетаться с реальной экономической выгодой.

Существует также проблема нехватки квалифицированных кадров для сферы управления отходами. В частности, для ее решения и ориентации при составлении образовательных программ в подготовке будущих специалистов разработан Профессиональной стандарт «Управление отходами (управление опасными и неопасными отходами)». Данный стандарт подготовлен совместными усилиями базовой организации Технического комитета по стандартизации № 122 Казахстанской ассоциации по управлению отходами «KazWaste», Министерства экологии и природных ресурсов Республики Казахстан и Министерства труда и социальной защиты населения Республики Казахстан [9].

В целом управление твёрдыми бытовыми отходами в Казахстане представляет собой комплексную задачу. Экономические ограничения переработки, поведение населения и качество государственного регулирования непосредственно связаны с состоянием инфраструктуры и объёмами образования отходов. Поэтому дальнейшее развитие системы должно одновременно учитывать экономические, организационные и экологические аспекты.

Для решения выявленных проблем недостаточно просто увеличивать количество полигонов или строить новые перерабатывающие предприятия. Необходима последовательная система, которая начинается с сокращения образования отходов и включает их раздельный сбор, сортировку, переработку и повторное использование полученного сырья.

Одним из первоочередных направлений является дальнейшее развитие инфраструктуры раздельного сбора. Контейнеры для отдельных категорий отходов необходимо устанавливать не только в крупных городах, но и в

небольших населённых пунктах. При этом при планировании инфраструктуры следует учитывать реальные объёмы образования отходов и особенности конкретной территории. Сама система раздельного сбора должна быть удобной для населения. Контейнеры следует размещать в доступных местах, своевременно освобождать от накопившихся отходов и снабжать понятной маркировкой. В противном случае даже наличие необходимой инфраструктуры не гарантирует её эффективного использования.

Вторым важным направлением является расширение перерабатывающей инфраструктуры. Необходимо стимулировать создание и модернизацию предприятий, работающих с бумагой, картоном, пластиком, стеклом, металлами и другими видами вторичного сырья. В первую очередь это актуально для регионов, где объём образующихся отходов значительно превышает имеющиеся мощности по их переработке. Развитие перерабатывающей отрасли позволит одновременно уменьшить количество захораниваемых отходов и создать дополнительные рабочие места. Для тех видов отходов, переработка которых при существующих ценах остаётся малорентабельной, необходимы экономические стимулы. Государственная поддержка может включать льготное кредитование, субсидирование инвестиционных проектов, налоговые меры и поддержку предприятий, использующих вторичное сырьё. Это позволит сделать переработку более привлекательной даже в тех случаях, когда рыночная стоимость материала сама по себе недостаточна для покрытия всех затрат.

Перспективным инструментом остаётся и дальнейшее развитие принципа расширенной ответственности производителей. Производители и импортёры должны учитывать не только реализацию продукции, но и последующее обращение с отходами, которые она образует. Такая экономическая ответственность может стимулировать компании сокращать использование трудно перерабатываемых материалов и постепенно переходить на более экологичные виды упаковки и продукции.

Необходимо продолжать работу и с населением. Информационные кампании должны объяснять не только саму необходимость сортировки, но и её конкретный результат. Гражданам важно понимать, какие отходы следует помещать в определённые контейнеры, что происходит с ними после вывоза и каким образом раздельный сбор помогает уменьшить объёмы захоронения.

Для формирования устойчивых привычек экологическое просвещение должно быть постоянным. В школах и других образовательных учреждениях можно проводить практические занятия, экологические акции и конкурсы. На уровне городов и регионов дополнительным инструментом могут стать социальные сети и средства массовой информации. Постепенно это позволит сделать сортировку не разовой акцией, а обычной частью повседневного поведения.

Ещё одним направлением является совершенствование регионального планирования. При разработке программ обращения с отходами необходимо учитывать численность населения, объёмы образования отходов, состояние

существующей инфраструктуры, расстояния между населёнными пунктами и перерабатывающими предприятиями. Такой подход позволит избежать ситуации, когда перерабатывающие мощности создаются без достаточного количества сырья либо, наоборот, имеющиеся отходы невозможно доставить до предприятия без значительных затрат.

В целях формирования устойчивой и циркулярной экономики в Казахстане принята Концепция управления всеми видами отходов в Республике Казахстан на 2026 - 2030 годы. Особенностью данного программного документа является постановка реально достижимых результатов, в частности, снижение выбрасываемых на полигоны ТБО на 10 % к 2023 году [17].

Так, в Карагандинской области принята Программа по управлению коммунальными отходами города Караганды на 2025 - 2029 годы. Важной особенностью данной программы является не только активизация государственных ресурсов, но также и коллаборация с предприятиями, действующими в данной сфере: ТОО «ГорКомТранс города Караганды», ТОО «Ресайклинг», ТОО «ЭкоАлем», ИП «Eco Lider», ИП «Вторсырье Караганда», ТОО «КазРемШина», ТОО «Клининговая компания «ЭкоКомфорт», ТОО «Промышленные отходы», ТОО «ЭкоИмпульс», ТОО «Казахстанский оператор по управлению отходами», ТОО «NLB», ТОО «EcoProfKZ», ТОО «Эко Тазалык Караганда», ТОО «Центр Утилизации Отходов «ЭкоЛидер», ТОО «ВАЮМ», ТОО «АлТемир», ТОО «Тристан-2018», ТОО «Ресайклинг Сервис», ТОО «Recycling Company» [18].

ВЫВОДЫ И ПРЕДЛОЖЕНИЯ

Проведённый анализ показал, что за 2021-2025 гг. объём коммунальных отходов в Казахстане вырос примерно на 36,4%, тогда как объём сортировки - лишь на 28,8%, а захоронение по-прежнему остаётся одним из основных способов обращения с отходами [8].

Все перечисленные меры соответствуют более широкому переходу от линейной модели обращения с ресурсами к принципам циркулярной экономики. При традиционном подходе сырьё используется для производства продукции, после чего значительная часть отходов оказывается на полигонах. Циркулярная модель предполагает максимально возможное возвращение материалов в хозяйственный оборот за счёт повторного использования, ремонта, переработки и производства вторичного сырья.

В результате приоритет в системе управления отходами должен постепенно смещаться от захоронения к предотвращению образования отходов, их повторному использованию и переработке. Такой подход позволяет одновременно решать экологические и экономические задачи: снижать нагрузку на полигоны, уменьшать потребность в первичном сырье, развивать перерабатывающую промышленность и создавать новые возможности для бизнеса. Таким образом, совершенствование системы управления твёрдыми бытовыми отходами в Казахстане требует сочетания инфраструктурных, экономических, организационных и информационных мер. К основным

направлениям относятся развитие раздельного сбора, увеличение перерабатывающих мощностей, создание стимулов для бизнеса, повышение экологической культуры населения и совершенствование государственного контроля.

Комплексная реализация этих мер позволит постепенно сократить объём отходов, направляемых на захоронение, увеличить долю перерабатываемых материалов и создать условия для перехода Казахстана к более устойчивой и ресурсосберегающей модели экономики.

На основе проведённого исследования предлагаются следующие меры:

1. Расширять инфраструктуру раздельного сбора не только в крупных городах, но и в небольших населённых пунктах, обеспечивая доступность контейнеров, их регулярный вывоз и понятную маркировку.
2. Стимулировать создание и модернизацию перерабатывающих предприятий, прежде всего в регионах с низкой долей сортировки и переработки ТБО (г. Алматы, г. Астана, Улытауская и Абайская области).
3. Использовать меры государственной поддержки (льготное кредитование, субсидирование инвестиционных проектов, налоговые стимулы) для переработки малорентабельных видов отходов.
4. Развивать принцип расширенной ответственности производителей и импортёров, стимулируя переход на легко перерабатываемую упаковку.
5. Проводить постоянное экологическое просвещение населения через образовательные учреждения, средства массовой информации и социальные сети.
6. Внедрять цифровые системы учёта движения отходов и усилить контроль за состоянием полигонов.
7. При региональном планировании учитывать численность населения, объёмы образования отходов и расстояния до перерабатывающих предприятий, а при подготовке кадров опираться на профессиональный стандарт в сфере управления отходами [9].

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MINTAQALARNI STRATEGIK RIVOJLANTIRISH SAMARADORLIGINI BAHOLASHDA BIOIQTISODIYOT KO‘RSATKICHLARINI QO‘LLASHNING METODOLOGIK ASOSLARI

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Annotatsiya

Maqolada mintaqalarni strategik rivojlantirish samaradorligini baholashda bioiqtisodiyot ko‘rsatkichlaridan foydalanishning metodologik asoslari o‘rganildi. Bioiqtisodiyotning resursga, biotexnologiyaga va ekologiyaga asoslangan talqinlarini umumlashtirib, uni hududiy strategiyaning mustaqil baholash obyekti sifatida asoslandi. Yevropa Ittifoqining bioiqtisodiyot monitoringi tajribasi va O‘zbekistonda qishloq xo‘jaligining yalpi ichki mahsulot hamda bandlikdagi ulushi rasmiy manbalar asosida qiyosiy baholandi, nisbiy unumdorlik koeffitsiyenti hisoblandi. Bio-asosli qo‘shilgan qiymat, bandlik, biomassa ta’minoti, resurs unumdorligi va bio-chiqindilarni qayta ishlashni qamrab olgan ko‘rsatkichlar tizimi hamda kompozit indeksni qurish tartibi taklif etildi. Kompozit indeksni qurishda minimum-maksimum usulida normallashtirish, vaznli agregatsiya va sezgirlik tahlili bosqichlari xalqaro qo‘llanma tavsiyalari asosida uslubiy jihatdan asoslandi. Natijada hududiy bioiqtisodiyot indeksini strategik maqsadlar bilan bog‘laydigan konseptual model ishlab chiqildi va uni hududiy statistika amaliyotiga joriy etish bo‘yicha takliflar asoslab berildi. Taklif etilgan yondashuv hududiy strategiyalar bajarilishini shaffof kuzatish imkonini berishi ko‘rsatildi.

Kalit so‘zlar: bioiqtisodiyot, hududiy strategiya, strategik samaradorlik, kompozit indeks, normallashtirish, vaznlash, bio-asosli qo‘shilgan qiymat, resurs unumdorligi.

Аннотация

В статье исследованы методологические основы использования показателей биоэкономики при оценке эффективности стратегического развития регионов. Автор обобщил ресурсную, биотехнологическую и экологическую трактовки биоэкономики и обосновал её в качестве самостоятельного объекта оценки региональной стратегии. На основе официальных источников сопоставлены опыт мониторинга биоэкономики Европейского союза и доля сельского хозяйства в валовом внутреннем продукте и занятости Узбекистана, рассчитан коэффициент относительной производительности. Предложены система показателей, охватывающая биобазированную добавленную стоимость, занятость, предложение биомассы, ресурсную производительность и переработку биоотходов, а также порядок построения композитного индекса. Этапы нормализации методом минимума-максимума, взвешенной агрегации и анализа чувствительности методологически обоснованы на основе рекомендаций международного руководства. В результате разработана концептуальная модель, связывающая региональный индекс биоэкономики со

стратегическими целями, и обоснованы предложения по её внедрению в практику региональной статистики. Показано, что предложенный подход обеспечивает прозрачный мониторинг выполнения региональных стратегий.

Ключевые слова: биоэкономика, региональная стратегия, стратегическая эффективность, композитный индекс, нормализация, взвешивание, биобазированная добавленная стоимость, ресурсная производительность.

Abstract

The article examined the methodological foundations of using bioeconomy indicators in assessing the effectiveness of regional strategic development. The author summarised the resource-based, biotechnology-based and ecology-based interpretations of the bioeconomy and substantiated it as an independent object of regional strategy assessment. The experience of the European Union bioeconomy monitoring system was compared with the share of agriculture in the gross domestic product and employment of Uzbekistan, and a relative productivity coefficient was calculated. A system of indicators covering bio-based value added, bio-based employment, biomass supply, resource productivity and bio-waste recycling was proposed together with a procedure for constructing a composite index. The stages of min-max normalisation, weighted aggregation and sensitivity analysis in constructing the composite index were methodologically substantiated on the basis of the recommendations of the international handbook. A conceptual model linking a regional bioeconomy index with strategic goals was developed, and proposals were substantiated for introducing it into regional statistical practice. It was shown that the proposed approach enables transparent monitoring of the implementation of regional strategies.

Keywords: bioeconomy, regional strategy, strategic effectiveness, composite index, normalisation, weighting, bio-based value added, resource productivity.

KIRISH

Zamonaviy mintaqaviy iqtisodiyot nazariyasida hududiy rivojlanish samaradorligi uzoq vaqt davomida yalpi hududiy mahsulot, investitsiyalar va bandlik kabi hajmiy ko‘rsatkichlar orqali o‘lchab kelingan. Biroq iqtisodiy o‘sishning tabiiy resurslarga tayanishi va ekologik cheklovlarning kuchayishi baholash tizimiga yangi o‘lchovlarni kiritishni taqozo etdi. Ana shunday o‘lchovlardan biri bioiqtisodiyot bo‘lib, u oziq-ovqat, yem, materiallar va energiya ishlab chiqarishda qayta tiklanuvchi biologik resurslardan foydalanishga asoslangan faoliyat turlarini yagona tizim sifatida qamrab oladi. K. Makkormik va N. Kautto bioiqtisodiyotni qishloq, o‘rmon va baliq xo‘jaligi, oziq-ovqat sanoati, bio-asosli kimyo va bioenergetikani birlashtiruvchi, innovatsiyalar orqali qazilma resurslarni biologik resurslar bilan almashtirishga yo‘naltirilgan iqtisodiy model sifatida tavsiflagan [8]. Mazkur ta’rif bioiqtisodiyotni tarmoqlar yig‘indisidan ko‘ra kengroq, resurs, texnologiya va institutlar o‘zaro bog‘langan iqtisodiy makon sifatida tushunish imkonini beradi.

Bioiqtisodiyot tushunchasining nazariy mazmuni bir xil emas. M. Bugge, T. Hansen va A. Klitkou ilmiy adabiyotni tizimlashtirib, uchta asosiy qarashni ajratgan: biotexnologik qarash ilmiy tadqiqotlar va ularning tijoratlashuvini, bioresurs qarashi

biologik xomashyoni qayta ishlash va yangi qiymat zanjirlarini, bioekologik qarash esa ekotizimlar barqarorligi va mahalliy resurslardan oqilona foydalanishni birinchi o‘ringa qo‘yadi [1]. Hududiy strategiya nuqtai nazaridan bu qarashlarning har biri o‘z baholash mantiqini taqozo etadi: birinchisi innovatsion salohiyatni, ikkinchisi qo‘shilgan qiymat va bandlikni, uchinchisi resurslardan foydalanish samaradorligini o‘lchashga undaydi. D. D’Amato va hammualliflari yashil, aylanma va bioiqtisodiyot konsepsiyalarini qiyosiy tahlil qilib, yashil iqtisodiyot qolgan ikkisini o‘z ichiga oluvchi umumiy konsepsiya vazifasini bajarishini ko‘rsatgan [2]. Demak, bioiqtisodiyot ko‘rsatkichlari yashil o‘sish strategiyalarining o‘lchanadigan tarkibiy qismi sifatida maydonga chiqadi.

Strategik rivojlanish samaradorligi deganda hududiy strategiyada belgilangan maqsadlarga erishish darajasi va bunga sarflangan resurslar o‘rtasidagi nisbat tushuniladi. Ushbu ta’rif baholash tizimida maqsad, ko‘rsatkich va natija o‘rtasida aniq bog‘liqlik bo‘lishini talab etadi. Bioiqtisodiyot ko‘rsatkichlari mazkur zanjirda ikki xil vazifani bajaradi: bir tomondan, ular hududning biologik resurslardan qo‘shilgan qiymat yaratish qobiliyatini aks ettiradi, ikkinchi tomondan, iqtisodiy o‘sishning resurs sarfi va ekologik yuklamadan qanchalik ajralayotganini ko‘rsatadi. J. Vesseler va I. fon Braun bioiqtisodiyotni o‘lchashning asosiy qiyinchiligi an’anaviy statistik tasniflagichlar bio-asosli va qazilma asosli mahsulotlarni ajratmasligida ekanini, maxsus ko‘rsatkichlar va hisob-kitob usullari zarurligini asoslagan [13]. Qishloq xo‘jaligi iqtisodiyotda salmoqli o‘rin tutadigan mamlakatlarda bu masala hududiy darajada yanada murakkab tus oladi.

O‘zbekistonda hududlarni kompleks rivojlantirish va yashil iqtisodiyotga o‘tish davlat siyosatining ustuvor yo‘nalishlari sifatida izchil amalga oshirilmoqda. “O‘zbekiston - 2030” strategiyasi iqtisodiy o‘sishni barqaror ta’minlash bilan birga qayta tiklanuvchi energiya ulushini oshirish va resurslardan tejamkor foydalanishni aniq maqsadlar sifatida belgilagan [16]. Ushbu maqsadlarning hududlar kesimida bajarilishini baholash uchun biologik resurslardan foydalanish samarasini aks ettiruvchi ko‘rsatkichlar tizimi talab etiladi. Maqolaning maqsadi mintaqalarni strategik rivojlantirish samaradorligini baholashda bioiqtisodiyot ko‘rsatkichlarini qo‘llashning metodologik asoslarini ishlab chiqishdan iborat. Maqsadga erishish uchun bioiqtisodiyotni o‘lchash yondashuvlarini tizimlashtirish, kompozit indeksni qurish tartibini asoslash, xalqaro va milliy ko‘rsatkichlarni qiyosiy baholash hamda hududiy bioiqtisodiyot indeksini strategik maqsadlar bilan bog‘laydigan konseptual model taklif etish vazifalari qo‘yildi.

ADABIYOTLAR SHARHI

Bioiqtisodiyotni o‘lchash bo‘yicha tadqiqotlarning ilk bosqichida asosiy e’tibor sektor chegaralarini aniqlashga qaratilgan. Yevropa Komissiyasining 2018-yilda yangilangan bioiqtisodiyot strategiyasi barqaror oziq-ovqat tizimlari, tabiiy resurslarni boshqarish, qazilma resurslarga bog‘liqlikni kamaytirish, iqlim o‘zgarishini yumshatish hamda raqobatbardoshlikni mustahkamlashdan iborat beshta maqsadni belgilab, ularni monitoring qilish tizimini yaratish vazifasini qo‘ygan [3]. N. Robert va hammualliflari ushbu vazifa asosida ishlab chiqilgan Yevropa Ittifoqi bioiqtisodiyot

monitoringi tizimining tuzilishini bayon qilib, u birlamchi tarmoqlar, qiymat zanjirlari va barqarorlikning iqtisodiy, ijtimoiy hamda ekologik ustunlarini qamrab olishini, ko‘rsatkichlar esa bazaviy, qayta ishlangan va tizimli darajalardan iborat piramida ko‘rinishida tashkil etilishini ko‘rsatgan [10]. Ushbu tuzilma hududiy baholash tizimini loyihalashda ham tayanch namuna bo‘la oladi.

Iqtisodiy ko‘rsatkichlar tanlovi masalasida T. Ronzon va R. M’Barek muhim uslubiy xulosaga kelgan: tovar aylanmasi takroriy hisobga olishga olib kelgani uchun bioiqtisodiyot hajmini qo‘shilgan qiymat orqali o‘lchash maqsadga muvofiq, hududlar ixtisoslashuvini esa bandlik bo‘yicha lokalizatsiya koeffitsiyenti va mehnat unumdorligi orqali tavsiflash lozim [11]. Mualliflar 2015-yilda Yevropa Ittifoqi bioiqtisodiyotida 18 mln kishi band bo‘lganini, qo‘shilgan qiymat 620 mlrd yevroni tashkil etganini, bir band xodimga to‘g‘ri keladigan qo‘shilgan qiymat qishloq xo‘jaligida 19 ming yevrodan kimyo va farmatsevtika tarmoqlarida 120 ming yevrodan ortiqqacha farqlanganini aniqlagan [11]. Bu natija bioiqtisodiyot ichida birlamchi ishlab chiqarish va chuqur qayta ishlash tarmoqlari o‘rtasidagi unumdorlik farqi hududiy strategiyaning asosiy o‘sish zaxirasi ekanini ko‘rsatadi.

M. Kardung va hammualliflari bioiqtisodiyot rivojlanishining harakatlantiruvchi kuchlari sifatida texnologik innovatsiyalar, bozorlar tuzilishi, iqlim va ekotizimlar holati, resurslar mavjudligi, iste’mol afzalliklari va davlat siyosatini ajratib, ularni Yevropa strategiyasining maqsadlari bilan bog‘langan 25 ta asosiy ko‘rsatkich orqali kuzatishni taklif etgan [5]. Ushbu ishning uslubiy qimmati shundaki, unda ko‘rsatkichlar alohida emas, balki strategik maqsadlarga bog‘langan holda tizimlashtirilgan. J. Vesseler va I. fon Braun ham bioiqtisodiyotni baholashda natija ko‘rsatkichlari bilan birga siyosat vositalarining samaradorligini ham hisobga olish zarurligini ta’kidlagan [13]. Shunday qilib, adabiyotlarda bioiqtisodiyot ko‘rsatkichlari statistik tavsif vositasidan strategik boshqaruv vositasiga aylanib borayotgani kuzatiladi.

Ko‘p o‘lchovli hodisalarni yagona ko‘rsatkichga keltirish metodologiyasi OECD va Yevropa Komissiyasi Qo‘shma tadqiqot markazining kompozit indikatorlar bo‘yicha qo‘llanmasida tizimli bayon qilingan [9]. Qo‘llanmada nazariy asosni belgilash, ko‘rsatkichlarni tanlash, yetishmayotgan ma’lumotlarni to‘ldirish, ko‘p o‘lchovli tahlil, normallashtirish, vaznlash va agregatsiya, noaniqlik va sezgirlik tahlili kabi bosqichlar ketma-ketligi asoslangan. S. Greko va hammualliflari vaznlash va agregatsiya usullarining keng sharhini berib, tanlangan usul natijalar reytingiga sezilarli ta’sir qilishini, shuning uchun uning nazariy asosi ochiq ko‘rsatilishi lozimligini qayd etgan [4]. M. Saysana, A. Saltelli va S. Tarantola noaniqlik va sezgirlik tahlilini kompozit indikatorlar sifatini tekshirishning majburiy bosqichi sifatida asoslagan [12]. M. Madzotta va A. Pareto esa ko‘rsatkichlar o‘rtasida o‘zaro to‘liq o‘rin bosishga yo‘l qo‘ymaydigan, ya’ni kompensatsion bo‘lmagan indeks shaklini taklif etgan [6]. Adabiyotlar tahlili hududiy bioiqtisodiyot indeksini qurishda aynan shu uslubiy talablarga tayanish zarurligini ko‘rsatadi.

METODOLOGIYA

Tadqiqotning metodologik asosini tizimli yondashuv tashkil etdi: bioiqtisodiyot hududiy iqtisodiyotning resurs, ishlab chiqarish va ekologik quyi tizimlarini bog‘lovchi ochiq tizim sifatida ko‘rib chiqildi. Nazariy qismda mantiqiy-tarixiy va qiyosiy usullar yordamida bioiqtisodiyotni o‘lchash yondashuvlari tizimlashtirildi. Amaliy qismda ikki axborot bloki qo‘llanildi. Birinchi blokni Yevropa Ittifoqi bioiqtisodiyoti bo‘yicha Qo‘shma tadqiqot markazi e’lon qilgan 2015 va 2021-yillar ma’lumotlari tashkil etdi [7]. Ikkinchi blokni Jahon banki ma’lumotlar bazasidagi O‘zbekiston qishloq, o‘rmon va baliq xo‘jaligining yalpi ichki mahsulotdagi ulushi [14] hamda qishloq xo‘jaligida bandlarning jami bandlikdagi ulushi [15] ko‘rsatkichlari tashkil etdi. Tarmoqning nisbiy unumdorligini baholash uchun T. Ronzon va R. M’Barek taklif etgan mehnat unumdorligi mantiqi asosida qo‘shilgan qiymatdagi ulushning bandlikdagi ulushga nisbati hisoblandi; bu koeffitsiyent birdan kichik bo‘lganda tarmoqda bir band xodimga to‘g‘ri keladigan qo‘shilgan qiymat iqtisodiyot bo‘yicha o‘rtacha darajadan past ekanini bildiradi.

Hududiy bioiqtisodiyot indeksini qurish OECD va Qo‘shma tadqiqot markazi qo‘llanmasida tavsiya etilgan bosqichlarga muvofiq amalga oshirildi [9]. Turli o‘lchov birliklariga ega ko‘rsatkichlarni taqqoslanadigan shaklga keltirish uchun minimum-maksimum usulida normallashtirish qo‘llanildi:

$$z_{ij} = \frac{x_{ij} - x_{j,\min}}{x_{j,\max} - x_{j,\min}} \qquad (1)$$

bu yerda z_{ij} - i-hudud uchun j-ko‘rsatkichning normallashtirilgan qiymati; x_{ij} - i-hududda j-ko‘rsatkichning haqiqiy qiymati; $x_{j,\min}$ va $x_{j,\max}$ - j-ko‘rsatkichning hududlar bo‘yicha eng kichik va eng katta qiymatlari. Normallashtirilgan qiymatlar 0 dan 1 gacha oraliqda joylashadi va hududning eng past natijali hududdan qanchalik ilgarilab ketganini ko‘rsatadi. Qiymati kamayishi ijobiy baholanadigan ko‘rsatkichlar, masalan, yalpi hududiy mahsulot birligiga to‘g‘ri keladigan issiqxona gazlari ajralmalari uchun suratda $x_{j,\max} - x_{ij}$ ifodasi olinadi. Ko‘p yillik baholashda chegaraviy qiymatlar tayanch yil bo‘yicha qayd etiladi, natijada indeks dinamikasi hududning o‘z natijalaridagi haqiqiy o‘zgarishni aks ettiradi.

Normallashtirilgan ko‘rsatkichlar vaznli agregatsiya yordamida hududiy bioiqtisodiyot indeksiga birlashtiriladi:

$$\mathrm{HBI}_i = \sum_{j=1}^{m} w_j \cdot z_{ij} \qquad (2)$$

bu yerda HBI_i - i-hududning bioiqtisodiyot indeksi; w_j - j-ko‘rsatkichning vazni, barcha vaznlar yig‘indisi birga teng; m - ko‘rsatkichlar soni. Vaznlarni aniqlashda ikki bosqichli yondashuv taklif etiladi: dastlab beshta o‘lchov blokiga teng vazn beriladi, so‘ngra blok ichidagi vaznlar bosh komponentalar usuli yoki ekspert baholari asosida aniqlanadi. Arifmetik agregatsiya bir ko‘rsatkichdagi yuqori natija boshqasidagi past natijani to‘liq qoplashiga imkon bergani uchun natijalar M. Madzotta va A. Pareto taklif etgan kompensatsion bo‘lmagan shakl bilan solishtirib tekshiriladi [6]. Indeksning ishonchliligi vaznlar va normallashtirish usullari o‘zgartirilganda hududlar reytingining barqarorligi orqali baholanadi.

TAHLIL VA NATIJALAR

Bioiqtisodiyot ko‘rsatkichlarini hududiy strategiyaga qo‘llash imkoniyatlarini aniqlash uchun avvalo xalqaro va milliy darajadagi tarkibiy ko‘rsatkichlar qiyosiy baholandi. Qo‘shma tadqiqot markazi ma’lumotlariga ko‘ra, 2021-yilda Yevropa Ittifoqi bioiqtisodiyotida 17,2 mln kishi band bo‘lib, u 728 mlrd yevro qo‘shilgan qiymat yaratgan, bu ittifoq yalpi ichki mahsulotining 5,0 foizi va ishchi kuchining 8,2 foiziga to‘g‘ri kelgan [7]. O‘zbekistonda qishloq, o‘rmon va baliq xo‘jaligining yalpi ichki mahsulotdagi ulushi 2024-yilda 17,73 foizni [14], qishloq xo‘jaligida bandlarning ulushi esa 25,65 foizni tashkil etgan [15]. Ushbu ko‘rsatkichlar va ular asosida hisoblangan nisbiy unumdorlik koeffitsiyenti 1-jadvalda keltirilgan.

1-jadval

Yevropa Ittifoqi bioiqtisodiyoti va O‘zbekiston birlamchi tarmog‘ining tarkibiy ko‘rsatkichlari[1]

Obyekt	Yil	YIMdagi ulush, foizda	Bandlikdagi ulush, oizda	Nisbiy unumdorlik
YI bioiqtisodiyoti	2015	4,2	8,2	0,51
YI bioiqtisodiyoti	2021	5,0	8,2	0,61
O‘zbekiston: qishloq, o‘rmon va baliq xo‘jaligi	2015	25,76	27,58	0,93
O‘zbekiston: qishloq, o‘rmon va baliq xo‘jaligi	2020	21,57	27,19	0,79
O‘zbekiston: qishloq, o‘rmon va baliq xo‘jaligi	2024	17,73	25,65	0,69

1-jadval ma’lumotlari ikki xil tarkibiy dinamikani aks ettiradi. Yevropa Ittifoqida bioiqtisodiyotning bandlikdagi ulushi o‘zgarmagan holda yalpi ichki mahsulotdagi ulushi 4,2 foizdan 5,0 foizga ko‘tarilgan, natijada nisbiy unumdorlik 0,51 dan 0,61 gacha oshgan. Qo‘shma tadqiqot markazi bu o‘sishni 2012-2021-yillarda qo‘shilgan qiymatning real ifodada 39 foizga ortishi va bandlarning 1,3 mln kishiga qisqarishi bilan izohlab, asosiy manba bio-asosli ishlab chiqarish tarmoqlari bo‘lganini qayd etgan [7]. O‘zbekistonda qishloq xo‘jaligining yalpi ichki mahsulotdagi ulushi 2015-2024-yillarda 25,76 foizdan 17,73 foizga pasaygan, bandlikdagi ulushi esa ancha sekin kamaygan. Bu holat sanoat va xizmatlar sohasining jadal rivojlanishi natijasida iqtisodiyot tarkibi diversifikatsiyalashayotganidan dalolat beradi. Nisbiy unumdorlikning 0,93 dan 0,69 gacha o‘zgarishi birlamchi tarmoqda band bo‘lgan katta mehnat resurslarini qayta ishlash zanjirlariga jalb etish orqali qo‘shilgan qiymatni oshirish salohiyati yuqori ekanini ko‘rsatadi.

Qiyosiy natijalarni talqin qilishda ko‘rsatkichlar qamrovidagi farqni hisobga olish zarur. Yevropa Ittifoqi ko‘rsatkichlari birlamchi tarmoqlar bilan birga oziq-ovqat, yog‘ochni qayta ishlash, bio-asosli kimyo va bioenergetikani o‘z ichiga oladi, O‘zbekiston ko‘rsatkichlari esa faqat birlamchi tarmoqni qamrab oladi. Aynan shu farq

[1] Manba: YI ko‘rsatkichlari T. Ronzon va R. M’Barek [11] hamda Qo‘shma tadqiqot markazi [7] ma’lumotlari, O‘zbekiston ko‘rsatkichlari Jahon banki [14] va [15] ma’lumotlari asosida; nisbiy unumdorlik muallif tomonidan hisoblangan.

milliy statistika tizimida bioiqtisodiyotni alohida hisobga olish zarurligini ko‘rsatadi. T. Ronzon va R. M’Barek ma’lumotlariga ko‘ra, 2015-yilda qishloq xo‘jaligi Yevropa bioiqtisodiyotidagi bandlarning 51 foizini jamlagan holda qo‘shilgan qiymatning 28 foizini yaratgan [11]. Demak, bioiqtisodiyotning umumiy samaradorligi birlamchi ishlab chiqarish va qayta ishlash tarmoqlari o‘rtasidagi nisbatga bog‘liq. Hududiy strategiyalar samaradorligini baholashda birlamchi tarmoq ko‘rsatkichlari bilan cheklanmasdan, biologik xomashyoni qayta ishlash chuqurligini aks ettiruvchi ko‘rsatkichlarni kiritish lozim. Ushbu xulosa quyida taklif etilgan ko‘rsatkichlar tizimini shakllantirishda asosiy tamoyil sifatida qabul qilindi.

Ko‘rsatkichlar tizimini hududiy strategiya bilan bog‘lash uchun milliy strategik hujjatlarda belgilangan miqdoriy mo‘ljallardan foydalanildi. 2019-yilda tasdiqlangan yashil iqtisodiyotga o‘tish strategiyasi resurslardan foydalanish samaradorligini oshirish, qishloq xo‘jaligini barqaror yuritish va chiqindilarni qayta ishlashni ustuvor yo‘nalishlar sifatida belgilagan [18]. 2022-yilda qabul qilingan qaror bilan 2030-yilgacha yalpi ichki mahsulot birligiga to‘g‘ri keladigan issiqxona gazlari solishtirma ajralmalarini 2010-yil darajasidan 35 foizga qisqartirish, 1 mln gektargacha maydonda suv tejovchi sug‘orish texnologiyalarini joriy etish va o‘rmon fondi zaxiralarini 90 mln kub metrdan ortiqroqqa yetkazish kabi aniq mo‘ljallar belgilangan [17]. Ushbu mo‘ljallar asosida taklif etilgan ko‘rsatkichlar tizimi 2-jadvalda keltirilgan.

2-jadval

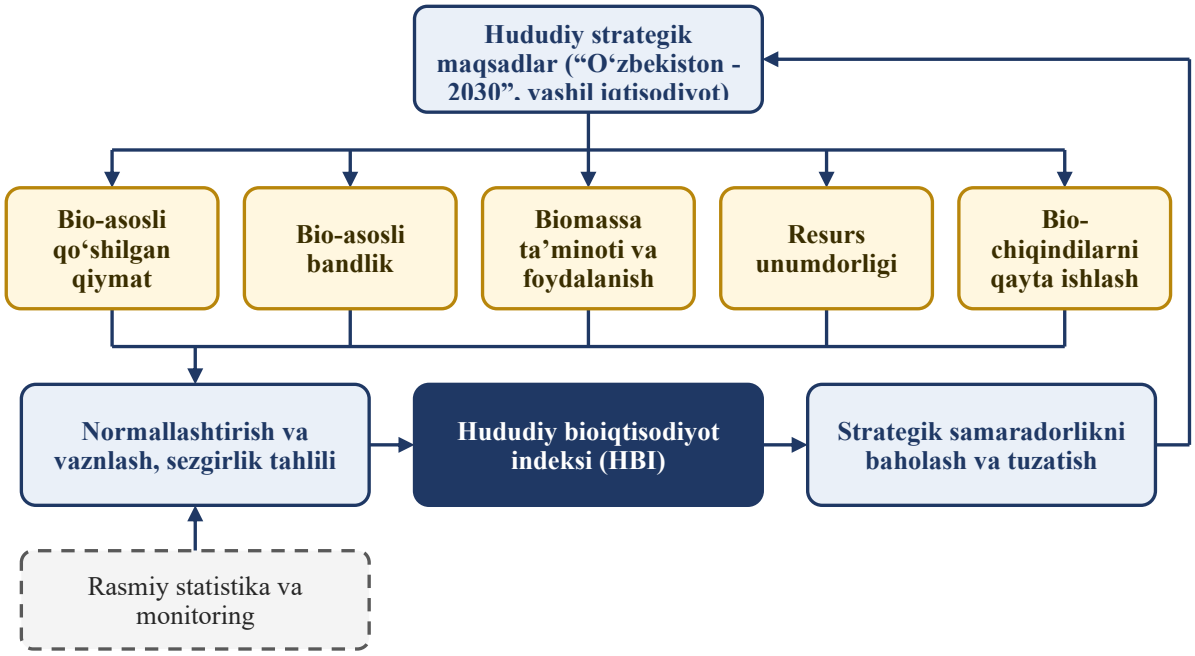
Hududiy bioiqtisodiyot indeksining ko‘rsatkichlar tizimi va strategik mo‘ljallar bilan bog‘liqligi[1]

O‘lchov bloki	Ko‘rsatkich	Ta’sir yo‘nalishi	Strategik mo‘ljal
Bio-asosli qo‘shilgan qiymat	Bio-asosli tarmoqlar qo‘shilgan qiymatining yalpi hududiy mahsulotdagi ulushi, foizda	+	Barqaror iqtisodiy o‘sish (“O‘zbekiston - 2030”)
Bio-asosli bandlik	Bio-asosli qayta ishlash tarmoqlaridagi bandlik ulushi, foizda; bir band xodimga qo‘shilgan qiymat	+	Yuqori daromadli ish o‘rinlari yaratish (“O‘zbekiston - 2030”)
Biomassa ta’minoti va foydalanish	O‘rmon fondi zaxiralari, ming kub metr; biomassadan foydalanish koeffitsiyenti	+	O‘rmon fondi zaxiralari 90 mln kub metrdan ortiq (2030)
Resurs unumdorligi	Suv tejovchi sug‘orish maydoni ulushi, foizda; yalpi hududiy mahsulot birligiga issiqxona gazlari	+ / –	1 mln gektargacha maydon; 2010-yilga nisbatan 35 foiz qisqarish
Bio-chiqindilarni qayta ishlash	Organik chiqindilarni qayta ishlash darajasi, foizda	+	Chiqindilarni qayta ishlashni kengaytirish (yashil iqtisodiyot strategiyasi)

[1] Manba: N. Robert va hammualliflari [10], M. Kardung va hammualliflari [5] yondashuvlari hamda 2022-yilgi qaror [17] mo‘ljallari asosida muallif ishlanmasi.

2-jadvalda keltirilgan tizim bioiqtisodiyotning M. Bugge va hammualliflari ajratgan uch talqinini baholash amaliyotida birlashtiradi. Bio-asosli qo‘shilgan qiymat va bandlik bloklari bioresurs qarashiga, biomassa ta’minoti va resurs unumdorligi bloklari bioekologik qarashga, bio-chiqindilarni qayta ishlash bloki esa aylanma iqtisodiyot tamoyillariga tayanadi. Har bir blok milliy strategik hujjatlardagi miqdoriy yoki sifat mo‘ljali bilan bog‘langani indeks natijalarini hududiy strategiya maqsadlariga erishish darajasi sifatida talqin etish imkonini beradi. Ta’sir yo‘nalishi ko‘rsatkichlarni (1) formula bo‘yicha normallashtirishda qaysi ifoda qo‘llanishini belgilaydi. Tizimdagi ko‘rsatkichlarning aksariyati hududiy statistika tomonidan yig‘iladigan ma’lumotlar asosida hisoblanadi, bio-asosli qayta ishlash tarmoqlarini ajratish uchun esa iqtisodiy faoliyat turlari tasniflagichi bo‘yicha kodlarni guruhlash kifoya. M. Kardung va hammualliflari ta’kidlaganidek, ko‘rsatkichlarni strategik maqsadlarga bog‘lash monitoring natijalarini siyosat qarorlariga aylantirishning zaruriy sharti hisoblanadi [5].

Ko‘rsatkichlar tizimi va kompozit indeks qurish tartibi asosida bioiqtisodiyot ko‘rsatkichlarini hududiy strategik rivojlanish samaradorligini baholashga qo‘llashning konseptual modeli ishlab chiqildi (1-rasm). Model strategik maqsadlardan boshlanib, ko‘rsatkichlar tizimi, normallashtirish va vaznlash, indeks hisoblash hamda samaradorlikni baholash bosqichlari orqali yana strategiyani takomillashtirishga qaytadigan yopiq boshqaruv sikli sifatida tuzilgan.



1-rasm. Hududiy bioiqtisodiyot indeksi asosida baholash modeli[1]

Izoh: HBI - hududiy bioiqtisodiyot indeksi; teskari aloqa strelkasi baholash natijalari asosida strategik maqsad va vazifalarning aniqlashtirilishini bildiradi.

1-rasmda tasvirlangan model bioiqtisodiyot ko‘rsatkichlarini strategik boshqaruv siklining tarkibiy qismi sifatida talqin etadi. Hududiy strategik maqsadlar beshta

[1] Manba: [9] tavsiyalari, [10] tajribasi va 2-jadval asosida muallif ishlanmasi.

o‘lchov blokidagi ko‘rsatkichlar orqali aniq o‘lchanadigan shaklga keltiriladi, ko‘rsatkichlar normallashtirilib, vaznlanadi va yagona hududiy bioiqtisodiyot indeksiga birlashtiriladi. Indeks qiymati va uning dinamikasi strategiyaning bajarilish darajasini baholash uchun asos bo‘lib xizmat qiladi, baholash natijalari esa teskari aloqa orqali keyingi davr maqsadlari va vazifalarini aniqlashtirishga yo‘naltiriladi. Rasmiy statistika va monitoring bloki modelning axborot tayanchi hisoblanadi: N. Robert va hammualliflari ta’kidlaganidek, bioiqtisodiyot monitoringining sifati mavjud statistik ma’lumotlarni uyg‘unlashtirish darajasiga bog‘liq [10]. Modelning afzalligi shundaki, u hududlarni faqat erishilgan daraja bo‘yicha emas, balki strategik mo‘ljallarga yaqinlashish sur’ati bo‘yicha ham taqqoslash imkonini beradi.

Modelni amaliyotga joriy etishda indeksning ishonchliligini ta’minlash muhim ahamiyat kasb etadi. M. Saysana va hammualliflari ko‘rsatganidek, normallashtirish usuli, vaznlar tizimi va agregatsiya shakli o‘zgartirilganda hududlar o‘rni qanchalik barqaror saqlanishini tekshirish indeks natijalariga asoslangan qarorlarning asoslilik darajasini oshiradi [12]. S. Greko va hammualliflari xulosalariga ko‘ra, vaznlarni faqat statistik usullar bilan emas, balki siyosat ustuvorliklarini aks ettiruvchi ekspert baholari bilan uyg‘unlashtirish maqsadga muvofiq [4]. Hududiy strategiyalar sharoitida bu yondashuv qishloq xo‘jaligiga ixtisoslashgan hududlar uchun biomassa ta’minoti blokiga, sanoat hududlari uchun esa bio-asosli qayta ishlash blokiga nisbatan yuqoriroq vazn berish imkonini yaratadi. Natijada indeks har bir hududning o‘ziga xos ixtisoslashuvini hisobga olgan holda yagona uslubiy asosda taqqoslashni ta’minlaydi.

Tahlil natijalarining amaliy ahamiyati hududlarning bioiqtisodiy salohiyatini strategik rejalashtirish jarayoniga kiritish imkoniyatida namoyon bo‘ladi. Qishloq xo‘jaligida band bo‘lgan mehnat resurslarining salmoqli ulushi va nisbiy unumdorlikning birdan pastligi hududlarda biologik xomashyoni chuqur qayta ishlash, oziq-ovqat va to‘qimachilik sanoatini rivojlantirish orqali qo‘shilgan qiymatni oshirish uchun keng imkoniyat mavjudligini ko‘rsatadi. “O‘zbekiston - 2030” strategiyasida belgilangan iqtisodiy o‘sish va yangi ish o‘rinlari yaratish maqsadlari ana shu imkoniyat bilan to‘liq uyg‘unlashadi [16]. Yevropa Ittifoqi tajribasi bio-asosli ishlab chiqarish tarmoqlari bandlik qisqarganda ham qo‘shilgan qiymatning barqaror o‘sishini ta’minlay olishini tasdiqlaydi [7]. Taklif etilgan indeks aynan ushbu tarkibiy siljishni hududlar kesimida kuzatish va uni strategik boshqaruv qarorlariga aylantirish vositasi bo‘lib xizmat qiladi.

XULOSA VA TAKLIFLAR

Tadqiqot bioiqtisodiyot ko‘rsatkichlari mintaqalarni strategik rivojlantirish samaradorligini baholashning mustaqil va uslubiy jihatdan asoslangan tarkibiy qismi bo‘la olishini ko‘rsatdi. Bioiqtisodiyotning biotexnologik, bioresurs va bioekologik talqinlari hududiy strategiyada qo‘shilgan qiymat, bandlik, resurs unumdorligi va aylanma foydalanish kabi o‘lchovlarga mos keladi. Kompozit indikatorlar metodologiyasi ushbu o‘lchovlarni yagona indeksga birlashtirishning ishonchli vositasi bo‘lib, normallashtirish, vaznlash va sezgirlik tahlili bosqichlariga qat’iy rioya etilganda hududlarni asosli taqqoslash imkonini beradi. Qiyosiy tahlil O‘zbekistonda iqtisodiyot tarkibining diversifikatsiyalashuvi davom etayotganini, birlamchi

tarmoqdagi mehnat resurslarini qayta ishlash zanjirlariga jalb etish esa qo‘shilgan qiymatni oshirishning muhim zaxirasi ekanini ko‘rsatdi.

Olingan natijalar asosida quyidagi takliflar ilgari suriladi. Birinchidan, hududiy statistika amaliyotida iqtisodiy faoliyat turlari tasniflagichi asosida bio-asosli tarmoqlar ro‘yxatini belgilab, ularning qo‘shilgan qiymati va bandlik ko‘rsatkichlarini viloyatlar kesimida muntazam e’lon qilish maqsadga muvofiq. Ikkinchidan, hududlarni rivojlantirish dasturlarining maqsadli ko‘rsatkichlari qatoriga 2-jadvalda keltirilgan beshta blokdan iborat hududiy bioiqtisodiyot indeksini kiritish tavsiya etiladi. Uchinchidan, indeks vaznlarini aniqlashda statistik usullar natijalarini hududlar ixtisoslashuvini hisobga oluvchi ekspert baholari bilan uyg‘unlashtirish va natijalarni har yili sezgirlik tahlili bilan tekshirish lozim. To‘rtinchidan, yashil iqtisodiyotga o‘tish bo‘yicha belgilangan 2030-yilgacha mo‘ljallarni hududlar kesimida taqsimlab, ularga erishish sur’atini indeks dinamikasi orqali kuzatish tizimini joriy etish zarur. Beshinchidan, hududiy bioiqtisodiyot monitoringi natijalarini ochiq raqamli platformada e’lon qilish investorlar va tadbirkorlar uchun biologik xomashyoni qayta ishlash loyihalarini joylashtirishda qulay axborot muhitini yaratadi.

Taklif etilgan metodologik yondashuv hududiy strategiyalarni iqtisodiy o‘sish, bandlik va resurslardan oqilona foydalanish maqsadlarini birgalikda o‘lchaydigan yaxlit baholash tizimi bilan ta’minlaydi. Uning amaliyotga joriy etilishi mamlakatda amalga oshirilayotgan yashil iqtisodiyotga o‘tish islohotlarining hududlardagi natijalarini aniq va shaffof kuzatish imkonini beradi. Keyingi tadqiqotlarda indeksni viloyatlar kesimidagi rasmiy ma’lumotlar asosida hisoblash hamda uning hududiy yalpi mahsulot o‘sishi bilan bog‘liqligini ekonometrik usullar yordamida baholash rejalashtirilgan.

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ГЛОБАЛЬНЫЕ И РЕГИОНАЛЬНЫЕ ПРИОРИТЕТЫ РАЗВИТИЯ БИОЭКОНОМИКИ: ВОЗМОЖНОСТИ ФОРМИРОВАНИЯ МОДЕЛИ ГОРНОЙ БИОЭКОНОМИКИ КЫРГЫЗСТАНА

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Аннотация

В статье рассматриваются современные глобальные и региональные тенденции формирования биоэкономики, как одного из перспективных направлений трансформации традиционной модели экономического развития. Обосновывается необходимость перехода к более эффективному использованию биологических ресурсов, основанному на принципах устойчивости, циркулярности, сохранения биоразнообразия, климатической адаптации и формирования добавленной стоимости. Особое внимание уделяется особенностям развития биоэкономики в Центральной Азии и возможностям их реализации в Кыргызской Республике. На основе анализа природно-ресурсного, аграрного, биологического и социально-экономического потенциала Кыргызстана предлагается рассматривать формирование «модели горной биоэкономики» как перспективное направление национального развития. Выделены приоритетные направления, включающие устойчивое сельское хозяйство, рациональное использование пастбищных и лесных ресурсов, переработку биологического сырья, биоэнергетику, биотехнологии, сохранение биоразнообразия, развитие экосистемных услуг и биоэкономику туризма. Обоснована необходимость расширения межгосударственного сотрудничества стран Центральной Азии в сфере биоэкономики, включая научно-технологическое взаимодействие, развитие трансграничных цепочек создания стоимости, обмен инновациями и подготовку кадров.

Ключевые слова: биоэкономика, зеленая экономика, природный капитал, циркулярная экономика, биоразнообразие, Кыргызстан, Центральная Азия, региональное сотрудничество.

Annotatsiya

Maqolada bioiqtisodiyotni an’anaviy iqtisodiy rivojlanish modelini transformatsiya qilishning istiqbolli yo‘nalishlaridan biri sifatida shakllantirishning

zamonaviy global va mintaqaviy tendensiyalari ko‘rib chiqiladi. Biologik resurslardan yanada samarali foydalanishga o‘tishning barqarorlik, aylanma iqtisodiyot tamoyillari, biologik xilma-xillikni saqlash, iqlim o‘zgarishiga moslashish va qo‘shilgan qiymat yaratishga asoslangan zarurati asoslab beriladi. Markaziy Osiyoda bioiqtisodiyotni rivojlantirishning o‘ziga xos xususiyatlari va ularni Qirg‘iziston Respublikasida amalga oshirish imkoniyatlariga alohida e’tibor qaratiladi. Qirg‘izistonning tabiiy-resurs, agrar, biologik va ijtimoiy-iqtisodiy salohiyatini tahlil qilish asosida “tog‘ bioiqtisodiyoti modeli”ni shakllantirish milliy rivojlanishning istiqbolli yo‘nalishi sifatida taklif etiladi. Ustuvor yo‘nalishlar sifatida barqaror qishloq xo‘jaligi, yaylov va o‘rmon resurslaridan oqilona foydalanish, biologik xomashyoni qayta ishlash, bioenergetika, biotexnologiyalar, biologik xilma-xillikni saqlash, ekotizim xizmatlarini rivojlantirish hamda bioiqtisodiyotga asoslangan turizm belgilangan. Markaziy Osiyo mamlakatlari o‘rtasida bioiqtisodiyot sohasidagi davlatlararo hamkorlikni kengaytirish, jumladan, ilmiy-texnologik hamkorlikni rivojlantirish, transchegaraviy qiymat zanjirlarini shakllantirish, innovatsiyalar almashinuvi va kadrlar tayyorlashni kuchaytirish zarurligi asoslab beriladi.

Kalit so‘zlar: bioiqtisodiyot, yashil iqtisodiyot, tabiiy kapital, aylanma iqtisodiyot, biologik xilma-xillik, Qirg‘iziston, Markaziy Osiyo, mintaqaviy hamkorlik.

Abstract

The article examines current global and regional trends in the development of the bioeconomy as one of the promising areas for transforming the traditional model of economic development. The study substantiates the need to transition towards more efficient use of biological resources based on the principles of sustainability, circularity, biodiversity conservation, climate adaptation, and value-added creation. Particular attention is paid to the specific features of bioeconomy development in Central Asia and the opportunities for their implementation in the Kyrgyz Republic. Based on an analysis of Kyrgyzstan’s natural-resource, agricultural, biological, and socio-economic potential, the article proposes considering the formation of a “mountain bioeconomy model” as a promising direction of national development. Priority areas are identified, including sustainable agriculture, rational use of pasture and forest resources, processing of biological raw materials, bioenergy, biotechnology, biodiversity conservation, development of ecosystem services, and bioeconomy-based tourism. The article substantiates the need to expand interstate cooperation among Central Asian countries in the field of bioeconomy, including scientific and technological cooperation, development of cross-border value chains, exchange of innovations, and human capital development.

Keywords: bioeconomy, green economy, natural capital, circular economy, biodiversity, Kyrgyzstan, Central Asia, regional cooperation.

ВВЕДЕНИЕ

Современный этап развития мировой экономики характеризуется усилением взаимосвязанных экологических, климатических, ресурсных и социально-экономических вызовов. Изменение климата, деградация земель,

сокращение биоразнообразия, дефицит водных ресурсов, рост объемов отходов и необходимость обеспечения продовольственной безопасности обусловливают поиск новых моделей экономического развития, способных одновременно обеспечивать экономический рост и сохранение природного капитала [9]; [10].

Одним из таких направлений становится биоэкономика, в основе которой находится использование биологических ресурсов, знаний и технологий для производства товаров и услуг при одновременном обеспечении устойчивого воспроизводства природной основы экономики [5].

Современное понимание биоэкономики значительно шире традиционного представления о производстве сельскохозяйственной продукции. Согласно подходу Продовольственной и сельскохозяйственной организации Объединенных Наций (FAO), биоэкономика предполагает устойчивое производство, использование, сохранение и восстановление биологических ресурсов, включая соответствующие знания, науку, технологии и инновации, с целью обеспечения устойчивого производства и потребления [5].

В научной литературе биоэкономика рассматривается как межсекторальная концепция, связывающая природные ресурсы, сельское хозяйство, лесное хозяйство, энергетику, промышленность, биотехнологии, инновации и устойчивое развитие. При этом ее взаимосвязь с циркулярной экономикой создает предпосылки для более эффективного использования ресурсов и сокращения отходов [4]; [14].

Принципиально важно учитывать региональную специфику развития биоэкономики. Анализ национальных стратегий показывает, что страны формируют различные модели биоэкономики в зависимости от ресурсной обеспеченности, структуры экономики, технологического потенциала, институциональной среды и экологических условий [15]. Следовательно, универсальная модель биоэкономики не может быть механически перенесена из одной страны в другую.

Для стран Центральной Азии данное положение имеет особое значение. Регион одновременно располагает значительным природным и биологическим потенциалом и сталкивается с серьезными ограничениями, связанными с деградацией земель, дефицитом водных ресурсов, изменением климата, сокращением биоразнообразия и необходимостью повышения эффективности сельскохозяйственного производства [17]; [20].

Современные региональные исследования UNECE показывают, что экологические проблемы Центральной Азии имеют выраженный трансграничный характер. Среди наиболее значимых вызовов выделяются изменение климата, дефицит воды, деградация земель, сокращение биоразнообразия, состояние экосистем и проблемы обращения с отходами. При этом их эффективное решение требует согласованных действий государств региона [20].

Поэтому развитие биоэкономики в Центральной Азии целесообразно рассматривать не только как экологическую инициативу, но и как

экономический механизм повышения эффективности использования природных ресурсов, формирования новых цепочек добавленной стоимости, развития сельских территорий и укрепления регионального сотрудничества [4];[20].

ЛИТЕРАТУРНЫЙ ОБЗОР

Понятие биоэкономики сформировалось в научной и политической литературе в течение последних двух десятилетий. К. Маккормик и Н. Каутто, анализируя европейский опыт, показали, что биоэкономика охватывает сельское, лесное и рыбное хозяйство, пищевую промышленность, биоэнергетику и производство продукции на биологической основе, а ее развитие во многом определяется государственными стратегиями и исследовательскими программами [13]. Систематизируя научные публикации, М. Бугге, Т. Хансен и А. Клитку выделили три основных видения биоэкономики: биотехнологическое, биоресурсное и биоэкологическое [2]. Первое делает акцент на науке и коммерциализации биотехнологий, второе - на переработке биологического сырья и создании новых цепочек стоимости, третье - на устойчивости экосистем, сохранении биоразнообразия и развитии территорий.

Различия этих подходов отражаются и в государственной политике. М. Проестоу, Н. Шульц и П. Х. Файндт на основе глобального анализа правительственных стратегий установили, что страны формулируют различные видения биоэкономики в зависимости от ресурсной базы, структуры экономики и приоритетов развития [15]. Этот вывод подтверждает, что модель биоэкономики должна разрабатываться с учетом национальных условий. Подход FAO, в свою очередь, подчеркивает устойчивое производство, использование, сохранение и восстановление биологических ресурсов как основу продовольственной безопасности и устойчивого потребления [5].

Значительная часть современных исследований посвящена взаимосвязи биоэкономики, циркулярной экономики и Целей устойчивого развития. Д. Ферраз и А. Пика в систематическом обзоре показали, что оба научных направления уделяют недостаточное внимание социальным целям - образованию, сокращению бедности и гендерному равенству [4]. Х. А. Меса и соавторы провели критическую оценку показателей циркулярной биоэкономики и обосновали необходимость комплексной системы индикаторов, учитывающей экономические, экологические и социальные эффекты [14]. М. Бьянки и соавторы обобщили эмпирические практики циркулярной биоэкономики на разных уровнях реализации - от отдельного предприятия до региона и страны [1].

Отдельное направление литературы связано с биоразнообразием. П. Стефенсон и А. Дамерелл отмечают, что биоэкономические и циркулярные подходы пока недостаточно определены и слабо учитывают воздействие на биоразнообразие, и предлагают расширить участие общества, уточнить механизмы управления и мониторинга [16]. Ö. Calicioglu рассматривает возможности и риски биоэкономики через призму Целей устойчивого развития

и подчеркивает важность мониторинга ее социально-экологических последствий [3].

Региональные материалы FAO и UNECE показывают, что для Европы и Центральной Азии наиболее значимы климатически устойчивое сельское хозяйство, пастбищное животноводство, лесное хозяйство, биоэнергетика и рациональное использование трансграничных водных ресурсов [12]; [17]; [20]. Вместе с тем в научной литературе пока мало работ, в которых биоэкономика рассматривается применительно к горным странам региона. Особенности горных экосистем, пастбищного хозяйства и традиционного природопользования Кыргызстана требуют отдельной модели, что и определяет направленность настоящего исследования.

МЕТОДОЛОГИЯ

Исследование носит качественный, аналитико-концептуальный характер. Цель работы - определить глобальные и региональные приоритеты развития биоэкономики и на этой основе обосновать модель горной биоэкономики Кыргызстана.

Информационную базу исследования составили три группы источников. Первая группа - материалы международных организаций: доклады и тематические материалы FAO по биоэкономике, биоразнообразию, биотехнологиям и биоэнергетике [5-10]; [12], а также региональные оценки UNECE по экологическим приоритетам, водно-энергетическому и земельному нексусу и природоориентированным решениям в Центральной Азии [17-20]. Вторая группа - научные публикации, посвященные концепции биоэкономики, ее связи с циркулярной экономикой, биоразнообразием и Целями устойчивого развития [1-4]; [13-16]. Третья группа - документы государственной политики Кыргызской Республики, включая Национальную программу развития до 2030 года и Программу развития зеленой экономики [21; 22], а также материалы FAO о национальном потенциале страны [8]; [11].

В работе использованы следующие методы: контент-анализ документов международных организаций и национальных программ; сравнительный анализ подходов к биоэкономике в научной литературе; системный подход, позволивший рассмотреть биоэкономику как межсекторальную систему, связывающую природный капитал, производство, технологии и рынки; структурно-логическое моделирование, на основе которого построена последовательная модель горной биоэкономики. Приоритетные направления выделены путем сопоставления глобальных тенденций с природно-ресурсными и социально-экономическими особенностями Кыргызстана.

Ограничением исследования является отсутствие количественной оценки вклада биоэкономики в экономику страны, поскольку соответствующая статистика в Кыргызстане пока не формируется как отдельный показатель. Количественная оценка может стать направлением дальнейших исследований.

АНАЛИЗ И РЕЗУЛЬТАТЫ

Глобальные приоритеты развития биоэкономики

На современном этапе можно выделить несколько взаимосвязанных глобальных приоритетов биоэкономики.

Первый приоритет - устойчивое использование биологических ресурсов.

Экономический рост должен обеспечиваться не за счет истощения природного капитала, а на основе его рационального использования и воспроизводства. В данном контексте биоэкономика предполагает переход от преимущественно экстенсивного использования биологических ресурсов к модели, в которой их экономическая ценность сочетается с обеспечением экологической устойчивости [5]; [15].

Второй - развитие биотехнологий и биоинноваций.

Биотехнологические решения позволяют повышать продуктивность сельского хозяйства, создавать устойчивые сорта растений, развивать биологические средства защиты растений, совершенствовать животноводство, производство пищевой продукции и переработку биологического сырья [5; 7].

Развитие биотехнологий одновременно формирует новые возможности для создания добавленной стоимости, развития инновационных производств и повышения конкурентоспособности национальных экономик. В связи с этим биоинновации становятся одним из важных элементов перехода к экономике, основанной на знаниях и более эффективном использовании природного капитала [15].

Третий - развитие биоэнергетики.

Использование биомассы и органических отходов позволяет одновременно решать энергетические и экологические задачи. Особенно перспективным является использование отходов сельского хозяйства и животноводства для производства биогаза, тепловой и электрической энергии [5]; [6].

Для стран с существенным аграрным сектором биоэнергетика может стать не только элементом энергетического перехода, но и дополнительным источником доходов сельских территорий.

Четвертый - формирование циркулярной биоэкономики.

Особое значение приобретает переход от линейной модели:

«ресурс → производство → потребление → отходы»

к более замкнутой модели:

«биологический ресурс → производство → переработка → вторичное использование → восстановление ресурса».

Научные исследования показывают, что объединение принципов биоэкономики и циркулярной экономики создает возможности для повышения эффективности использования ресурсов, сокращения отходов и содействия достижению Целей устойчивого развития [1]; [4]; [14].

При этом циркулярная биоэкономика должна оцениваться не только с позиции экономической эффективности, но и с учетом экологических и

социальных последствий. Современные исследования подчеркивают необходимость разработки системы показателей, позволяющих оценивать устойчивость циркулярных биоэкономических моделей [14].

Пятый - сохранение биоразнообразия.

Биоразнообразие становится не только объектом экологической охраны, но и важнейшим элементом природного капитала, обеспечивающим продовольствие, лекарственные ресурсы, экосистемные услуги и устойчивость сельскохозяйственного производства [16].

При этом развитие биоэкономики не должно приводить к чрезмерной эксплуатации биологических ресурсов. Наоборот, сохранение биоразнообразия должно рассматриваться как необходимое условие долгосрочной устойчивости самой биоэкономики [3]; [16].

Шестой - развитие сельских территорий.

Современная биоэкономика должна обеспечивать не только экологический эффект, но и новые источники доходов для сельского населения. Развитие переработки биологического сырья, биотехнологий, органического сельского хозяйства, биоэнергетики и экосистемных услуг способно формировать новые рабочие места и дополнительные источники доходов в сельских регионах [4]; [12].

Именно этот аспект имеет особое значение для Кыргызстана, где значительная часть населения связана с сельским хозяйством и использованием природных ресурсов.

Региональная специфика Центральной Азии

Центральная Азия обладает значительным потенциалом для развития биоэкономики, однако региональные условия требуют формирования собственной модели, учитывающей природно-климатические и социально-экономические особенности государств.

FAO в современных региональных материалах рассматривает развитие устойчивой биоэкономики в Европе и Центральной Азии через такие направления, как климатически устойчивое сельское хозяйство, биоэнергетика, устойчивое пастбищное животноводство, лесное хозяйство, агролесоводство и переработка биологических ресурсов [12].

Особенно показательным является пример Кыргызстана. FAO отмечает, что на юге страны управляемые ореховые леса используются для получения недревесной лесной продукции в сочетании с сенокошением [12]. Данный пример показывает, что отдельные элементы биоэкономики уже существуют в традиционных хозяйственных практиках Кыргызстана, хотя пока они не объединены в единую национальную систему.

Для Центральной Азии особенно важным становится сочетание биоэкономических подходов с задачами рационального использования водных ресурсов. UNECE подчеркивает необходимость координации действий государств региона в отношении трансграничных водных ресурсов, поскольку

водный дефицит, изменение климата и рост потребности в воде непосредственно влияют на устойчивость сельского хозяйства и других секторов экономики [17].

Таким образом, региональная биоэкономика Центральной Азии должна учитывать взаимосвязь:

вода → земля → сельское хозяйство → биоразнообразие → продовольственная безопасность → климатическая устойчивость → экономическое развитие.

Современная региональная экологическая повестка также показывает необходимость перехода от отдельных национальных экологических мероприятий к согласованным региональным решениям. В 2026 году UNECE отмечает, что климатические изменения, водный дефицит, утрата биоразнообразия, деградация земель и управление отходами не могут эффективно решаться исключительно на национальном уровне [20].

Потенциал Кыргызстана для развития биоэкономики

Кыргызстан обладает специфическим природным потенциалом, связанным прежде всего с горными экосистемами, пастбищами, сельскохозяйственными ресурсами, лесами, водными ресурсами и биологическим разнообразием [8].

Горный характер территории определяет особенности хозяйственной деятельности и одновременно формирует специфические возможности для развития биоэкономики. К ним относятся производство сельскохозяйственной продукции, использование пастбищных ресурсов, переработка плодово-ягодного и орехового сырья, использование лекарственных и эфиромасличных растений, развитие органического производства, экотуризма и других видов деятельности, основанных на природном капитале.

Важным фактором является то, что отдельные направления государственной политики Кыргызстана уже непосредственно связаны с принципами зеленой и биоэкономики.

Национальная программа развития Кыргызской Республики до 2030 года определяет необходимость обеспечения устойчивого экономического роста, развития сельского хозяйства, энергетики, промышленности, туризма и повышения эффективности использования имеющегося потенциала страны [21].

Дополнительную основу создает Программа развития зеленой экономики Кыргызской Республики на 2025-2029 годы, утвержденная постановлением Кабинета Министров Кыргызской Республики от 1 сентября 2025 года № 544 [22]. Документ ориентирован на повышение эффективности использования ресурсов, развитие экологически устойчивого производства, повышение производительности сельского хозяйства, восстановление деградированных земель, развитие зеленых инвестиций и других элементов зеленой трансформации.

Кыргызстан также присоединился к инициативе FAO по зеленому сельскому хозяйству в качестве пилотной страны в 2025 году, что создает дополнительные возможности для внедрения устойчивых сельскохозяйственных

практик, обмена знаниями и развития научно-технологического сотрудничества [11].

Таким образом, формирование биоэкономики Кыргызстана не требует создания полностью новой экономической системы. Более реалистичным представляется объединение уже существующих направлений государственной политики в единую межсекторальную биоэкономическую систему.

Авторское предложение - модель горной биоэкономики Кыргызстана

С учетом природных и социально-экономических особенностей страны представляется целесообразным рассматривать формирование модели горной биоэкономики Кыргызстана как перспективное направление национального развития.

Под моделью горной биоэкономики предлагается понимать межсекторальную систему формирования экономической и социальной добавленной стоимости на основе устойчивого использования биологических ресурсов горных территорий, развития технологий и глубокой переработки биологического сырья при обязательном обеспечении воспроизводства природного капитала.

Предлагаемая модель может быть представлена следующим образом:



Рисунок 1. Межсекторальная модель формирования добавленной стоимости в горной биоэкономике Кыргызстана[1]

Таким образом, биоэкономика рассматривается не как отдельный сектор экономики, а как межсекторальная система формирования добавленной стоимости на основе биологических ресурсов при условии их воспроизводства.

[1] Источник: разработано автором.

Данная модель позволяет объединить экономические, экологические и социальные цели развития.

Приоритетные направления биоэкономики Кыргызстана

С учетом проведенного анализа можно выделить семь приоритетных направлений.

1. Биоэкономизация сельского хозяйства.

Основными направлениями являются развитие органического производства, применение биологических средств защиты растений, рациональное использование водных ресурсов, восстановление плодородия почв и внедрение климатически устойчивых технологий.

2. Устойчивое управление пастбищами.

Пастбищное животноводство следует рассматривать не только как традиционный аграрный сектор, но и как элемент управления природным капиталом. Рациональное использование пастбищ позволяет одновременно поддерживать животноводство, занятость сельского населения и экологическую устойчивость горных территорий.

3. Глубокая переработка биологического сырья.

Особое значение имеют плодово-ягодная продукция, орехи, лекарственное и эфиромасличное сырье, а также продукты животноводства. Переход от реализации сырья к глубокой переработке способен увеличить долю добавленной стоимости, остающейся внутри страны.

4. Развитие биотехнологий.

Перспективными направлениями являются селекция, биологические удобрения, биологическая защита растений, ветеринарные биотехнологии, лабораторные технологии и другие виды биоинноваций.

5. Биоэнергетика и переработка органических отходов.

Особенно перспективными являются отходы животноводства и сельского хозяйства, которые могут использоваться для производства биогаза и других видов биоэнергии.

6. Экосистемная биоэкономика.

Включает лесовосстановление, восстановление деградированных земель, охрану биоразнообразия, устойчивое управление водными и горными экосистемами. В данном направлении важны природоориентированные решения, позволяющие одновременно укреплять экосистемную устойчивость и получать экономические и социальные эффекты [19].

7. Биоэкономика туризма.

Экотуризм, агротуризм, природно-рекреационные услуги и использование уникального горного природного капитала могут стать дополнительным источником доходов регионов.

Кыргызстан - Узбекистан: перспективы регионального сотрудничества

Для формирования региональной биоэкономики особое значение имеет развитие сотрудничества между странами Центральной Азии.

Кыргызстан и Узбекистан обладают взаимодополняющими возможностями в области сельского хозяйства, переработки, науки, образования и использования природных ресурсов. При этом региональное взаимодействие целесообразно строить не по принципу простого обмена сырьем, а на основе создания совместной добавленной стоимости.

Перспективная модель сотрудничества может быть представлена следующим образом:

наука → технологии → производство → переработка → рынок.

Возможными направлениями являются:

- совместные научные исследования в области биотехнологий;
- разработка и внедрение биологических средств производства;
- создание трансграничных цепочек добавленной стоимости;
- глубокая переработка сельскохозяйственного и природного сырья;
- обмен технологиями и инновациями;
- подготовка кадров для биоэкономики;
- развитие экологического и агротуризма;
- совместные проекты в сфере переработки органических отходов;
- сотрудничество в области устойчивого управления водными и земельными ресурсами.

Важность такого сотрудничества определяется также трансграничным характером природных ресурсов Центральной Азии. Современные инициативы UNECE показывают, что взаимодействие стран региона в сфере воды, энергетики, землепользования и климатической устойчивости постепенно приобретает комплексный характер [17; 18].

Следовательно, региональная биоэкономика может стать одним из инструментов укрепления экономической взаимосвязанности государств Центральной Азии.

ВЫВОДЫ И ПРЕДЛОЖЕНИЯ

Проведенный анализ показывает, что биоэкономика становится одним из перспективных направлений трансформации современной экономической системы. Ее развитие связано не только с использованием биологических ресурсов, но и с формированием новых технологических, производственных и организационных моделей, основанных на принципах устойчивости, циркулярности и сохранения природного капитала [4; 5; 15].

Для Центральной Азии развитие биоэкономики приобретает особое значение вследствие сочетания высокого природно-биологического потенциала с такими вызовами, как изменение климата, деградация земель, водный дефицит, сокращение биоразнообразия и необходимость повышения эффективности сельского хозяйства [17; 20].

Кыргызстан обладает предпосылками для формирования собственной модели биоэкономики, основанной на особенностях горных экосистем, биологическом разнообразии, аграрном потенциале, пастбищных и лесных

ресурсах, а также на развитии биотехнологий и глубокой переработки биологического сырья.

В отличие от моделей биоэкономики, ориентированных преимущественно на высокотехнологичные биопромышленные производства, для Кыргызстана более целесообразной представляется комбинированная модель горной биоэкономики, объединяющая природный капитал, устойчивое сельское хозяйство, глубокую переработку биологического сырья, биотехнологии, биоэнергетику, экосистемные услуги и туризм.

При этом биоэкономизация должна сопровождаться развитием науки, инновационной инфраструктуры, системы подготовки кадров, механизмов финансирования и государственной поддержки предпринимательства.

Формирование биоэкономики Кыргызстана целесообразно рассматривать не только как национальную задачу, но и как элемент становления региональной биоэкономики Центральной Азии, основанной на кооперации, совместных инновациях, рациональном использовании трансграничных природных ресурсов и формировании региональных цепочек добавленной стоимости.

Таким образом, перспективность биоэкономики для Кыргызстана определяется возможностью соединения трех взаимосвязанных целей:

экономическая эффективность + социальное развитие + сохранение природного капитала.

Именно такое сочетание может стать основой формирования устойчивой модели горной биоэкономики Кыргызстана и ее дальнейшей интеграции в региональное экономическое пространство Центральной Азии.

На основе проведенного исследования предлагается:

1. Разработать концепцию горной биоэкономики Кыргызстана как межсекторального документа, объединяющего положения Национальной программы развития до 2030 года и Программы развития зеленой экономики [21; 22].

2. Поддерживать глубокую переработку орехового, плодово-ягодного, лекарственного и эфиромасличного сырья, чтобы большая часть добавленной стоимости оставалась внутри страны.

3. Внедрять устойчивое управление пастбищами, восстановление деградированных земель и природоориентированные решения в горных экосистемах [19].

4. Развивать производство биогаза и других видов биоэнергии на основе отходов животноводства и сельского хозяйства [6].

5. Сформировать систему показателей мониторинга биоэкономики, учитывающую экономические, социальные эффекты и состояние биоразнообразия [14; 16].

6. Расширять сотрудничество Кыргызстана и Узбекистана через совместные научные проекты, подготовку кадров и создание трансграничных цепочек добавленной стоимости в переработке биологического сырья.

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MINTAQAVIY AGLOMERATSIYALARDA BIOIQTISODIY RESURSLARDAN SAMARALI FOYDALANISHNING TASHKILIY-IQTISODIY MEXANIZMLARI

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Annotatsiya

Maqolada mintaqaviy aglomeratsiyalarda bioiqtisodiy resurslardan samarali foydalanishning tashkiliy-iqtisodiy mexanizmlari nazariy va amaliy jihatdan o‘rganildi. Muallif aglomeratsiya iqtisodiyotining mikroasoslari, sanoat simbiozi va bioiqtisodiyot konsepsiyalarini umumlashtirib, aglomeratsiyani qishloq xo‘jaligi qoldiqlari, organik maishiy chiqindilar va boshqa biologik resurslarni yig‘ish hamda qayta ishlash uchun qulay makon sifatida talqin etdi. Aholining joylashuvi, maishiy chiqindilar hajmi, qishloq xo‘jaligi ishlab chiqarishi va chiqindilardan energiya olish stansiyalarining hududiy parametrlari rasmiy manbalar asosida baholandi. Resurslardan foydalanish koeffitsiyenti va energiya chiqishi ko‘rsatkichi hisoblab chiqildi hamda yirik aglomeratsiyalarda qurilayotgan obyektlar qayta ishlash darajasini sezilarli oshirish salohiyatiga ega ekani aniqlandi. Natijada biologik klaster, munitsipal-xususiy sheriklik, iqtisodiy rag‘batlar va hududiy rejalashtirishni birlashtirgan mexanizm modeli ishlab chiqildi hamda Xorazm viloyati misolida amaliy takliflar asoslab berildi. Taklif etilgan yondashuv hududlarning barqaror va mutanosib rivojlanishiga xizmat qiladi. Tadqiqot natijalaridan mahalliy hokimliklar va investorlar bioresurslarni qayta ishlash loyihalarini rejalashtirishda foydalanishlari mumkin.

Kalit so‘zlar: aglomeratsiya, bioiqtisodiyot, bioresurslar, sanoat simbiozi, biologik klaster, munitsipal-xususiy sheriklik, maishiy chiqindilar, Xorazm viloyati.

Аннотация

В статье с теоретической и практической стороны исследованы организационно-экономические механизмы эффективного использования биоэкономических ресурсов в региональных агломерациях. Автор обобщил концепции микрооснований агломерационной экономики, промышленного симбиоза и биоэкономики и интерпретировал агломерацию как благоприятное пространство для сбора и переработки сельскохозяйственных остатков, органических бытовых отходов и других биологических ресурсов. На основе официальных источников оценены размещение населения, объём бытовых отходов, сельскохозяйственное производство и региональные параметры станций по получению энергии из отходов. Рассчитаны коэффициент использования ресурсов и показатель энергетического выхода, установлено, что строящиеся в крупных агломерациях объекты способны существенно повысить уровень переработки. В результате разработана модель механизма, объединяющая биологический кластер, муниципально-частное партнёрство,

экономические стимулы и территориальное планирование, а также обоснованы практические предложения на примере Хорезмской области. Предложенный подход служит устойчивому и сбалансированному развитию регионов. Результаты исследования могут быть использованы местными хокимиятами и инвесторами при планировании проектов по переработке биоресурсов.

Ключевые слова: агломерация, биоэкономика, биоресурсы, промышленный симбиоз, биологический кластер, муниципально-частное партнёрство, бытовые отходы, Хорезмская область.

Abstract

The article examined, from theoretical and practical perspectives, the organizational and economic mechanisms for the efficient use of bioeconomic resources in regional agglomerations. The author synthesised the concepts of the micro-foundations of agglomeration economies, industrial symbiosis and the bioeconomy, and interpreted the agglomeration as a favourable space for collecting and processing agricultural residues, organic household waste and other biological resources. The spatial distribution of the population, the volume of household waste, agricultural output and the regional parameters of waste-to-energy plants were assessed on the basis of official sources. A resource utilisation coefficient and an energy yield indicator were calculated, and it was found that the facilities under construction in large agglomerations have the potential to significantly raise the level of processing. As a result, a mechanism model combining a bio-based cluster, municipal-private partnership, economic incentives and spatial planning was developed, and practical proposals were substantiated for the Khorezm region. The proposed approach serves the sustainable and balanced development of the regions. The findings can be used by local authorities (khokimiyats) and investors when planning bio-resource processing projects.

Keywords: agglomeration, bioeconomy, bio-resources, industrial symbiosis, bio-based cluster, municipal-private partnership, household waste, Khorezm region.

KIRISH

Iqtisodiy faollikning makonda to‘planishi zamonaviy mintaqaviy iqtisodiyot nazariyasining markaziy mavzularidan biri hisoblanadi. A. Marshall davridan beri shakllanib kelgan an’anaga ko‘ra, korxonalar va aholining bir hududda zich joylashuvi mehnat bozorining chuqurlashuvi, yetkazib beruvchilar tarmog‘ining kengayishi va bilimlarning tez tarqalishi hisobiga qo‘shimcha samara yaratadi. G. Duranton va D. Puga bu samaralarni uchta mikromexanizmga, ya’ni bo‘linmas infratuzilma va resurslarni birgalikda foydalanish, ishchi kuchi va ish o‘rinlarini moslashtirish hamda o‘zaro o‘rganish jarayonlariga ajratib, aglomeratsiya iqtisodiyotining nazariy asosini tizimlashtirgan [4]. Ushbu yondashuvdagi “birgalikda foydalanish” mexanizmi biologik resurslar uchun alohida ahamiyatga ega, chunki organik chiqindilarni yig‘ish, saralash va qayta ishlash infratuzilmasi yuqori boshlang‘ich xarajat talab etadi va faqat yetarli hajmdagi xomashyo oqimi mavjud bo‘lgan joyda iqtisodiy jihatdan o‘zini oqlaydi.

Bioiqtisodiyot tushunchasi ilmiy muomalaga XXI asr boshida kirib, qayta tiklanuvchi biologik resurslardan oziq-ovqat, yem, energiya, materiallar va kimyoviy mahsulotlar ishlab chiqarishga asoslangan iqtisodiy faoliyat majmuini anglatadi. OECD bioiqtisodiyotni biotexnologiyalar birlamchi ishlab chiqarish, sog‘liqni saqlash va sanoat sohalarida yaratadigan qiymatning yig‘indisi sifatida ta’riflab, uning rivojlanishi tadqiqot, infratuzilma va bozorni tartibga solishni uyg‘unlashtiruvchi siyosatga bog‘liqligini ko‘rsatgan [8]. Tushunchaning mazmuni keyinchalik kengayib, texnologik talqin bilan bir qatorda resurs va ekologik talqinlar ham shakllandi. Resurs talqinida asosiy e’tibor biomassani qayta ishlash zanjirlariga, ekologik talqinda esa ekotizimlar barqarorligi va hududiy o‘ziga xoslikka qaratiladi. Ana shu uchta talqinning kesishgan nuqtasida aglomeratsiyalar o‘ziga xos o‘rin egallaydi: ular bir vaqtning o‘zida organik chiqindilarning eng katta manbai, bioqayta ishlash mahsulotlarining eng yirik iste’molchisi va texnologik bilimlar markazi hisoblanadi.

Mintaqaviy aglomeratsiyada bioiqtisodiy resurslar uch guruhga birlashtiriladi. Birinchi guruhni shahar atrofidagi qishloq xo‘jaligi ishlab chiqarishidan hosil bo‘ladigan o‘simlik qoldiqlari va chorvachilik chiqindilari tashkil etadi. Ikkinchi guruh shahar hayot faoliyati natijasida vujudga keladigan organik maishiy chiqindilar, oziq-ovqat sanoati qoldiqlari va oqova suv cho‘kindilarini qamrab oladi. Uchinchi guruhga suv va yer bilan bog‘liq biologik resurslar, jumladan, yashil hududlar biomassasi, baliqchilik va suv havzalarining organik mahsulotlari kiradi. Ushbu resurslarning iqtisodiy qiymati ular alohida-alohida emas, balki yagona tashkiliy zanjirda boshqarilganda to‘liq namoyon bo‘ladi, bunday zanjirni shakllantirish esa tashkiliy-iqtisodiy mexanizm tushunchasini ilmiy tahlil markaziga olib chiqadi.

Tashkiliy-iqtisodiy mexanizm deganda iqtisodiy sub’ektlar o‘rtasidagi munosabatlarni muvofiqlashtiruvchi institutlar, tashkiliy shakllar va rag‘batlantirish vositalarining o‘zaro bog‘langan tizimi tushuniladi. Bioresurslar sohasida bunday mexanizmning asosiy vazifasi tarqoq manbalarda hosil bo‘ladigan xomashyoni barqaror oqimga aylantirish, qayta ishlash korxonalari uchun uzoq muddatli iqtisodiy kafolat yaratish va olingan mahsulotni hudud ichida iste’mol qilish imkoniyatini ta’minlashdan iborat. O‘zbekistonda urbanizatsiya jarayonlarini takomillashtirish va aglomeratsiyalarni ilg‘or xalqaro tajriba asosida boshqarish bo‘yicha qabul qilingan qarorlar hamda qattiq maishiy chiqindilar sohasidagi uzoq muddatli strategiya ushbu mexanizmni shakllantirish uchun mustahkam huquqiy zamin yaratdi.

Maqolaning maqsadi mintaqaviy aglomeratsiyalarda bioiqtisodiy resurslardan samarali foydalanishning tashkiliy-iqtisodiy mexanizmlarini nazariy jihatdan asoslash va ularni takomillashtirish yo‘nalishlarini ishlab chiqishdan iborat. Maqsadga erishish uchun aglomeratsiya iqtisodiyoti, sanoat simbiozi va bioiqtisodiyot nazariyalarining o‘zaro bog‘liqligini aniqlash, O‘zbekistonda bioresurslar bazasi va uni qayta ishlash infratuzilmasining holatini rasmiy ma’lumotlar asosida baholash, aglomeratsiya darajasida qo‘llaniladigan mexanizm modelini ishlab chiqish hamda Xorazm viloyati sharoitiga moslashtirilgan takliflarni asoslash vazifalari belgilandi.

ADABIYOTLAR SHARHI

Aglomeratsiya va klasterlar nazariyasi bioresurslarni boshqarish masalalariga metodologik asos beradi. M. Porter klasterni muayyan sohada o‘zaro bog‘langan kompaniyalar, ixtisoslashgan yetkazib beruvchilar, xizmat ko‘rsatuvchi tashkilotlar va tegishli institutlarning geografik jamlanmasi sifatida ta’riflab, klaster ichidagi raqobat va hamkorlik uyg‘unligi mahsuldorlik va innovatsiyalarni rag‘batlantirishini asoslagan [9]. Porter yondashuvida hududiy raqobatbardoshlik tabiiy resurslar zaxirasidan ko‘ra ular asosida yuzaga keladigan tashkiliy aloqalar zichligiga bog‘liq ekani ta’kidlanadi. Bioresurslar kontekstida bu xulosa qishloq xo‘jaligi qoldiqlari yoki organik chiqindilar hajmining o‘zi emas, balki ularni yig‘uvchi, tashuvchi, qayta ishlovchi va mahsulotni iste’mol qiluvchi sub’ektlarning bir makonda uyushishi iqtisodiy natijani belgilashini anglatadi.

Sanoat simbiozi nazariyasi bir korxona chiqindisini boshqasi uchun xomashyoga aylantirish orqali resurs samaradorligini oshirish g‘oyasini ilgari suradi. M. Chertou sanoat simbiozini an’anaviy ravishda alohida faoliyat yurituvchi korxonalarning material, energiya, suv va qo‘shimcha mahsulotlarni jismoniy almashish asosida birgalikda raqobat ustunligiga erishishi sifatida ta’riflagan hamda almashuv shakllarining besh turdan iborat tasnifini taklif etgan [2]. Uning xulosasiga ko‘ra, simbiozning muvaffaqiyati ishtirokchilarning geografik yaqinligiga bevosita bog‘liq bo‘lib, aynan shu jihat simbioz nazariyasini aglomeratsiya iqtisodiyoti bilan tutashtiradi. Dj. Erenfeld va N. Gertler Daniyaning Kalundborg shahrida bir necha o‘n yillar davomida shakllangan simbioz tarmog‘ini o‘rganib, u markazlashgan reja asosida emas, balki ikki tomonlama tijorat shartnomalarining bosqichma-bosqich to‘planishi natijasida vujudga kelganini ko‘rsatgan [5]. Mazkur tajriba bioresurslar zanjirini shakllantirishda shartnomaviy munosabatlarning ishonchliligi va uzoq muddatliligi hal qiluvchi omil ekanini tasdiqlaydi.

Bioiqtisodiyot adabiyotida tushunchaning ko‘p ma’noliligi alohida muhokama qilingan. M. Bugge, T. Hansen va A. Klitkou bibliometrik tahlil asosida bioiqtisodiyotning uchta ideal ko‘rinishini, ya’ni biotexnologik, bioresurs va bioekologik yondashuvlarni ajratib, ular maqsad, qiymat yaratish manbai va hududiy fokus jihatidan farqlanishini asoslaganlar [1]. Bioresurs yondashuvi qishloq xo‘jaligi, o‘rmon xo‘jaligi va chiqindilardan olinadigan biomassani qayta ishlash zanjirlarini asosiy qiymat manbai sifatida ko‘radi, bioekologik yondashuv esa mahalliy ekotizimlar va hududiy xususiyatlarga tayangan integratsiyalashgan ishlab chiqarishga urg‘u beradi. K. Makkormik va N. Kautto Yevropa mamlakatlari tajribasini umumlashtirib, bioiqtisodiyot strategiyalarining muvaffaqiyati hududiy darajadagi ishtirokchilarni jalb etish, fanlararo hamkorlik va barqarorlik mezonlarini aniq belgilashga bog‘liqligini ko‘rsatganlar [7].

Bioiqtisodiyotni barqaror rivojlanishning boshqa yo‘nalishlari bilan qiyoslash bo‘yicha tadqiqotlar ham muhim xulosalar bergan. D. D’Amato va hammualliflari “yashil”, aylanma va bioiqtisodiyot konsepsiyalarini qiyosiy tahlil qilib, bioiqtisodiyot resurslarni almashtirish, aylanma iqtisodiyot resurs oqimlarini yopish, “yashil” iqtisodiyot esa ekologik tizimlarni asrash mantiqiga tayanishini aniqlaganlar [3].

Mualliflarning fikricha, bu yondashuvlar bir-birini inkor etmaydi, aksincha, hududiy siyosatda ularni birlashtirish barqarorlik natijalarini kuchaytiradi. Aglomeratsiya darajasida bunday birlashuv organik chiqindilarni energiya va o‘g‘itga aylantirish orqali ham fotoalbar resurslarni almashtirish, ham resurs oqimini yopish imkonini beradi.

Bioresurslar infratuzilmasini moliyalashtirish masalasi davlat-xususiy sheriklik nazariyasi bilan bog‘liq. G. Xodj va K. Greve turli mamlakatlardagi sheriklik loyihalari samaradorligini baholab, ularning natijasi shartnoma tuzilmasi, xavflarni taqsimlash aniqligi va davlat organlarining nazorat salohiyatiga bog‘liqligini ko‘rsatgan [6]. Chiqindilarni qayta ishlash va bioenergetika obyektlari uzoq muddatli va kapital talab loyihalar bo‘lganligi sababli, sheriklikning kafolatlangan xarid, tarif va xizmat ko‘rsatish shartnomalari kabi vositalari aynan shu sohada eng yuqori samara beradi.

Adabiyotlar tahlili bir qator umumiy xulosalarga olib keladi. Aglomeratsiya iqtisodiyoti bioresurslarni qayta ishlash uchun zarur miqyos va zichlikni ta’minlaydi, sanoat simbiozi korxonalar o‘rtasidagi resurs almashuvi mantiqini ochib beradi, bioiqtisodiyot nazariyasi esa qiymat yaratish manbalari va hududiy fokusni belgilaydi. Shu bilan bir qatorda, mavjud tadqiqotlarda aglomeratsiya darajasida bu uch yondashuvni yagona tashkiliy-iqtisodiy mexanizmga birlashtirgan modellar, xususan, rivojlanayotgan mamlakatlar sharoitiga moslashtirilgan ishlanmalar yetarli darajada ishlab chiqilmagan. Ushbu bo‘shliqni to‘ldirish maqolaning ilmiy yangiligini tashkil etadi.

METODOLOGIYA

Tadqiqotning metodologik asosini tizimli va institutsional yondashuvlar tashkil etdi. Aglomeratsiya bioresurslar manbalari, qayta ishlash korxonalari, mahsulot iste’molchilari va tartibga soluvchi institutlar o‘zaro ta’sirda bo‘lgan ochiq iqtisodiy tizim sifatida ko‘rib chiqildi. Nazariy qismda tarixiy-mantiqiy, qiyosiy va umumlashtirish usullari qo‘llanilib, aglomeratsiya iqtisodiyoti, sanoat simbiozi va bioiqtisodiyot konsepsiyalarining tayanch nuqtalari aniqlandi. Amaliy qismda tarkibiy tahlil, nisbiy ko‘rsatkichlar usuli va modellashtirish qo‘llanildi. Axborot bazasini aholi soni va uning shahar hamda qishloq bo‘yicha taqsimlanishi [17], maishiy chiqindilar hosil bo‘lishi va qayta ishlanishi to‘g‘risidagi ma’lumotlar [19], qishloq xo‘jaligi ishlab chiqarishining yillik ko‘rsatkichlari [18] hamda hududlarda qurilayotgan chiqindilardan energiya olish stansiyalarining parametrlari [10] tashkil etdi. Normativ tahlil O‘zbekiston Respublikasining qonun hujjatlari milliy bazasida e’lon qilingan hujjatlar asosida amalga oshirildi.

Bioresurslardan foydalanish darajasini baholash uchun resurslardan foydalanish koeffitsiyenti qo‘llanildi:

$$K_f = \frac{Q_q}{Q_h} \times 100 \qquad (1)$$

bu yerda K_f - bioresurslardan foydalanish koeffitsiyenti, foizda; Q_q - yil davomida qayta ishlangan yoki qayta ishlash quvvati bilan ta’minlangan resurs hajmi, tonna; Q_h - shu davrda hosil bo‘lgan resursning umumiy hajmi, tonna. Koeffitsiyent resurs

bazasining qanday qismi xo‘jalik aylanmasiga kiritilganini ko‘rsatadi va turli davrlar hamda hududlar o‘rtasida taqqoslash imkonini beradi. Uning dinamikasi tashkiliy-iqtisodiy mexanizmning natijadorligini baholashda asosiy mezon vazifasini bajaradi, chunki mexanizmning pirovard maqsadi aynan Q_q hajmini Q_h ga yaqinlashtirishdan iborat.

Qayta ishlash obyektlarining iqtisodiy samaradorligini qiyoslash uchun bir tonna resursdan olinadigan energiya chiqishi ko‘rsatkichi hisoblandi:

$$e_i = \frac{W_i}{365 \cdot q_i} \quad (2)$$

bu yerda e_i - i-obyektda bir tonna chiqindidan olinadigan elektr energiyasi, kVt·soat/tonna; W_i - obyektning yillik elektr energiyasi ishlab chiqarish hajmi, kVt·soat; q_i - obyektning sutkalik qayta ishlash quvvati, tonna. Ko‘rsatkich turli aglomeratsiyalarda joylashgan obyektlarning texnologik samaradorligini bir xil o‘lchov birligida taqqoslash, xomashyo tarkibining energetik salohiyatini baholash hamda loyihalarning tarif va xarid shartlarini asoslash uchun xizmat qiladi.

TAHLIL VA NATIJALAR

Aglomeratsiyalarda bioresurslarni boshqarish salohiyati birinchi navbatda aholining makonda joylashuvi bilan belgilanadi. Rasmiy statistikaga ko‘ra, 2025-yil 1-yanvar holatiga O‘zbekistonning doimiy aholisi 37,5 mln kishiga yetgan bo‘lib, shundan 19,1 mln kishi yoki 51 foizi shaharlarda, 18,4 mln kishi yoki 49 foizi qishloq joylarida istiqomat qiladi [17]. Aholining deyarli teng taqsimlanishi O‘zbekiston aglomeratsiyalarining o‘ziga xos xususiyatini belgilaydi: shahar markazlari zich joylashgan qishloq aholi punktlari bilan o‘ralgan bo‘lib, ular yagona iqtisodiy makonni tashkil etadi. Bunday tuzilmada shahar organik chiqindilari va qishloq xo‘jaligi qoldiqlari geografik jihatdan bir-biriga yaqin joylashgan bo‘ladi. Resurs bazasini tavsiflovchi asosiy ko‘rsatkichlar 1-jadvalda umumlashtirildi.

1-jadval

O‘zbekistonda aglomeratsiyalar bioresurs bazasini tavsiflovchi asosiy ko‘rsatkichlar[1]

Ko‘rsatkich	Qiymati	Davr
Doimiy aholi soni, mln kishi	37,5	01.01.2025
Shahar aholisining ulushi, %	51	01.01.2025
Maishiy chiqindilarning yillik hajmi, mln tonna	14,0	2025-yil
Aholi jon boshiga maishiy chiqindi, kg/yil	373	2025-yil
Maishiy chiqindilarni qayta ishlash darajasi, %	5	2025-yil
Qishloq, o‘rmon va baliq xo‘jaligi mahsulotlari, trln so‘m	538,9	2025-yil
Tarmoq mahsulotlarining o‘sish sur’ati, %	4,4	2025-yil
Dehqon va tomorqa xo‘jaliklarining ulushi, %	62,3	2025-yil
Xorazm viloyatining doimiy aholisi, ming kishi	2032,4	01.01.2025

[1] Manba: aholi ko‘rsatkichlari [17] va [21]; chiqindilar ko‘rsatkichlari [19]; qishloq xo‘jaligi ko‘rsatkichlari [18] ma’lumotlari asosida tuzilgan, aholi jon boshiga chiqindi hajmi muallif tomonidan hisoblangan.

1-jadval ma'lumotlari aglomeratsiyalarning bioresurs bazasi keng va barqaror ekanini ko‘rsatadi. Mamlakatda har yili 14 mln tonna maishiy chiqindi hosil bo‘lib, uning to‘rtdan bir qismi qog‘oz, plastik, rezina, shisha va to‘qimachilik qoldiqlaridan iborat, qolgan asosiy qismini esa organik fraksiya tashkil etadi [19]. Aholi jon boshiga hisoblanganda bu ko‘rsatkich yiliga taxminan 373 kg ni tashkil etadi va aglomeratsiyalarda xomashyo oqimining zichligini tavsiflaydi. Qayta ishlash darajasining so‘nggi yillardagi loyihalar natijasida 5 foizga yetgani sohada ijobiy siljish boshlanganini va katta o‘sish zaxirasi mavjudligini bildiradi. Qishloq xo‘jaligi mahsulotlari 2025-yilda 538,9 trln so‘mni tashkil etib, 4,4 foizga o‘sgani o‘simlik qoldiqlari va chorvachilik chiqindilari hajmining ham barqaror ortib borishini ta'minlaydi [18]. Mahsulotlarning 62,3 foizi dehqon va tomorqa xo‘jaliklarida yetishtirilishi resurs manbalarining tarqoqligini ko‘rsatadi va ularni yagona zanjirga birlashtiruvchi tashkiliy mexanizmga ehtiyojni asoslaydi.

Resurs bazasini qayta ishlash infratuzilmasi bilan bog‘lashda davlat siyosati hal qiluvchi rol o‘ynaydi. 2019-2028-yillarga mo‘ljallangan qattiq maishiy chiqindilar strategiyasida aholini chiqindilarni yig‘ish va olib chiqish xizmatlari bilan qamrab olishni 100 foizga yetkazish hamda hosil bo‘ladigan chiqindilarning kamida 60 foizini qayta ishlash vazifasi belgilangan [16]. “Yashil” iqtisodiyotga o‘tish bo‘yicha 2030-yilgacha mo‘ljallangan chora-tadbirlarda qayta tiklanuvchi energiya manbalari quvvatini 15 GVt ga oshirish va ularning elektr energiyasi ishlab chiqarishdagi ulushini 30 foizdan ortiqqa yetkazish ko‘zda tutilgan [15]. Ushbu maqsadlar aglomeratsiyalardagi organik chiqindilarni energiya manbai sifatida qarash uchun aniq yo‘nalish beradi. Mazkur siyosatning amaliy ifodasi sifatida yirik aglomeratsiyalarda chiqindilardan energiya olish stansiyalari qurilishi boshlandi, ularning asosiy parametrlari 2-jadvalda keltirilgan.

2-jadval

Aglomeratsiyalarda chiqindilardan energiya olish stansiyalarining loyiha parametrlari[1]

Hudud	Sutkalik quvvat, tonna	Yillik elektr energiyasi, mln kVt·soat	Energiya chiqishi (e), kVt·soat/t
Toshkent viloyati	2500	390,0	427
Andijon viloyati	1500	240,0	438
Qashqadaryo viloyati	1500	240,0	438
Samarqand viloyati	1500	240,0	438
Namangan viloyati	1500	227,5	416
Farg‘ona viloyati	1500	227,5	416
Jami / o‘rtacha	10000	1565,0	429

2-jadval ma'lumotlari chiqindilardan energiya olish obyektlarining aynan yirik aglomeratsiyalar atrofida joylashtirilayotganini ko‘rsatadi. Toshkent viloyatidagi obyekt sutkasiga 2500 tonna, qolgan beshta obyekt esa 1500 tonnadan chiqindini qayta ishlashga mo‘ljallangan bo‘lib, ularning yillik elektr energiyasi ishlab chiqarish hajmi

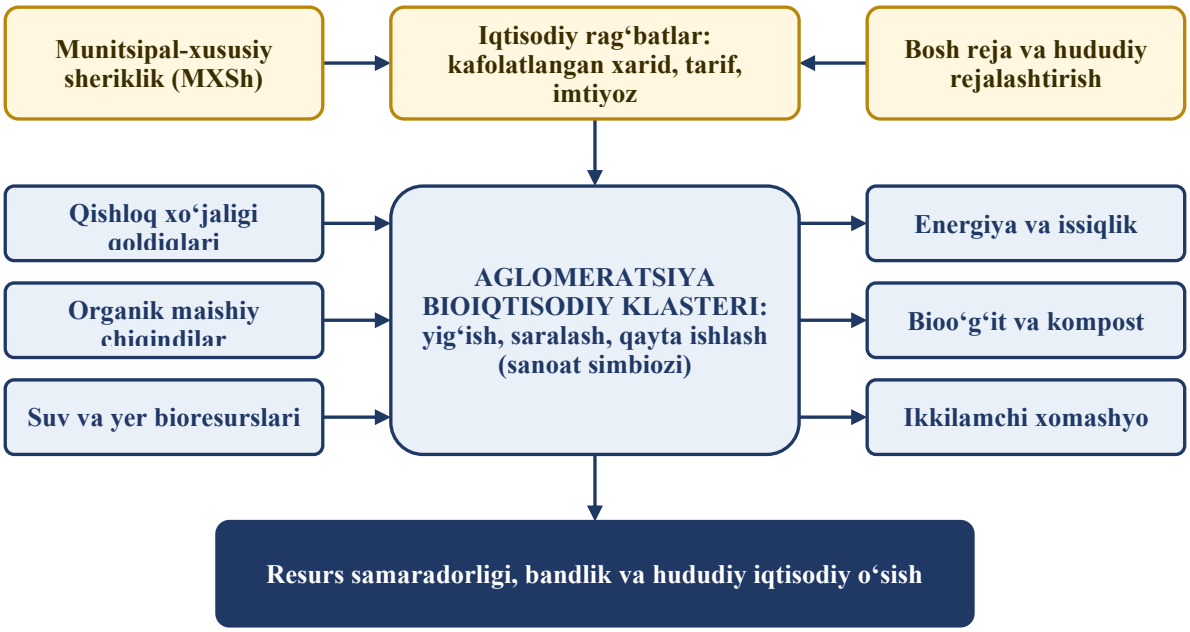
[1] Manba: The Times of Central Asia nashri ma'lumotlari [10] asosida tuzilgan; energiya chiqishi ko‘rsatkichi (2) formula bo‘yicha muallif tomonidan hisoblangan.

jami 1565 mln kVt·soatni tashkil etadi [10]. (2) formula bo‘yicha hisoblangan energiya chiqishi 416-438 kVt·soat/tonna oralig‘ida bo‘lib, obyektlar o‘rtasidagi farqning kichikligi loyihalarning yagona texnologik standart asosida ishlab chiqilganini bildiradi. Stansiyalar uchun 30 yillik kafolatlangan xarid shartnomalarining nazarda tutilgani investorlar uchun uzoq muddatli daromad barqarorligini ta’minlaydi va sanoat simbiozi adabiyotida ta’kidlangan shartnomaviy ishonchlilik tamoyilining amaliy ifodasi hisoblanadi.

Resurslardan foydalanish koeffitsiyentini (1) formula asosida hisoblash infratuzilma rivojining miqyosini aniq ko‘rsatadi. Oltita obyektning sutkalik quvvati jami 10 ming tonna bo‘lib, yil davomida bu 3,65 mln tonnaga teng qayta ishlash imkoniyatini beradi. Ushbu hajmni maishiy chiqindilarning yillik 14 mln tonnalik umumiy hajmiga nisbatlash natijasida K_f ko‘rsatkichi taxminan 26,1 foizni tashkil etadi, bu mavjud 5 foizlik darajadan besh barobardan ko‘proq yuqori. Mazkur natija faqat energiya yo‘nalishidagi obyektlar hisobiga olinganini hisobga olsak, kompostlash, biogaz ishlab chiqarish va ikkilamchi xomashyoni saralash quvvatlari qo‘shilganda strategiyada belgilangan 60 foizlik maqsadga erishish real istiqbolga aylanadi [16]. Hisob-kitob aglomeratsiya miqyosidagi yirik obyektlar bilan birga tuman darajasidagi kichik va o‘rta quvvatli qayta ishlash tarmog‘ini rivojlantirish zarurligini ko‘rsatadi.

Aglomeratsiyalarni rivojlantirishning huquqiy asoslari ham bioresurslar mexanizmini shakllantirish uchun qulay sharoit yaratmoqda. Urbanizatsiya jarayonlarini takomillashtirish to‘g‘risidagi farmonda aglomeratsiya afzalliklaridan barqaror rivojlanish vositasi sifatida foydalanish, o‘rta va kichik shaharlar hamda tuman markazlarini ilg‘or xalqaro tajriba asosida boshqarish, yirik shaharlar atrofida qulay transport aloqasiga ega yo‘ldosh shaharlar tarmog‘ini kengaytirish vazifalari belgilangan [13]. 2024-yilda qabul qilingan hududlarning iqtisodiy salohiyatini ro‘yobga chiqarish to‘g‘risidagi qarorda 38 ta tuman va shahar uchun urbanizatsiyani jadallashtirish va aglomeratsiya klasterlarini shakllantirishga yo‘naltirilgan bosh rejalar ishlab chiqish nazarda tutilgan [14]. Bosh rejalarda bioresurslarni qayta ishlash obyektlari uchun maxsus hududlar ajratilishi ularning xomashyo manbalari va iste’molchilarga yaqin joylashuvini ta’minlaydi.

Tahlil natijalari va nazariy umumlashmalar asosida mintaqaviy aglomeratsiyalarda bioiqtisodiy resurslardan foydalanishning tashkiliy-iqtisodiy mexanizmi modeli ishlab chiqildi (1-rasm). Model uch darajali tuzilishga ega: yuqori daraja institutsional muhitni, o‘rta daraja resurs oqimlari va qayta ishlashni, quyi daraja esa hududiy natijani aks ettiradi.



1-rasm. Aglomeratsiyada bioresurslardan foydalanish mexanizmi modeli[1]

Izoh: MXSh - munitsipal-xususiy sheriklik. Chap ustunda resurs manbalari, o‘ng ustunda klaster mahsulotlari, yuqori qatorda institutsional mexanizmlar ko‘rsatilgan; o‘qlar resurs va boshqaruv ta’sirining yo‘nalishini bildiradi.

1-rasmda aks ettirilgan modelning markaziy bo‘g‘ini aglomeratsiya bioiqtisodiy klasteri bo‘lib, u sanoat simbiozi tamoyili asosida faoliyat yuritadi. Qishloq xo‘jaligi qoldiqlari, organik maishiy chiqindilar hamda suv va yer bilan bog‘liq bioresurslar klasterga yagona xomashyo oqimi sifatida kelib tushadi va energiya, issiqlik, bioo‘g‘it, kompost hamda ikkilamchi xomashyoga aylantiriladi. Institutsional daraja uchta mexanizmdan iborat: munitsipal-xususiy sheriklik infratuzilmani moliyalashtirish va xavflarni taqsimlashni, iqtisodiy rag‘batlar kafolatlangan xarid, tarif va soliq imtiyozlari orqali loyihalarning daromadliligini, hududiy rejalashtirish esa obyektlarning maqbul joylashuvini ta’minlaydi. Modelning quyi darajasidagi natija resurs samaradorligining oshishi, yangi ish o‘rinlari va hududiy iqtisodiy o‘sish shaklida namoyon bo‘ladi. G. Duranton va D. Puga ta’riflagan “birgalikda foydalanish” samarasi modelda qayta ishlash infratuzilmasining butun aglomeratsiya uchun umumiy bo‘lishi orqali amalga oshadi [4].

Modelning munitsipal-xususiy sheriklik bo‘g‘ini milliy qonunchilik bilan mustahkam ta’minlangan. Davlat-xususiy sheriklik to‘g‘risidagi qonun sheriklik loyihalarini tayyorlash, xususiy sherikni tanlash, xavflarni taqsimlash va davlat tomonidan qo‘llab-quvvatlash tartibini belgilab, mahalliy hokimliklar va xususiy investorlar o‘rtasidagi uzoq muddatli hamkorlik uchun huquqiy asos yaratgan [11]. G. Xodj va K. Greve xulosalariga tayangan holda, bioresurslar sohasida sheriklik shartnomalarida xomashyo yetkazib berishning kafolatlangan hajmi, mahsulotni xarid qilish narxi va ekologik talablar aniq belgilanishi loyihaning muvaffaqiyatini ta’minlovchi asosiy shartlar hisoblanadi [6]. Munitsipal darajadagi sheriklikning

[1] Manba: G. Duranton va D. Puga [4], M. Chertou [2] hamda M. Bugge va hammualliflari [1] ishlari hamda 1-2-jadvallar natijalari asosida muallif ishlanmasi.

afzalligi shundaki, hokimlik chiqindilarni yig‘ish xizmatlari va yer ajratish vakolatlariga ega bo‘lib, xususiy sherik esa texnologiya va boshqaruv tajribasini olib kiradi.

Model Xorazm viloyati sharoitiga moslashtirilganda o‘ziga xos imkoniyatlar ochiladi. 2025-yil 1-yanvar holatiga viloyat aholisi 2 mln 32,4 ming kishini tashkil etib, bir yil davomida 1,8 foizga ko‘paygan [21]. Urganch shahri va unga tutash tumanlar zich aholi punktlari tarmog‘i bilan birgalikda mintaqaviy aglomeratsiya xususiyatlariga ega. Viloyat qishloq xo‘jaligida dehqon xo‘jaliklarining ulushi yuqori bo‘lib, 2023-yilning birinchi choragida tarmoq mahsulotlarining 87,9 foizi dehqon xo‘jaliklari, 5,3 foizi fermer xo‘jaliklari va 6,8 foizi qishloq xo‘jaligi tashkilotlari hissasiga to‘g‘ri kelgan [20]. Ushbu tuzilma chorvachilik chiqindilari va o‘simlik qoldiqlarining ko‘plab kichik manbalarda hosil bo‘lishini anglatadi. Tarqoq manbalarni yagona oqimga birlashtirishda mahalla darajasidagi yig‘ish punktlari va kooperatsiya shakllari hal qiluvchi ahamiyat kasb etadi.

Olingan natijalar xalqaro tadqiqotlar xulosalari bilan hamohang. K. Makkormik va N. Kautto ta’kidlaganidek, bioiqtisodiyot strategiyalari hududiy ishtirokchilar faol jalb etilgan joyda eng yuqori samara beradi [7], D. D’Amato va hammualliflari esa resurslarni almashtirish va resurs oqimlarini yopish mantiqlarini birlashtirish barqarorlik natijalarini kuchaytirishini ko‘rsatgan [3]. Taklif etilgan model ushbu ikki xulosani aglomeratsiya darajasida birlashtiradi: dehqon xo‘jaliklari va mahallalar xomashyo yetkazib beruvchi sifatida klasterga jalb etiladi, olingan bioo‘g‘it esa qishloq xo‘jaligiga qaytib, resurs aylanishini yakunlaydi. “O‘zbekiston-2030” strategiyasida belgilangan barqaror iqtisodiy o‘sish va aholi farovonligini oshirish maqsadlari bunday yondashuvning strategik mazmunini tasdiqlaydi [12].

XULOSA VA TAKLIFLAR

Tadqiqot mintaqaviy aglomeratsiyalar bioiqtisodiy resurslardan samarali foydalanish uchun eng qulay makon ekanini nazariy jihatdan asosladi. Aglomeratsiya iqtisodiyoti qayta ishlash infratuzilmasi uchun zarur miqyos va zichlikni, sanoat simbiozi korxonalar o‘rtasida resurs almashuvi mantiqini, bioiqtisodiyot nazariyasi esa qiymat yaratish manbalarini belgilab beradi. Ushbu uch yondashuvning birlashuvi tashkiliy-iqtisodiy mexanizmni resurs oqimlari, institutsional vositalar va hududiy natijalarni o‘zaro bog‘lovchi tizim sifatida talqin etish imkonini berdi. Amaliy tahlil O‘zbekistonda yiliga 14 mln tonna maishiy chiqindi hosil bo‘lishini, qayta ishlash darajasi 5 foizga yetganini hamda yirik aglomeratsiyalarda qurilayotgan chiqindilardan energiya olish obyektlari resurslardan foydalanish koeffitsiyentini taxminan 26 foizgacha oshirish salohiyatiga ega ekanini ko‘rsatdi. Energiya chiqishining obyektlar bo‘yicha yaqin qiymatlari loyihalarning yagona texnologik standartga asoslanganini tasdiqladi.

Mexanizmni takomillashtirish bo‘yicha quyidagi takliflar ilgari suriladi.

1. Aglomeratsiyalar bosh rejalarida bioresurslarni qayta ishlash uchun maxsus sanoat hududlarini ajratish va ularni chiqindilarni yig‘ish punktlari hamda transport yo‘laklari bilan bog‘lash maqsadga muvofiq.

2. Har bir aglomeratsiyada hokimlik, qayta ishlash korxonalari, fermer va dehqon xo‘jaliklarini birlashtiruvchi bioiqtisodiy klaster tashkil etib, uning doirasida sanoat simbiozi shartnomalarining namunaviy shaklini joriy etish tavsiya etiladi.

3. Munitsipal-xususiy sheriklik loyihalarida xomashyo yetkazib berishning kafolatlangan hajmi va mahsulotni xarid qilish shartlarini uzoq muddatga belgilash investorlar uchun barqaror daromad muhitini yaratadi.

4. Bioresurslardan foydalanish koeffitsiyenti va energiya chiqishi ko‘rsatkichlarini hududlar faoliyatini baholash tizimiga kiritish mexanizm natijadorligini muntazam kuzatish imkonini beradi.

5. Xorazm viloyatida Urganch shahri va tutash tumanlarni qamrab olgan tajriba aglomeratsiyasi sifatida mahalla darajasidagi organik chiqindilarni yig‘ish punktlari va dehqon xo‘jaliklari kooperatsiyasiga asoslangan biogaz hamda kompost ishlab chiqarish tarmog‘ini yaratish maqsadga muvofiq.

Taklif etilgan choralar qattiq maishiy chiqindilarni qayta ishlash va “yashil” iqtisodiyotga o‘tish bo‘yicha belgilangan maqsadlarga erishishni jadallashtirib, aglomeratsiyalarda resurs samaradorligi, bandlik va hududiy iqtisodiy o‘sishning yangi manbalarini shakllantirishga xizmat qiladi. Keyingi tadqiqotlarda tuman kesimidagi bioresurslar balansini tuzish va klaster loyihalarining iqtisodiy samarasini miqdoriy baholash vazifalari ko‘zda tutiladi.

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INNOVATIVE METHODS OF FINANCING THE CIRCULAR ECONOMY IN AGRICULTURE: A REVIEW OF INTERNATIONAL EXPERIENCE

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Abstract

This paper examines the innovative financing mechanisms that are driving the shift toward a circular economy in agriculture, drawing on recent international research and documented practice. The analysis synthesizes findings from the European Environment Agency (EEA), the United Nations Environment Programme Finance Initiative (UNEP FI) and the Global Alliance on Circular Economy and Resource Efficiency (GACERE), together with peer-reviewed studies published in international journals. The evidence suggests that green bonds, blended finance, sustainability-linked loans and public-private partnerships are among the most effective instruments for scaling circular practices in the sector, although a substantial global financing gap persists. The paper closes with a set of recommendations for adapting this experience to agriculture in Uzbekistan.

Keywords: circular economy, agricultural finance, green bonds, blended finance, sustainability-linked loans, innovative financial instruments.

Annotatsiya

Maqolada qishloq xo‘jaligida sirkulyar iqtisodiyotga o‘tishni ta’minlayotgan innovatsion moliyalashtirish mexanizmlari so‘nggi xalqaro tadqiqotlar va hujjatlashtirilgan amaliyot asosida o‘rganildi. Tahlilda Yevropa atrof-muhit agentligi (EEA), BMT Atrof-muhit dasturining Moliyaviy tashabbusi (UNEP FI) va Sirkulyar iqtisodiyot va resurs samaradorligi bo‘yicha global alyans (GACERE) materiallari hamda xalqaro jurnallarda chop etilgan taqrizlangan tadqiqotlar natijalari umumlashtirildi. Natijalar yashil obligatsiyalar, aralash moliyalashtirish, barqarorlikka bog‘langan kreditlar va davlat-xususiy sheriklik tarmoqda sirkulyar amaliyotlarni kengaytirishning eng samarali vositalari qatoriga kirishini ko‘rsatadi. Shu bilan birga, jahon miqyosida moliyalashtirishdagi sezilarli tafovut saqlanib qolmoqda: faqat Yevropa Ittifoqida yillik yetishmovchilik kamida 29 mlrd yevroga teng. Tavakkalchilikni kamaytirish mexanizmlari, qishloq xo‘jaligiga moslashtirilgan instrumentlar, soliq rag‘batlari va ma’lumotlar shaffofligi masalalari alohida ko‘rib chiqildi. Maqola so‘nggida ushbu tajribani O‘zbekiston qishloq xo‘jaligiga moslashtirish bo‘yicha tavsiyalar berildi.

Kalit so‘zlar: sirkulyar iqtisodiyot, qishloq xo‘jaligini moliyalashtirish, yashil obligatsiyalar, aralash moliyalashtirish, barqarorlikka bog‘langan kreditlar, innovatsion moliyaviy instrumentlar.

Аннотация

В статье рассмотрены инновационные механизмы финансирования, обеспечивающие переход сельского хозяйства к циркулярной экономике, на основе последних международных исследований и задокументированной практики. В анализе обобщены материалы Европейского агентства по окружающей среде (EEA), Финансовой инициативы Программы ООН по окружающей среде (UNEP FI) и Глобального альянса по циркулярной экономике и эффективности использования ресурсов (GACERE), а также рецензируемые исследования, опубликованные в международных журналах. Результаты показывают, что зелёные облигации, смешанное финансирование, кредиты, привязанные к показателям устойчивости, и государственно-частное партнёрство относятся к наиболее эффективным инструментам расширения циркулярных практик в отрасли. Вместе с тем сохраняется значительный глобальный разрыв в финансировании: только в Европейском союзе ежегодный дефицит составляет не менее 29 млрд евро. Отдельно рассмотрены механизмы снижения рисков, инструменты, адаптированные к сельскому хозяйству, налоговые стимулы и вопросы прозрачности данных. В заключение сформулированы рекомендации по адаптации этого опыта к сельскому хозяйству Узбекистана.

Ключевые слова: циркулярная экономика, сельскохозяйственное финансирование, зелёные облигации, смешанное финансирование, кредиты, привязанные к устойчивости, инновационные финансовые инструменты.

INTRODUCTION

The shift from a linear to a circular economic model calls for more efficient use of resources, less waste, and production practices that are regenerative rather than extractive [15]. In agriculture, this transition is particularly capital-intensive: it depends on upfront investment in new technologies, infrastructure and process redesign that most conventional lenders are not built to support. Traditional financing arrangements tend to reward short-term profitability, which works against the longer payback periods that circular business models typically require [13].

The scale of the challenge is well documented in Europe. According to the European Environment Agency, completing the transition to a circular economy across the EU will require an estimated EUR 170 billion a year, against a current financing baseline of roughly EUR 141 billion - leaving an annual shortfall of at least EUR 29 billion [6] (Figure 1). At the same time, private investment in circular economy sectors such as recycling, repair and reuse, and rental and leasing grew by 36% in real terms between 2010 and 2023, with gross value added rising by 15% over the same period - evidence that investor interest in the sector is building, even if funding has not yet caught up with need [6].

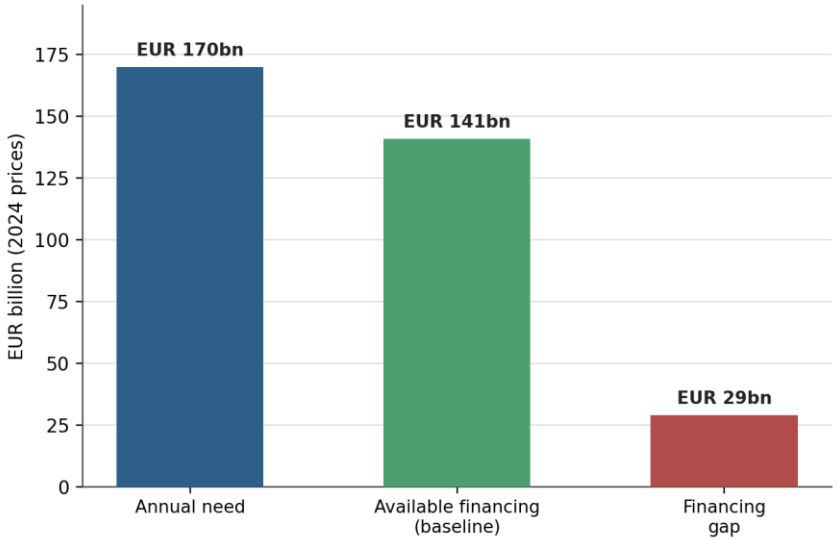


Figure 1. The EU's circular economy financing need against available funding[1]

Figure 1 shows that the annual need of EUR 170 billion exceeds the available baseline financing of EUR 141 billion, so the remaining gap of EUR 29 billion corresponds to roughly one-sixth (about 17%) of the total requirement. In other words, most of the necessary funding is already in place, but the missing share is large enough to slow the transition unless additional, mainly private, capital is mobilized [6].

The picture looks similar at global scale. UNEP FI and GACERE estimate that roughly USD 350 billion has been committed to circular economy financing since 2019: public equity funds grew from USD 0.3 billion to USD 6.6 billion between 2019 and 2023, while the number of sovereign bonds issued for this purpose increased more than thirteen-fold, reaching a cumulative USD 93 billion [19] (Figure 2). Even so, circular economy finance remains a small fraction of the broader sustainable finance market, which exceeded USD 7 trillion in 2023 - a reminder that the field is still in an early stage of development [19].

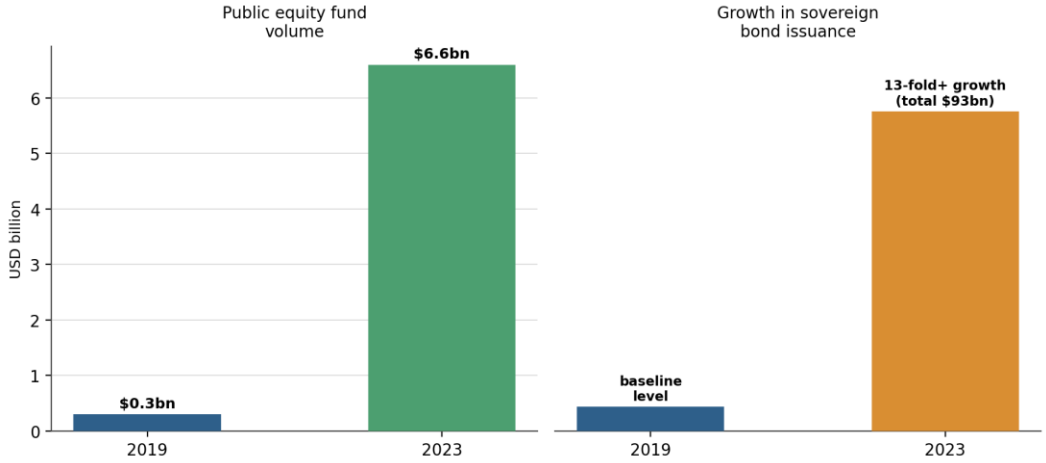


Figure 2. Growth in global circular economy financing, 2019-2023[2]

[1] Source: European Environment Agency (2025) [6].
[2] Source: United Nations Environment Programme & GACERE (2025) [19].

As Figure 2 illustrates, the volume of public equity funds increased about 22 times (from USD 0.3 billion to USD 6.6 billion) in four years, while sovereign bond issuance grew more than thirteen-fold from its 2019 baseline to a cumulative USD 93 billion. Both instruments therefore expanded rapidly, although from a very low starting level [19].

This paper sets out to map the innovative financing instruments that support the circular transition in agriculture, drawing on international research and case evidence, and to identify the conditions under which they work best.

The underlying trend is visible in the EEA's own monitoring data. As Figure 3 shows, both gross value added and private investment in the EU's core circular economy sectors - recycling, repair and reuse, and rental and leasing - have risen almost every year since 2010, with gross value added briefly spiking in 2021 before settling back onto its longer-term upward path [6].

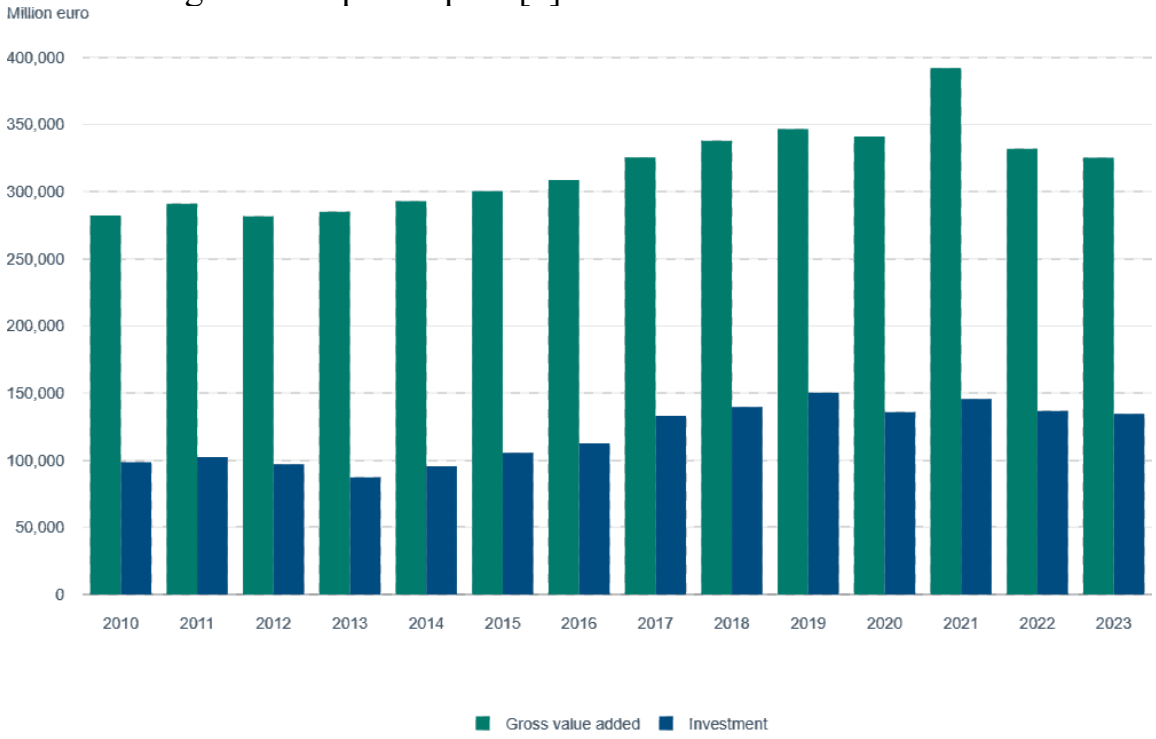


Figure 3. Private investment and gross value added in circular economy sectors (recycling, repair and reuse, rental and leasing), at 2024 prices, 2010-2023[1]

Figure 3 indicates that gross value added in these sectors increased from about EUR 282 billion in 2010 to about EUR 325 billion in 2023, peaking at almost EUR 392 billion in 2021, while investment rose from about EUR 98 billion to about EUR 134 billion, with its highest value (about EUR 150 billion) in 2019. These values are consistent with the reported real growth of 15% in gross value added and 36% in investment over the period [6].

[1] Source: European Environment Agency (2025) [6].

LITERATURE REVIEW

Research on the circular economy increasingly treats finance as one of the main conditions of the transition. Akahome [1] shows, on the example of small and medium-sized enterprises, that the move to digital circular practices requires investment in new technologies and business processes, while Qureshi et al. [15] link the integration of environmental, social and governance (ESG) factors with market dynamics and sustainable transitions. At the macro level, Chen et al. [2] provide empirical evidence from the European Union on how financial development affects circular economy performance, placing the financial system at the centre of the circular agenda.

The role of financial institutions has also been studied directly. Rataj et al. [16] analyse how European banks innovate in circular economy financing and find that sustainability priorities dominate the early stages of institutional change, while profitability considerations gain weight later; employees and middle managers, learning together with clients and external stakeholders, act as key drivers of this change. Sumerli, Malik and Shah [18] review financing models for circular business innovation and conclude that tailored mechanisms, such as green bonds, impact investing, performance-based loans and blended finance, are associated with better innovation and sustainability outcomes.

For agriculture specifically, Havemann, Negra and Werneck [9] examine blended finance as a way of combining concessional capital, guarantees and other risk-sharing tools to attract private investment into sustainable agricultural transitions, and they highlight both its possibilities and its constraints. Practical guidance from the Climate Bonds Initiative [3] on transition pathways for agri-food issuers, the FAO Investment Centre [8] on sustainability-linked loans, and the International Finance Corporation [10] on blended finance for agribusiness shows that such instruments are already being adapted to the agrifood sector.

A further strand of work focuses on the enabling environment. The European Environment Agency [6] and UNEP FI and GACERE [19] quantify the financing gap and stress the importance of de-risking instruments, fiscal policy and reliable data. The Chatham House briefing summarized by the Exeter Centre for Circular Economy [7] argues that public policy is central to de-risking circular investment. Muzamwese [13] demonstrates the value of networks such as the Africa Circular Economy Network in spreading circular practice, and Metta and Rousseau [12] show that economic incentives, such as discount schemes, can shift consumer behaviour toward circular options.

Taken together, the literature describes a wide range of instruments, but these findings are rarely brought together for agriculture and even more rarely related to the conditions of transition economies such as Uzbekistan. This paper addresses that gap by systematizing the international evidence into a taxonomy of financing instruments for circular agriculture.

METHODOLOGY

The study follows a qualitative approach combining a systematic literature review with case analysis. It builds on Sumerli, Malik and Shah [18], who reviewed 60 sources

published between 2015 and 2025 - peer-reviewed articles, industry reports and firm-level case studies - selected through purposive sampling and analysed thematically for patterns in financing models, capital structures and investment outcomes. This paper extends that evidence base with more recent findings from the European Environment Agency [6], UNEP FI and GACERE [19], and the Chatham House briefing distributed through the Exeter Centre for Circular Economy [7], applying the combined findings specifically to the agricultural sector.

The analysis was carried out in three steps. First, the instruments described in the sources were grouped into thematic blocks: comparative effectiveness of financing models, de-risking mechanisms, instruments tailored to agriculture, market-building and fiscal incentives, and data and transparency. Second, the quantitative indicators reported in the sources (the financing gap, the frequency of use of financing models and their reported outcomes) were compiled into Table 1 and Figures 1-4 without re-estimation. Third, the instruments were organized into a taxonomy (Figure 5), and their transferability to agriculture in Uzbekistan was assessed. The study relies on secondary data; its conclusions therefore depend on the coverage and quality of the reviewed sources and should be tested with primary data in future research.

ANALYSIS AND RESULTS

Comparing the effectiveness of financing models

Table 1 summarizes the financing models identified across the 60 sources reviewed by Sumerli, Malik and Shah [18], together with how often each was used and the innovation and sustainability outcomes reported.

Table 1

Circular economy financing models and their outcomes[1]

Financing model	Frequency of use (%)	Innovation outcomes (%)	Sustainability impact (%)
Green bonds	35	72	68
Impact investing	28	65	61
Leasing schemes	22	58	55
Public-private partnerships	15	50	48

Table 1 shows that green bonds are both the most frequently used model (35%) and the one with the strongest reported results (72% for innovation outcomes and 68% for sustainability impact). Impact investing (28%; 65% and 61%) and leasing schemes (22%; 58% and 55%) follow, while public-private partnerships are used least often (15%) and show the lowest outcomes (50% and 48%). For every model, innovation outcomes exceed sustainability impact by 2-4 percentage points [18] (Figure 4).

[1] Source: compiled by the author based on Sumerli, Malik & Shah [18].

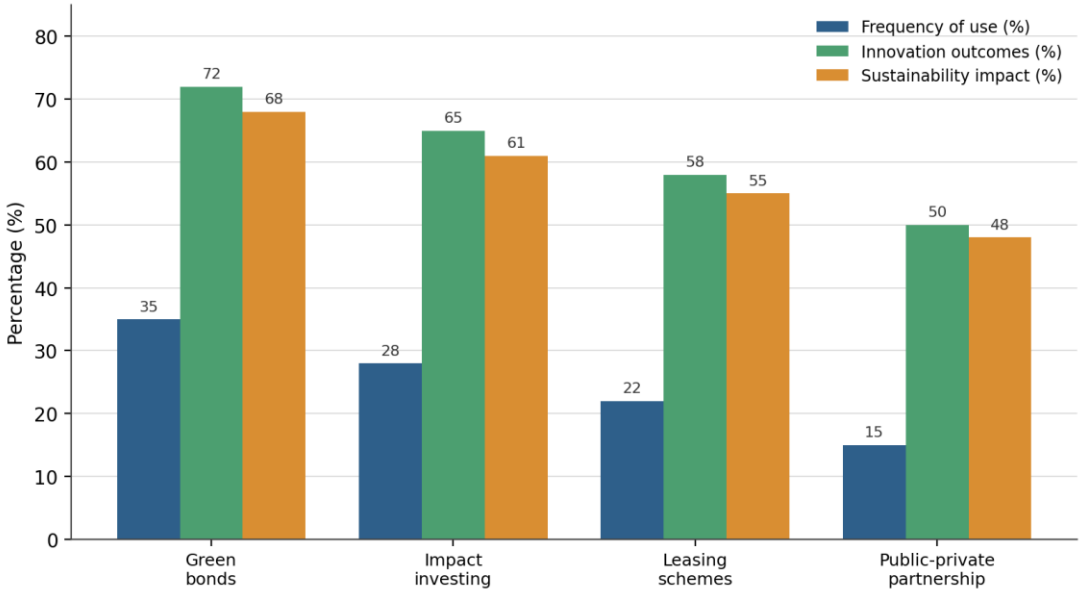


Figure 4. Financing models compared by frequency of use, innovation outcomes and sustainability impact[1]

Figure 4 makes the pattern visible: the ranking of the four models by frequency of use coincides with their ranking by reported outcomes, and the gap between the most and the least effective model is 22 percentage points for innovation outcomes (72% versus 50%) and 20 percentage points for sustainability impact (68% versus 48%) [18].

Regression analysis in the same study found that green bonds and impact investing were significant predictors of both capital allocation to circular projects ($\beta = 0.53$, $p < 0.01$) and improvements in resource-efficiency metrics ($\beta = 0.49$, $p < 0.01$), controlling for firm size and sector. The use of targeted financing models was also strongly correlated with successful implementation of circular innovations
($r = 0.61$, $p < 0.001$), and firms that combined several financing approaches at once tended to report better innovation and sustainability outcomes than those relying on a single
instrument [18].

A case in point: a European manufacturing firm that combined green bonds with impact investing to fund closed-loop production technologies cut material waste by 22% and energy use by 18% over three years [18].

De-risking mechanisms and return enhancement

UNEP FI and GACERE [19] frame the challenge of scaling circular economy financing around two priorities: making circular business models economically viable, and building the evidence base that proves their value to investors. Because circular projects typically involve higher upfront costs and longer payback periods, public-sector mechanisms that absorb or share risk play an outsized role. The most commonly used instruments include:

[1] Source: Sumerli, Malik & Shah (2025) [18].

1. Blended finance - concessional public capital used to draw in additional private investment;

2. Junior tranches - instruments that absorb first losses, giving other investors priority in repayment;

3. Credit guarantees - protection against losses if a borrower defaults or a project underperforms;

4. Concessional loans - financing offered below market interest rates;

5. Performance-based financing - terms tied to measurable circular outcomes.

One illustration: the European Bank for Reconstruction and Development, the European Investment Bank and the International Finance Corporation jointly financed a battery-recycling facility in Poland through a combined USD 290 million equity investment - a structure that blended equity, debt and grant financing to de-risk a technically ambitious project. The African Development Bank's Africa Circular Economy Facility (ACEF) plays a comparable role at continental scale, helping mainstream circular practice across African economies [19].

Financing instruments tailored to agriculture

Alongside these general-purpose instruments, a number of mechanisms designed specifically for agriculture have gained traction internationally.

a) Agricultural green bonds.

The market for green, social, sustainability and sustainability-linked (GSS+) bonds passed USD 6 trillion in 2025 [4]. In September of that year, Sweden's Landshypotek Bank issued a USD 500 million bond under a revised framework that, for the first time, extended eligibility beyond forestry to sustainable agriculture [14].

b) Blended finance for smallholder farmers.

Aceli Africa has mobilized more than USD 150 million for underserved agricultural SMEs through a first-loss cover mechanism, while the IFC's GAFSP programme channels blended finance to smallholder farmers in some of the world's poorest countries [5; 10].

c) Sustainability-linked loans (SLLs).

Unlike a conventional green loan, an SLL leaves the use of proceeds unrestricted; instead, the cost of borrowing is tied to whether the borrower meets predefined environmental targets. Globally, USD 327 billion in SLLs was issued in 2023 [8].

d) Crowdfunding platforms.

Lithuania-based InSoil, licensed as a European crowdfunding service provider, and Steward8 in the United States both use peer-to-peer lending to finance soil regeneration and regenerative farming practices [11].

e) Cooperatives and local financial institutions continue to be identified as a critical channel for inclusive, broad-based rural finance [17].

Building markets and fiscal incentives

UNEP FI and GACERE [19] argue that governments can do much to create the demand certainty that investors need, largely through fiscal policy. Examples include:

1. Sweden's VAT cut on repair services from 25% to 12% in 2017, which was followed by growth in nine of twenty-two repair businesses surveyed;

2. Thailand's tax incentives for biodegradable plastics, which helped attract roughly USD 1 billion in investment across more than 24 bioplastics projects between 2018 and 2023;

3. Chile's extended producer responsibility law, which by 2024 required 20% recycled plastic content in agriculture, construction and fisheries production;

4. Public procurement policy - which accounts for an average of 12% of GDP in OECD countries and up to 30% in many developing economies, making it one of the most powerful levers governments have for shaping demand for circular products [19].

Data and transparency

The 2021 Chatham House briefing, distributed via the Exeter Centre for Circular Economy, argues that policy instruments are central to de-risking and incentivizing circular investment, and makes the case for integrating circularity directly into public investment and stimulus packages [7]. UNEP FI and GACERE identify the absence of robust, science-based data and shared metrics as one of the principal obstacles to scaling investment - without common measurement frameworks, investors struggle to assess and compare circular projects. In response, De Nederlandsche Bank has developed a circular risk scorecard; across more than 100 assessments to date, it has consistently found that circular companies carry a lower risk profile than their linear counterparts [19].

Key barriers

The literature points to several recurring obstacles:

1. Elevated perceived risk and limited access to capital, particularly for small and medium-sized enterprises that lack collateral or a credit history;

2. Low awareness of available circular financing options and limited in-house expertise to evaluate them;

3. A shortage of science-based data and widely accepted metrics, which complicates investment decision-making;

4. A persistent disconnect between public and private financing, which makes blended structures a practical necessity rather than an optional refinement;

5. A substantial global financing gap - an estimated EUR 29 billion a year in the EU alone [6]; [19].

CONCLUSION AND SUGGESTIONS

The evidence reviewed here suggests that financing a circular transition in agriculture is rarely a matter of a single instrument; it depends on combining several complementary approaches. International practice points to five broad categories worth distinguishing: (1) market-based instruments such as green bonds and sustainability-linked loans; (2) blended and concessional finance, exemplified by GAFSP, Aceli Africa and ACEF-type facilities; (3) digital and crowd-based finance through platforms such as those reviewed above; (4) institutional and cooperative mechanisms; and (5) fiscal incentives, including tax relief and public procurement policy (Figure 5).

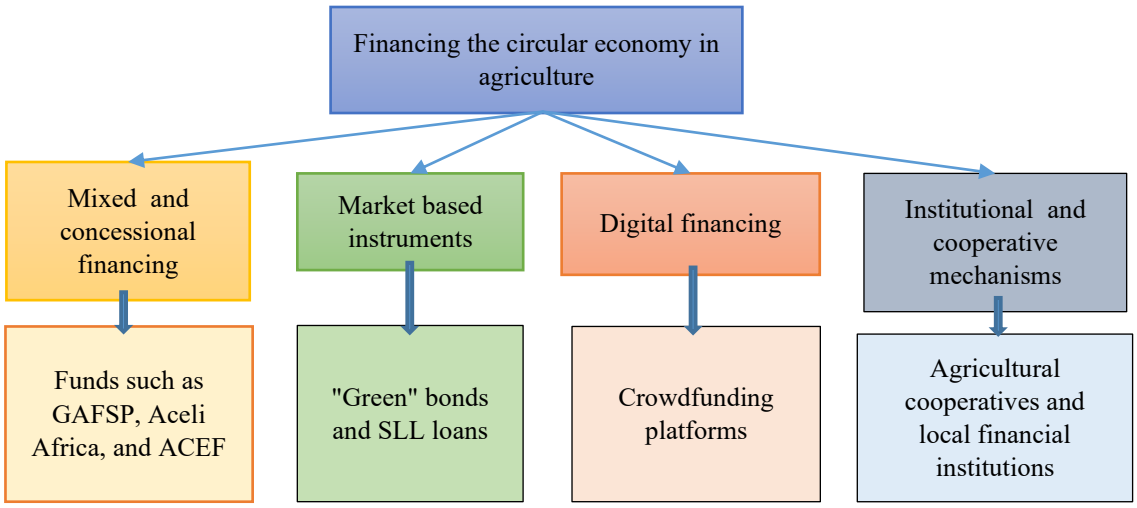


Figure 5. A taxonomy of financing instruments for the circular economy in agriculture[1]

Figure 5 groups the instruments under a single goal - financing the circular economy in agriculture - into four branches: mixed and concessional financing (funds such as GAFSP, Aceli Africa and ACEF), market-based instruments (green bonds and SLL loans), digital financing (crowdfunding platforms), and institutional and cooperative mechanisms (agricultural cooperatives and local financial institutions). Fiscal incentives, the fifth category, act as a policy layer that supports all four branches [5]; [10]; [11]; [17]; [19].

Adapting this experience to agriculture in Uzbekistan suggests several practical directions:

1. Introducing green and sustainability-linked credit lines through agricultural banks and financial institutions;
2. Developing blended finance programmes with first-loss cover for smallholder farms, in partnership with international financial institutions such as the EBRD and the IFC;
3. Building a national system of circular economy metrics and data collection;
4. Embedding circularity criteria into public procurement policy;
5. Designing tax incentives and subsidy schemes to support agricultural waste-recycling projects.

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BIOIQTISODIYOTNI RIVOJLANTIRISHDA FARMATSEVTIKA TEXNOLOGIYALARI TRANSFERI VA MAHALLIY ISHLAB CHIQARISHNING USTUVOR YO‘NALISHLARI

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Annotatsiya

Maqolada bioiqtisodiyotni rivojlantirish sharoitida farmatsevtika texnologiyalari transferi va dori vositalarini mahalliy ishlab chiqarishning ustuvor yo‘nalishlari nazariy va amaliy jihatdan o‘rganildi. Muallif OECD va Yevropa Ittifoqining bioiqtisodiyot bo‘yicha strategik hujjatlarida bayon etilgan konsepsiyalarini, yutish salohiyati nazariyasini hamda Jahon sog‘liqni saqlash tashkilotining mahalliy ishlab chiqarish doirasini qiyosiy tahlil qilib, texnologiya transferini biologik resurslarni yuqori qo‘shilgan qiymatli mahsulotga aylantiruvchi bo‘g‘in sifatida talqin etdi. O‘zbekiston farmatsevtika bozorining tarkibi, 2022-2026-yillarga mo‘ljallangan prognoz ko‘rsatkichlari va dorivor o‘simliklar xomashyo bazasi rasmiy hamda tahliliy manbalar asosida baholandi. Natijada bioresurslar, texnologiya transferi, yutish salohiyati va davlat siyosatini birlashtirgan konseptual model ishlab chiqildi. Substansiyalar ishlab chiqarishni rivojlantirish, fitopreparatlar qiymat zanjirini chuqurlashtirish va farmatsevtika kadrlarini tayyorlashni kengaytirish bo‘yicha takliflar asoslab berildi. Taklif etilgan yondashuv tarmoqning barqaror o‘sishi va aholining sifatli dori vositalari bilan ta’minlanishiga xizmat qiladi. Tadqiqot natijalaridan tarmoqni rivojlantirish dasturlarini ishlab chiqishda foydalanish mumkin.

Kalit so‘zlar: bioiqtisodiyot, farmatsevtika sanoati, texnologiya transferi, yutish salohiyati, mahalliy ishlab chiqarish, dorivor o‘simliklar, import o‘rnini bosish, Tashkent Pharma Park.

Аннотация

В статье с теоретической и практической стороны исследованы трансфер фармацевтических технологий и приоритетные направления локального производства лекарственных средств в условиях развития биоэкономики. Автор сопоставил концепции биоэкономики ОЭСР и Европейского союза, теорию абсорбционной способности и рамочный подход Всемирной организации здравоохранения к локальному производству и интерпретировал трансфер технологий как звено, превращающее биологические ресурсы в продукцию с высокой добавленной стоимостью. На основе официальных и аналитических источников оценены структура фармацевтического рынка Узбекистана, прогнозные показатели на 2022-2026 годы и сырьевая база лекарственных растений. В результате разработана концептуальная модель, объединяющая биоресурсы, трансфер технологий, абсорбционную способность и государственную политику. Обоснованы предложения по развитию производства субстанций, углублению цепочки создания стоимости фитопрепаратов и расширению подготовки фармацевтических кадров, способствующие устойчивому росту отрасли и повышению лекарственной

обеспеченности населения. Результаты исследования могут быть использованы при разработке программ развития отрасли.

Ключевые слова: биоэкономика, фармацевтическая промышленность, трансфер технологий, абсорбционная способность, локальное производство, лекарственные растения, импортозамещение, Tashkent Pharma Park.

Abstract

The article examined, from theoretical and practical perspectives, pharmaceutical technology transfer and the priority directions of local production of medicines in the context of bioeconomy development. The author compared the OECD and European Union bioeconomy concepts, absorptive capacity theory and the WHO local production framework, and interpreted technology transfer as the link converting biological resources into high value-added products. Uzbekistan's pharmaceutical market structure, the 2022-2026 forecast indicators and the medicinal plant raw material base were assessed using official and analytical sources. A conceptual model combining bioresources, technology transfer, absorptive capacity and state policy was developed. Proposals were substantiated on producing active substances, deepening the herbal medicine value chain and expanding pharmaceutical personnel training, which contributes to the sustained growth of the sector. The results can be used in developing sector development programmes.

Keywords: bioeconomy, pharmaceutical industry, technology transfer, absorptive capacity, local production, medicinal plants, import substitution, Tashkent Pharma Park.

KIRISH

Bioiqtisodiyot tushunchasi XXI asr boshida biologik fanlar yutuqlarini iqtisodiy o‘sish manbaiga aylantirish g‘oyasi atrofida shakllandi. OECD bioiqtisodiyotni uch unsurning birligi sifatida ta’riflaydi: genlar va murakkab hujayra jarayonlari haqidagi ilg‘or bilimlar, qayta tiklanuvchi biomassa hamda biotexnologik yechimlarning qishloq xo‘jaligi, sanoat va sog‘liqni saqlash tarmoqlari o‘rtasida integratsiyalashuvi [10]. Tashkilot baholashicha, 2030-yilga borib biotexnologiyalar sanoati rivojlangan mamlakatlarda yalpi ichki mahsulotning 2,7 foizigacha bo‘lgan qismini ta’minlashi mumkin, uning salmoqli ulushi esa sog‘liqni saqlash sohasidagi qo‘llanishlarga to‘g‘ri keladi [10]. Ushbu yondashuvda farmatsevtika bioiqtisodiyotning chekka bo‘g‘ini emas, balki bilim sig‘imi eng yuqori bo‘lgan, biologik xomashyoni yuqori qo‘shilgan qiymatli mahsulotga aylantiruvchi yetakchi tarmoq sifatida namoyon bo‘ladi.

Bioiqtisodiyotning nazariy talqinlari bir xil emas. T. Bugge, T. Hansen va A. Klitkou adabiyotlarni umumlashtirib, bioiqtisodiyotning uch qarashini ajratgan: biotexnologik qarash, bioresurs qarashi va bioekologik qarash [1]. Birinchisi ilmiy-tadqiqot va tijoratlashtirishga, ikkinchisi biologik xomashyoni qayta ishlashga, uchinchisi ekotizimlar barqarorligiga urg‘u beradi. Farmatsevtika sanoati uchun birinchi ikki qarashning kesishuvi hal qiluvchi ahamiyatga ega, chunki zamonaviy dori vositasi bir vaqtning o‘zida murakkab texnologik bilim va sifatli biologik yoki kimyoviy xomashyoga tayanadi. Rivojlanayotgan iqtisodiyotlarda bunday

bilimlarning asosiy qismi dastlab tashqaridan, texnologiya transferi kanallari orqali kirib keladi, shuning uchun transfer jarayoni bioiqtisodiyotga o‘tishning boshlang‘ich mexanizmi sifatida qaralishi lozim.

Texnologiya transferining samaradorligini tushuntiruvchi markaziy nazariy tushuncha yutish salohiyatidir. V. Koen va D. Levintal uni firmaning tashqi bilimlarning qimmatini tan olish, o‘zlashtirish va tijorat maqsadida qo‘llash qobiliyati sifatida ta’riflab, bu qobiliyat oldindan to‘plangan bilimlar va ilmiy-tadqiqot faoliyatining kumulyativ natijasi ekanini ko‘rsatgan [2]. Ushbu g‘oyadan kelib chiqadigan muhim xulosa shundan iboratki, litsenziya yoki uskunani sotib olishning o‘zi mahalliy ishlab chiqarishni kafolatlamaydi: transfer faqat qabul qiluvchi tomonda malakali kadrlar, laboratoriya bazasi va tashkiliy tartiblar mavjud bo‘lgandagina barqaror texnologik salohiyatga aylanadi. Mahalliy farmatsevtika ishlab chiqarishi shu tariqa sog‘liqni saqlash, sanoat va ilm-fan siyosatlari tutashgan institutsional hodisa sifatida talqin etiladi.

Maqolaning maqsadi bioiqtisodiyotni rivojlantirish sharoitida farmatsevtika texnologiyalari transferining nazariy asoslarini umumlashtirish va O‘zbekistonda dori vositalarini mahalliy ishlab chiqarishning ustuvor yo‘nalishlarini asoslashdan iborat. Maqsadga erishish uchun bioiqtisodiyot va yutish salohiyati nazariyalarini farmatsevtika tarmog‘iga tatbiq etish, milliy farmatsevtika bozorining tarkibiy ko‘rsatkichlarini baholash, tarmoqni rivojlantirish bo‘yicha belgilangan maqsadli parametrlarni tahlil qilish, dorivor o‘simliklar xomashyo bazasining salohiyatini aniqlash hamda transfer va mahalliy ishlab chiqarishni bog‘lovchi konseptual modelni ishlab chiqish vazifalari qo‘yildi.

ADABIYOTLAR SHARHI

Bioiqtisodiyot siyosati bo‘yicha adabiyotlarda Yevropa tajribasi alohida o‘rin tutadi. K. Makkormik va N. Kautto Yevropa mamlakatlarida bioiqtisodiyotga oid strategiyalarni tahlil qilib, ular qazib olinadigan resurslarga bog‘liqlikni kamaytirish, iqlim o‘zgarishiga moslashish va qishloq hududlarini rivojlantirish maqsadlarini birlashtirganini, biroq bioiqtisodiyotning muvaffaqiyati ko‘p jihatdan tarmoqlararo muvofiqlashtirish va innovatsion tizim sifatiga bog‘liqligini ko‘rsatgan [9]. Yevropa Komissiyasining 2018-yilda yangilangan bioiqtisodiyot strategiyasi bio-asosli tarmoqlarni kengaytirish, mahalliy bioiqtisodiyotlarni butun Yevropa bo‘ylab joriy etish va ekologik chegaralarni hisobga olishni asosiy harakat yo‘nalishlari sifatida belgilagan [3]. Ushbu hujjatlar bioiqtisodiyotni yagona tarmoq emas, balki biologik resurslardan foydalanuvchi barcha faoliyat turlarini qamrab oluvchi tizimli strategiya sifatida qarash zarurligini tasdiqlaydi.

Yutish salohiyati nazariyasi keyingi tadqiqotlarda aniqlashtirildi. Sh. Zahra va G. Jorj uni potensial va amalga oshirilgan salohiyatga ajratib, bilimlarni egallash va o‘zlashtirish bosqichlari transformatsiya va ekspluatatsiya bosqichlari bilan to‘ldirilgandagina transfer iqtisodiy natija berishini asoslagan [14]. S. Lal texnologik salohiyatni investitsiya, ishlab chiqarish va bog‘lanish salohiyatlariga ajratib, rivojlanayotgan mamlakatlarda sanoatlashtirish muvaffaqiyati korxonalar ichidagi o‘rganish jarayonlari va ularni qo‘llab-quvvatlovchi milliy institutlar uyg‘unligiga

bog‘liqligini ko‘rsatgan [7]. Farmatsevtika sohasiga tatbiqan bu tipologiya GMP talablariga mos zavod qurish, mavjud texnologik jarayonlarni barqaror yuritish va yetkazib beruvchilar hamda ilmiy markazlar bilan hamkorlik qilish qobiliyatlarini alohida baholash imkonini beradi.

Farmatsevtika tarmog‘ida texnologik yetib olishning qiyosiy tajribasi S. Gennif va Sh. Ramani tadqiqotida atroflicha yoritilgan. Mualliflar Hindiston va Braziliyani milliy innovatsion tizim nuqtai nazaridan solishtirib, har ikki mamlakat o‘xshash boshlang‘ich imkoniyatlarga ega bo‘lsa-da, Hindistonda davlat siyosati, patent rejimi va xususiy korxonalar strategiyasining izchil uyg‘unligi mahalliy ishlab chiqaruvchilarning jahon generik bozorida yetakchi o‘rin egallashiga olib kelganini ko‘rsatgan [4]. V. Kaplan va R. Leyng mahalliy farmatsevtika ishlab chiqarishini sanoat siyosati va dori vositalaridan foydalanish imkoniyati kesishuvida tahlil qilib, uning ijtimoiy samarasi bozor hajmi, sifat standartlari va tartibga solish tizimining yetukligi bilan belgilanishini asoslagan [5].

Jahon sog‘liqni saqlash tashkiloti UNCTAD va ICTSD bilan hamkorlikda ishlab chiqqan doira hujjati mahalliy ishlab chiqarishni sog‘liqni saqlash va sanoat siyosatlarining muvofiqligi, dori vositalaridan foydalanish imkoniyatini kengaytirish hamda texnologiya transferi orqali mahalliy salohiyatni mustahkamlash vositasi sifatida belgilaydi [13]. M. Makintosh va hammualliflari Afrika mamlakatlari tajribasi asosida mahalliy dori ishlab chiqarish sog‘liqni saqlash tizimi bilan chuqur bog‘langanda sanoat rivoji va aholining sifatli dorilarga ega bo‘lishini bir vaqtda ta’minlashini ko‘rsatgan [8]. Adabiyotlar tahlili bioiqtisodiyot, yutish salohiyati va mahalliy ishlab chiqarish konsepsiyalari o‘zaro to‘ldiruvchi ekanini, biroq ularni yagona analitik modelda birlashtirgan hamda milliy farmatsevtika tarmog‘i ko‘rsatkichlariga tatbiq etgan ishlar hali kam ekanini ko‘rsatadi.

METODOLOGIYA

Tadqiqotning metodologik asosini tizimli yondashuv tashkil etdi: farmatsevtika tarmog‘i bioresurslar, texnologik bilimlar, ishlab chiqarish quvvatlari va davlat tartibga solish mexanizmlari o‘zaro ta’sir qiluvchi ochiq tizim sifatida ko‘rib chiqildi. Nazariy qismda qiyosiy-mantiqiy tahlil, umumlashtirish va konseptual modellashtirish usullari qo‘llanildi. Amaliy qismning axborot bazasini farmatsevtika bozori bo‘yicha ixtisoslashgan tahliliy agentlik ma’lumotlari [11], soha ekspertining bozor ko‘rsatkichlari sharhi [6], tarmoqni rivojlantirishga oid Prezident farmonlari va qarorlari hamda soha bo‘yicha rasmiy axborotlar tashkil etdi. Texnologiya transferi salohiyatini kompleks baholash uchun normallashtirilgan ko‘rsatkichlarga asoslangan integral indeks taklif etildi:

$$I_T = \sum_{j=1}^{n} w_j \cdot \frac{x_j - x_{\min}}{x_{\max} - x_{\min}} \qquad (1)$$

bu yerda I_T - hudud yoki korxonaning texnologiya transferi salohiyati integral indeksi; x_j - yutish salohiyatini tavsiflovchi j-ko‘rsatkich (ilmiy-tadqiqot xarajatlari ulushi, GMP sertifikatiga ega liniyalar soni, farmatsevt-muhandislar ulushi, litsenziya shartnomalari soni); $x_{\min}$ va $x_{\max}$ - taqqoslanayotgan obyektlar bo‘yicha

ko‘rsatkichning eng kichik va eng katta qiymatlari; w_j - ko‘rsatkichning ekspert usulida belgilanadigan vazni; n - ko‘rsatkichlar soni. Indeks 0 dan 1 gacha oraliqda qiymat olib, birga yaqinlashgani sari obyektning tashqi texnologiyalarni o‘zlashtirish va tijoratlashtirishga tayyorligi yuqori ekanini bildiradi. Ifoda V. Koen va D. Levintal hamda Sh. Zahra va G. Jorj ilgari surgan yutish salohiyati bosqichlarini miqdoriy shaklga keltirib, transfer loyihalarini joylashtirishda ustuvor obyektlarni asosli tanlash imkonini beradi.

Mahalliy ishlab chiqarishning bozordagi o‘rnini baholash uchun lokalizatsiya darajasi ko‘rsatkichi qo‘llanildi:

$$L = \frac{Q_l}{Q_l + M} \times 100 \qquad (2)$$

bu yerda L - ichki bozorda mahalliy ishlab chiqarilgan dori vositalarining ulushi, foizda; Q_l - mahalliy ishlab chiqaruvchilar mahsulotining sotuv hajmi; M - import qilingan dori vositalarining sotuv hajmi. Ko‘rsatkich qiymat va natural ifodada alohida hisoblanganda ikki xil ma’lumot beradi: qiymat bo‘yicha ulush mahalliy mahsulot assortimentining narx segmentini, natural ulush esa aholining kundalik ehtiyojini qoplash darajasini aks ettiradi. Ular o‘rtasidagi farq mahalliy ishlab chiqarishning texnologik murakkabligini bilvosita tavsiflaydi va transfer siyosatining ustuvorliklarini aniqlashda muhim mezon bo‘lib xizmat qiladi.

TAHLIL VA NATIJALAR

O‘zbekiston farmatsevtika bozori so‘nggi yillarda barqaror kengayish bosqichini boshdan kechirmoqda. Proxima Research ma’lumotlariga ko‘ra, 2024-yilda bozor hajmi 24,8 trln so‘mni yoki 2,0 mlrd AQSh dollarini tashkil etib, milliy valyutada 19 foizga o‘sgan [11]. Bozorning uzoq muddatli dinamikasi va tarkibiy ko‘rsatkichlari 1-jadvalda umumlashtirildi.

1-jadval

O‘zbekiston farmatsevtika bozorining asosiy tarkibiy ko‘rsatkichlari[1]

Ko‘rsatkich	Qiymati	Davr
Bozor hajmi, mlrd AQSh dollari	0,888	2018-yil
Bozor hajmi, mlrd AQSh dollari	2,14	2024-yil oktabr - 2025-yil sentabr
Bozor hajmining o‘sishi, marta	2,41	2018-2025-yillar
Bozor hajmi, trln so‘m	24,8	2024-yil
Dori vositalari sotuvida import ulushi (qiymat bo‘yicha), foizda	87	2024-yil
Dori vositalari sotuvida mahalliy ulush (qiymat bo‘yicha), foizda	13	2024-yil
Dori vositalari sotuvida import ulushi (natural hajmda), foizda	63	2024-yil
Dori vositalari sotuvida mahalliy ulush (natural hajmda), foizda	37	2024-yil

[1] Manba: Proxima Research [11] va The Times of Central Asia nashri [6] ma’lumotlari; o‘sish koeffitsiyenti muallif tomonidan hisoblangan.

1-jadval ma'lumotlari bozorning yetti yil ichida dollar ifodasida 2,4 barobar kengayganini ko‘rsatadi, bu ichki talabning barqaror o‘sib borayotganidan va mahalliy ishlab chiqaruvchilar uchun keng imkoniyatlar ochilayotganidan dalolat beradi. (2) ifoda bo‘yicha lokalizatsiya darajasi 2024-yilda qiymat bo‘yicha 13 foiz, natural hajmda esa 37 foizni tashkil etgan [11]. Ikki ko‘rsatkich o‘rtasidagi qariyb uch barobarlik farq mahalliy korxonalar asosan ommaviy iste'moldagi, nisbatan arzon generik preparatlarni ishlab chiqarishga ixtisoslashganini, yuqori texnologik va qimmat preparatlar segmenti esa hali asosan import hisobiga qoplanayotganini bildiradi. Mahalliy ishlab chiqaruvchilarning natural hajmdagi ulushi 2018-yildagi 40 foizdan 2025-yilda 41,2 foizgacha oshgani qayd etilgan [6]. Bu holat texnologiya transferining keyingi bosqichi qiymat ulushini oshirishga, ya'ni murakkab dori shakllari va substansiyalar ishlab chiqarishni o‘zlashtirishga yo‘naltirilishi lozimligini ko‘rsatadi.

Tarmoqni rivojlantirishning institutsional asosi izchil shakllantirilgan. 2018-yilda qabul qilingan Prezident qarori farmatsevtika tarmog‘ini jadal rivojlantirish bo‘yicha qo‘shimcha chora-tadbirlarni belgilab, sohadagi islohotlarning yangi bosqichini boshlab berdi [18]. 2022-yil 21-yanvardagi PF-55-son Farmon bilan 2022-2026-yillarda tarmoqni rivojlantirishning miqdoriy mo‘ljallari tasdiqlanib, ilg‘or ilmiy-texnika yutuqlari va innovatsiyalarni joriy etish orqali ishlab chiqarish hajmini oshirish va ichki bozorni ta'minlash darajasini 80 foizga yetkazish vazifasi qo‘yildi [16]. Ushbu mo‘ljallar 2-jadvalda keltirilgan.

2-jadval

Farmatsevtika tarmog‘ini rivojlantirishning 2022-2026-yillarga mo‘ljallangan prognoz parametrlari[1]

Ko‘rsatkich	2021	2022	2023	2024	2025	2026	2026/2021
Yillik talabni qoplash darajasi (mahsulot turlari bo‘yicha), foizda	45	55	59	63	78	80	35.
Farmatsevtika mahsulotlari eksporti, mln AQSh dollari	60	90	100	110	122	130	2,17 marta
O‘zlashtirilgan mahsulotlar soni, dona	3350	3450	3800	4150	4800	5100	1,52 marta

2-jadvaldagi parametrlar tarmoqni rivojlantirishning uch yo‘nalishli mantiqini aks ettiradi. Ichki talabni qoplash darajasining 45 foizdan 80 foizga ko‘tarilishi import o‘rnini bosishni asosiy maqsad sifatida belgilaydi, eksportning 60 mln dollardan 130 mln dollarga, ya'ni 2,17 barobar oshirilishi mahalliy mahsulotning xalqaro raqobatbardoshligiga yo‘naltirilgan, o‘zlashtirilgan mahsulotlar sonining 1,52 barobar ko‘payishi esa assortimentni kengaytirishni nazarda tutadi [16]. Uchala yo‘nalish ham texnologiya transferi bilan bevosita bog‘liq, chunki yangi mahsulotni o‘zlashtirish, xalqaro standartlarga mos sifatni ta'minlash va tashqi bozorlarga chiqish litsenziyalar, texnologik hujjatlar va malakali kadrlarni talab etadi. UzDaily nashri keltirgan

[1] Manba: O‘zbekiston Respublikasi Prezidentining PF-55-son Farmoni 1-ilovasi [16]; oxirgi ustun muallif tomonidan hisoblangan.

ma'lumotlarga ko'ra, 51 ta korxona 2000 turdagi dori vositasi uchun mahalliy ishlab chiqarish sertifikatini olgan, 2030-yilga borib ichki iste'molda mahalliy dorilar ulushini 70 foizga yetkazish mo'ljallangan [12].

Eksport ko'rsatkichlari texnologiya transferining tashqi bozordagi samarasini baholash imkonini beradi. UzDaily nashri ma'lumotlariga ko'ra, mahalliy farmatsevtika mahsulotlari 55 mamlakatga eksport qilinmoqda, sohada faoliyat yuritayotgan korxonalar soni 300 tadan oshgan, ulardan 58 tasi bevosita dori vositalari ishlab chiqarish bilan shug'ullanadi va tarmoqda 40 mingdan ortiq kishi band [12]. Eksport geografiyasining kengligi mahalliy korxonalar mahsulotining sifat va ro'yxatdan o'tkazish talablari turlicha bo'lgan bozorlarda tan olinayotganini ko'rsatadi. Yutish salohiyati nazariyasi nuqtai nazaridan eksport faoliyati o'zlashtirilgan texnologiyalarning ekspluatatsiya bosqichiga o'tganini tavsiflaydi, chunki tashqi bozorga chiqish xalqaro standartlarga mos hujjatlashtirish, barqaror sifat nazorati va logistika tizimini talab etadi. Eksportdan olinadigan tushumlar esa yangi litsenziyalar va ilmiy ishlanmalarni moliyalashtirish manbaiga aylanib, transferning keyingi aylanmasini ta'minlaydi.

Texnologiya transferining infratuzilma markazi sifatida "Tashkent Pharma Park" innovatsion ilmiy-ishlab chiqarish farmatsevtika klasteri shakllantirilmoqda. PF-55-son Farmonga muvofiq klaster hududi Toshkent viloyatining Zangiota tumanida qo'shimcha 80 gektarga kengaytirilgan, uning birinchi bosqichida farmatsevtika universiteti, farmakopeya markazi, ilmiy-tadqiqot instituti, ekspertiza markazi, BSL-3 laboratoriyasi, vivariy va tajriba ishlab chiqarish liniyalarini tashkil etish belgilangan [16]. Klasterning ilmiy-o'quv qismlarini yaratish loyihasi Vazirlar Mahkamasining alohida qarori bilan amalga oshirilmoqda [19]. Yutish salohiyati nazariyasi nuqtai nazaridan bunday tuzilma ahamiyati shundaki, u kadrlar tayyorlash, ilmiy tadqiqot va ishlab chiqarishni bitta hududda birlashtirib, transfer qilingan bilimlarni o'zlashtirish va transformatsiya qilish bosqichlarini bir-biriga yaqinlashtiradi.

Bioiqtisodiyotning bioresurs qarashi farmatsevtika uchun mahalliy dorivor o'simliklar xomashyosi bilan bevosita bog'liq. PQ-4670-son qarorga ko'ra, respublika florasidagi 4,3 mingdan ortiq o'simlik turidan 750 tasi dorivor hisoblanadi, ulardan 112 tasi ilmiy tibbiyotda foydalanish uchun ro'yxatga olingan va 70 tasi farmatsevtika sanoatida faol qo'llaniladi [17]. 2022-yil 20-maydagi PF-139-son Farmon bilan 2022-2026-yillarda 36 ming gektar maydonda yangi dorivor o'simliklar plantatsiyalarini tashkil etish vazifasi belgilangan [15]. Resurs bazasining asosiy ko'rsatkichlari 3-jadvalda umumlashtirildi.

3-jadval

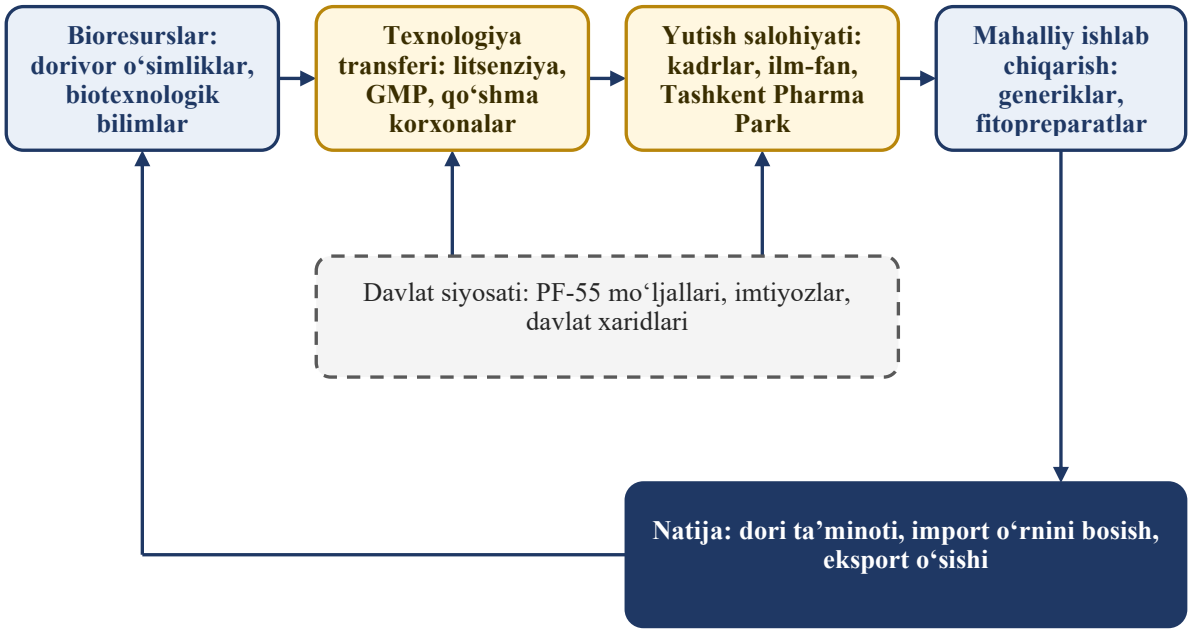
Dorivor o'simliklar xomashyo bazasining asosiy ko'rsatkichlari[1]

Ko'rsatkich	Qiymati
Respublika florasidagi o'simlik turlari	4,3 mingdan ortiq
Dorivor o'simlik turlari	750
Ilmiy tibbiyotda foydalanish uchun ro'yxatga olingan turlar	112
Farmatsevtika sanoatida faol qo'llaniladigan turlar	70

[1] Manba: PQ-4670-son qaror [17] va 2022-yil 20-maydagi PF-139-son Farmon [15] ma'lumotlari asosida tuzilgan.

Ko‘rsatkich	Qiymati
Qayta ishlangan dorivor o‘simlik mahsulotlari eksporti (2019-yil), mln AQSh dollari	48
2022-2026-yillarda tashkil etiladigan yangi plantatsiyalar, ming gektar	36
Qishloq xo‘jaligini qo‘llab-quvvatlash fondidan kredit resurslari, mlrd so‘m	100

3-jadval ma’lumotlari dorivor o‘simliklar salohiyatidan foydalanishda katta zaxira mavjudligini ko‘rsatadi: 750 ta dorivor turdan faqat 70 tasi, ya’ni 9,3 foizi farmatsevtika sanoatida faol qo‘llanilmoqda (muallif hisobi). Ro‘yxatga olingan turlar sonini ko‘paytirish va ularni standartlashtirilgan fitopreparatlar hamda o‘simlik substansiyalariga aylantirish texnologiyalarini o‘zlashtirish bioresurslardan olinadigan qo‘shilgan qiymatni sezilarli oshirishi mumkin. 36 ming gektar yangi plantatsiyalar tashkil etilishi xomashyoni yovvoyi holda yig‘ishdan madaniy yetishtirishga o‘tishni ta’minlab, sifat barqarorligini oshiradi [15]. Madaniy plantatsiyalar, zamonaviy ekstraksiya texnologiyalari va GMP talablariga mos ishlab chiqarish uyg‘unlashganda qishloq xo‘jaligi va farmatsevtika sanoati o‘rtasida yaxlit bio-asosli qiymat zanjiri shakllanadi. Tahlil natijalari asosida bioiqtisodiyot sharoitida texnologiya transferi va mahalliy ishlab chiqarishni bog‘lovchi konseptual model ishlab chiqildi (1-rasm).



1-rasm. Texnologiya transferi va mahalliy ishlab chiqarish modeli[1]

Izoh: model OECD bioiqtisodiyot konsepsiyasi, yutish salohiyati nazariyasi va JSST mahalliy ishlab chiqarish doirasini birlashtiradi; pastki qaytuvchi strelka natijalarning bioresurslar va ilmiy salohiyatga qayta investitsiyalanishini bildiradi.

1-rasmda tasvirlangan model mahalliy farmatsevtika ishlab chiqarishini ketma-ket bog‘langan to‘rt bo‘g‘in natijasi sifatida talqin etadi. Birinchi bo‘g‘inni dorivor

[1] Manba: V. Koen va D. Levintal [2], Sh. Zahra va G. Jorj [14] hamda JSST [13] yondashuvlari va 1-3-jadvallar tahlili asosida muallif ishlanmasi.

o‘simliklar va biotexnologik bilimlardan iborat bioresurslar tashkil etadi. Ikkinchi bo‘g‘in litsenziya shartnomalari, GMP standartlarini joriy etish va qo‘shma korxonalar ko‘rinishidagi texnologiya transferidir. Uchinchi bo‘g‘in, ya’ni yutish salohiyati, transfer qilingan bilimlarning korxona ichida o‘zlashtirilishini ta’minlaydi va “Tashkent Pharma Park” tuzilmasida mujassamlashadi. To‘rtinchi bo‘g‘in generiklar, fitopreparatlar va substansiyalar ishlab chiqarishni qamrab oladi. Davlat siyosati transfer va yutish salohiyati bo‘g‘inlarini qo‘llab-quvvatlovchi omil sifatida chiqadi. Natija bo‘g‘inidan bioresurslarga qaytuvchi aloqa daromadlarning bir qismi ilmiy tadqiqot va xomashyo bazasiga qayta yo‘naltirilganda tizim o‘z-o‘zini kuchaytiruvchi xususiyat kasb etishini ko‘rsatadi.

Model asosida ustuvor yo‘nalishlarni aniqlashda (1) ifodadagi integral indeks tayanch vosita bo‘lib xizmat qiladi. Yutish salohiyati yuqori bo‘lgan korxonalar uchun murakkab dori shakllari va biotexnologik preparatlar bo‘yicha litsenziya shartnomalari ustuvor bo‘lsa, salohiyati shakllanish bosqichidagi korxonalar uchun avval generik preparatlar ishlab chiqarishni takomillashtirish va sifat tizimlarini mustahkamlash maqsadga muvofiq. S. Gennif va Sh. Ramani ko‘rsatganidek, Hindiston tajribasida korxonalar dastlab ishlab chiqarish texnologiyalarini o‘zlashtirib, keyinchalik ilmiy-tadqiqot salohiyatini bosqichma-bosqich oshirgan [4]. O‘zbekiston sharoitida bu mantiq qiymat bo‘yicha 13 foizlik lokalizatsiya darajasini oshirishning real yo‘lini belgilaydi: natural hajmdagi mustahkam pozitsiyalarga tayangan holda texnologik zinapoyadan yuqoriroq segmentlarga izchil ko‘tarilish.

Olingan natijalar xalqaro tajriba bilan hamohang. V. Kaplan va R. Leyng mahalliy ishlab chiqarishning barqarorligi sifat standartlari va tartibga solish tizimi yetukligiga bog‘liqligini qayd etgan bo‘lsa [5], O‘zbekistonda farmakopeya markazi, ekspertiza markazi va BSL-3 laboratoriyasining klaster tarkibida tashkil etilishi aynan shu institutsional shartlarni ta’minlashga qaratilgan. 2025-yilning yanvar-avgust oylarida sohaga 290 mln dollardan ortiq investitsiya kiritilgani, shundan 262,7 mln dollari xorijiy investitsiyalar ekani qayd etilgan [6]. Xorijiy investitsiyalarning yuqori ulushi texnologiya transferi uchun qulay kanal mavjudligini bildiradi, chunki to‘g‘ridan-to‘g‘ri investitsiyalar odatda uskunalar bilan birga texnologik hujjatlar, sifat tizimlari va boshqaruv tajribasini ham olib kiradi. Sh. Zahra va G. Jorj ta’kidlaganidek, bunday bilimlar faqat mahalliy kadrlar tomonidan transformatsiya qilinganda amalga oshirilgan yutish salohiyatiga aylanadi [14].

XULOSA VA TAKLIFLAR

Tadqiqot farmatsevtika texnologiyalari transferi bioiqtisodiyotni rivojlantirishning boshlang‘ich va hal qiluvchi mexanizmi ekanini nazariy jihatdan asosladi. Bioiqtisodiyotning biotexnologik va bioresurs qarashlari farmatsevtika tarmog‘ida kesishadi, yutish salohiyati nazariyasi esa transfer samaradorligi qabul qiluvchi tomonning bilim bazasi va institutsional muhitiga bog‘liqligini tushuntiradi. O‘zbekiston farmatsevtika bozori barqaror o‘sish sur’atlarini namoyon etmoqda, mahalliy ishlab chiqaruvchilar natural hajmda muhim pozitsiyalarni egallagan, PF-55-son Farmon bilan belgilangan mo‘ljallar va “Tashkent Pharma Park” klasteri tarmoqning keyingi sifat bosqichiga o‘tishi uchun mustahkam asos yaratmoqda.

Dorivor o‘simliklar resurslari va ularni madaniy yetishtirishni kengaytirish choralari bio-asosli qiymat zanjirini shakllantirish imkonini beradi.

Tahlil natijalariga tayangan holda quyidagi takliflar ilgari suriladi:

1. Farmatsevtika korxonalarining texnologiya transferi salohiyatini (1) ifoda asosida muntazam baholab, litsenziya shartnomalari va qo‘shma loyihalarni qo‘llab-quvvatlashda indeks qiymatini ustuvorlik mezoni sifatida qo‘llash maqsadga muvofiq.

2. Qiymat bo‘yicha lokalizatsiya darajasini oshirish uchun faol farmatsevtik substansiyalar va murakkab dori shakllari ishlab chiqarish bo‘yicha transfer loyihalarini alohida rag‘batlantirish tavsiya etiladi.

3. Dorivor o‘simliklar plantatsiyalari, ekstraksiya korxonalari va fitopreparat ishlab chiqaruvchilarni yagona klaster zanjiriga birlashtirib, farmatsevtika sanoatida qo‘llaniladigan dorivor turlar sonini bosqichma-bosqich ko‘paytirish lozim.

4. “Tashkent Pharma Park” negizidagi farmatsevtika universiteti bilan korxonalar o‘rtasida dual ta’lim va qo‘shma ilmiy laboratoriyalar tizimini kengaytirish yutish salohiyatining kadrlar tarkibiy qismini mustahkamlaydi.

5. Xorijiy investitsiya loyihalarida mahalliy mutaxassislarni o‘qitish va texnologik hujjatlarni to‘liq topshirish shartlarini standart talab sifatida belgilash transfer qilingan bilimlarning mamlakatda mustahkam o‘rnashishiga xizmat qiladi.

Taklif etilgan choralar dori vositalari bilan ta’minlash darajasini oshirish, eksport salohiyatini kengaytirish va biologik resurslardan yuqori qo‘shilgan qiymat olish vazifalarini uyg‘unlashtirib, milliy iqtisodiyotda bioiqtisodiyot tarmoqlarining shakllanishiga xizmat qiladi. Keyingi tadqiqotlarda integral indeksni korxonalar kesimidagi empirik ma’lumotlar asosida hisoblash va uning mahalliy ishlab chiqarish ko‘rsatkichlariga ta’sirini ekonometrik baholash rejalashtirilmoqda.

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SIRKULYAR BIOIQTISODIYOT ASOSIDA AHOLINI QISHLOQ XO‘JALIGI MAHSULOTLARI BILAN TA’MINLASH SAMARADORLIGINI OSHIRISHNING USTUVOR YO‘NALISHLARI

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Annotatsiya

Mazkur maqolada global integratsiyalashuv sharoitida sirkulyar bioiqtisodiyot tamoyillarini qishloq xo‘jaligi tizimiga joriy etishning tashkiliy-iqtisodiy va ekologik mexanizmlari tadqiq etilgan. Tadqiqotda Qashqadaryo viloyatining qishloq xo‘jaligi salohiyati, suv va yer resurslaridan foydalanish samaradorligi, qishloq xo‘jaligi mahsulotlarini qayta ishlash, logistika, raqamli texnologiyalar va ekologik barqarorlik bilan bog‘liq muammolar sirkulyar bioiqtisodiyot konsepsiyasi asosida qayta baholangan. Sirkulyar bioiqtisodiyotning asosiy tamoyili sifatida biologik resurslardan takroriy foydalanish, chiqindilarni resursga aylantirish, ishlab chiqarish - qayta ishlash - iste’mol zanjirlarini integratsiyalash va tabiiy resurslarga bosimni kamaytirish masalalari asoslangan. Tadqiqot natijasida hududiy “sirkulyar agroiqtisodiy monitoring” tizimini shakllantirish, qishloq xo‘jaligi chiqindilarini qayta ishlash kooperatsiyasini rivojlantirish, raqamli monitoring platformasini joriy etish hamda xalqaro texnologik va investitsion integratsiyani kuchaytirish taklif etilgan. Qashqadaryo viloyatida tomchilatib sug‘orish, smart farming, sovutkichli omborlar, qayta ishlash korxonalari va ekologik texnologiyalarni bir yagona sirkulyar tizimga birlashtirish hududning oziq-ovqat xavfsizligi va eksport salohiyatini oshirish bilan birga tashqi ekologik bosimni kamaytirishga xizmat qiladi.

Kalit so‘zlar: sirkulyar bioiqtisodiyot, global integratsiyalashuv, qishloq xo‘jaligi, bioresurslar, ekologik barqarorlik, raqamli monitoring, qayta ishlash, oziq-ovqat xavfsizligi.

Аннотация

В статье исследуются организационно-экономические и экологические механизмы внедрения принципов циркулярной биоэкономики в сельское хозяйство в условиях глобальной интеграции. На примере Кашкадарьинской области рассмотрены вопросы эффективного использования земельных и водных ресурсов, цифровизации сельского хозяйства, переработки сельскохозяйственной продукции, логистики и обеспечения экологической устойчивости. Обоснована необходимость перехода от линейной модели

«производство-потребление-отходы» к циркулярной модели, основанной на повторном использовании биологических ресурсов, переработке отходов и интеграции производственных цепочек. Предложены механизмы цифрового мониторинга циркулярных процессов, развития кооперации по переработке аграрных отходов и усиления международной технологической и инвестиционной интеграции. Показано, что объединение капельного орошения, технологий smart farming, холодильных складов, перерабатывающих предприятий и экологических технологий в единую циркулярную систему способствует повышению продовольственной безопасности и экспортного потенциала региона, одновременно снижая внешнюю экологическую нагрузку. Также предложено сформировать региональную систему «циркулярного агроэкономического мониторинга».

Ключевые слова: циркулярная биоэкономика, глобальная интеграция, сельское хозяйство, биоресурсы, экологическая устойчивость, цифровизация, переработка, продовольственная безопасность.

Abstract

This article examines organizational, economic and environmental mechanisms for implementing circular bioeconomy principles in agriculture under conditions of global integration. The study reassesses the agricultural potential of Kashkadarya region, the efficiency of water and land resources, agricultural processing, logistics, digital technologies and environmental sustainability from the perspective of the circular bioeconomy. The research emphasizes repeated use of biological resources, conversion of agricultural waste into economic resources, integration of production, processing and consumption chains, and reduction of pressure on natural resources. The study proposes the establishment of a regional circular agro-economic monitoring system, development of cooperation for agricultural waste processing, implementation of a digital monitoring platform, and strengthening of international technological and investment integration. Integrating drip irrigation, smart farming, cold storage, processing facilities and ecological technologies into a unified circular system can increase food security and export potential while reducing environmental pressure.

Keywords: circular bioeconomy, global integration, agriculture, bioresources, environmental sustainability, digital monitoring, processing, food security.

KIRISH

Global iqtisodiyotda tabiiy resurslardan oqilona foydalanish, iqlim o‘zgarishining salbiy oqibatlarini kamaytirish, oziq-ovqat xavfsizligini ta’minlash va iqtisodiy o‘sishning ekologik chegaralarini hisobga olish muhim ilmiy-amaliy masalaga aylanmoqda. An’anaviy iqtisodiy modelda tabiiy resurslar ishlab chiqarishga jalb etiladi, tayyor mahsulot iste’mol qilinadi va hosil bo‘lgan chiqindilarning katta qismi iqtisodiy jarayondan tashqariga chiqariladi [7]. Mazkur chiziqli model resurslar tanqisligi, ekologik ifloslanish, biologik xilma-xillikning qisqarishi va ishlab chiqarish xarajatlarining oshishiga olib kelishi mumkin [1]. Shu nuqtai nazardan sirkulyar bioiqtisodiyot modeli tabiiy va biologik resurslardan qayta foydalanish, ishlab chiqarish chiqindilarini ikkilamchi resursga aylantirish, qo‘shimcha qiymat zanjirlarini

uzaytirish hamda iqtisodiy va ekologik manfaatlarni uyg‘unlashtirishning istiqbolli yo‘nalishi sifatida namoyon bo‘lmoqda [2]; [10].

Qashqadaryo viloyatida ushbu yondashuvni qo‘llash uchun muhim agrar baza mavjud. 2024-yil yanvar-sentabr oylarida viloyatda qishloq xo‘jaligi mahsulotlari hajmi 30 409,1 mlrd so‘mni tashkil etib, uning 12 106,4 mlrd so‘mi dehqonchilik, 18 302,7 mlrd so‘mi chorvachilik mahsulotlariga to‘g‘ri kelgan [17].

Biroq hududda yerlarning sho‘rlanishi, yerosti suvlarining ifloslanishi va suv ta’minotidagi muammolar mavjudligi agrar ishlab chiqarishning ekologik va iqtisodiy samaradorligiga salbiy ta’sir ko‘rsatmoqda [13]. Demak, qishloq xo‘jaligi ishlab chiqarish hajmini oddiy kengaytirish emas, balki mavjud resurslardan takroriy va samarali foydalanishga asoslangan yangi iqtisodiy mexanizmni shakllantirish talab etiladi.

Mamlakatimizda ushbu masalalarga davlat siyosati darajasida alohida e’tibor qaratilmoqda. Qishloq xo‘jaligini rivojlantirishning 2020-2030-yillarga mo‘ljallangan strategiyasida suv va yer resurslaridan oqilona foydalanish, qishloq xo‘jaligi mahsulotlarini qayta ishlashni chuqurlashtirish va tarmoqqa zamonaviy texnologiyalarni joriy etish ustuvor vazifa sifatida belgilangan [13]. “O‘zbekiston - 2030” strategiyasi [14] hamda “yashil” iqtisodiyotga o‘tish strategiyasi [15] resurs tejovchi texnologiyalar va ekologik barqarorlikni iqtisodiy o‘sish bilan uyg‘unlashtirishni nazarda tutadi. Qashqadaryo viloyatini 2024-2025-yillarda kompleks ijtimoiy-iqtisodiy rivojlantirish bo‘yicha qabul qilingan chora-tadbirlar esa hududiy darajada ushbu yo‘nalishlarni amalga oshirishga xizmat qiladi [16].

Mazkur maqolaning maqsadi - Qashqadaryo viloyati misolida sirkulyar bioiqtisodiyot asosida aholini qishloq xo‘jaligi mahsulotlari bilan ta’minlash samaradorligini oshirishning ustuvor yo‘nalishlarini asoslashdan iborat. Tadqiqot vazifalari: (1) sirkulyar bioiqtisodiyotning qishloq xo‘jaligi va oziq-ovqat tizimidagi o‘rniga oid ilmiy yondashuvlarni umumlashtirish; (2) hududda sirkulyar qiymat zanjirlari va klasterlarni shakllantirish imkoniyatlarini aniqlash; (3) qishloq xo‘jaligi mahsulotlari ishlab chiqarish hajmiga ta’sir etuvchi omillarni ekonometrik baholash; (4) 2030-yilgacha bo‘lgan davr uchun amaliy mexanizm va takliflarni ishlab chiqish.

ADABIYOTLAR SHARHI

So‘nggi yillarda qishloq xo‘jaligi va oziq-ovqat tizimlarining resurslardan samarali foydalanish, agrochiqindilarni qayta iqtisodiy aylanishga jalb etish hamda oziq-ovqat xavfsizligini ta’minlashga yo‘naltirilgan yangi iqtisodiy modellari shakllanmoqda. Mazkur yo‘nalishlardan biri sirkulyar bioiqtisodiyot (circular bioeconomy) bo‘lib, u biologik resurslardan oqilona foydalanish, qayta tiklanadigan xomashyoni iqtisodiy jarayonga jalb etish, ishlab chiqarish chiqindilarini qayta ishlash va resurslarni iqtisodiy siklga qaytarish tamoyillariga asoslanadi [2; 10]. Shu jihatdan sirkulyar bioiqtisodiyot qishloq xo‘jaligi mahsulotlarini ishlab chiqarish samaradorligini oshirish bilan bir qatorda, oziq-ovqat ta’minoti barqarorligini ta’minlashning muhim institutsional-iqtisodiy mexanizmi sifatida namoyon bo‘lmoqda.

Sirkulyar bioiqtisodiyotning iqtisodiy mazmuni va qishloq xo‘jaligi tizimidagi ahamiyatini o‘rganishda M. Khanna, D. Zilberman, G. Hochman va B. Bassolarning tadqiqotlari [6] alohida ahamiyatga ega. Olimlar sirkulyar bioiqtisodiyotni oziq-ovqat va qishloq xo‘jaligi sektorida resurslarning yopiq aylanishini ta’minlovchi iqtisodiy tizim sifatida ko‘rib, agrobiologik resurslardan foydalanish samaradorligi, chiqindilarni qayta ishlash, bioenergiya va biomahsulotlar ishlab chiqarish masalalarini iqtisodiy nuqtai nazardan asoslagan. Ularning yondashuvida sirkulyarlikni faqat chiqindilarni kamaytirish yoki ekologik barqarorlik bilan cheklab qo‘ymasdan, balki iqtisodiy xarajatlar va ijtimoiy manfaatlar o‘rtasidagi optimal nisbat orqali baholash zarurligi ta’kidlanadi.

Mazkur yondashuv tadqiqotimiz uchun muhim metodologik asos bo‘lib, qishloq xo‘jaligi mahsulotlari bilan aholini ta’minlash samaradorligini faqat ishlab chiqarish hajmining o‘sishi orqali emas, balki resurs sarfi, mahsulot tannarxi, agrochiqindilardan qayta foydalanish, ekologik ta’sir va yakuniy oziq-ovqat ta’minoti natijalari bilan birgalikda baholash zarurligini ko‘rsatadi.

Sirkulyar bioiqtisodiyotning qishloq xo‘jaligi va oziq-ovqat tizimlaridagi zamonaviy rivojlanish tendensiyalari W. Ma, J. Sauer, D.B. Rahut va T. Sonobe [8] tomonidan umumlashtirilgan. Mualliflar sirkulyar bioiqtisodiyotning barqaror qishloq xo‘jaligini rivojlantirishdagi asosiy yo‘nalishlari sifatida agrochiqindilarni qayta ishlash, bioo‘g‘itlardan foydalanish, ekin yetishtirish va chorvachilikni integratsiyalashtirish, biomassa va bioenergiya ishlab chiqarish, resurslardan foydalanish samaradorligini oshirish hamda fermerlarning bilim va ko‘nikmalarini rivojlantirishni ajratib ko‘rsatadi. Shu bilan birga, sirkulyar bioiqtisodiyotning amaliy samaradorligi faqat texnologik innovatsiyalarga emas, balki infratuzilma, moliyaviy rag‘batlar, institutsional qo‘llab-quvvatlash va davlat siyosatining uyg‘unligiga ham bog‘liqligi asoslangan.

H. Zheng, W. Ma, D.B. Rahut, L. Zhang va X. Zhou tadqiqotlarida [12] sirkulyar bioiqtisodiyotning amaliy mexanizmlaridan biri sifatida integratsiyalashgan ekin-chorvachilik tizimining ahamiyati tahlil qilingan. Mualliflar mazkur tizimni joriy etish orqali chorvachilik chiqindilaridan organik o‘g‘it sifatida foydalanish, mineral o‘g‘itlarga bo‘lgan ehtiyojni kamaytirish va ishlab chiqarish resurslarining ichki aylanishini kuchaytirish imkoniyatlarini ko‘rsatadi. Ushbu yondashuv qishloq xo‘jaligida mahsulot ishlab chiqarish va resurslardan foydalanish jarayonlarini alohida emas, balki yagona agroiqtisodiy tizim sifatida ko‘rib chiqish zarurligini ko‘rsatadi.

Sirkulyar bioiqtisodiyotning oziq-ovqat xavfsizligi bilan bog‘liqligi G. Hochman, D. Zilberman, M. Khanna va B. Basso tadqiqotlarida [4] yanada rivojlantirilgan. Ularning yondashuviga ko‘ra, iqlim o‘zgarishi sharoitida qishloq xo‘jaligining barqarorligini ta’minlash uchun iqlimga mos texnologiyalarni sirkulyar bioiqtisodiyot tamoyillari bilan uyg‘unlashtirish talab etiladi. Bunda resurslardan foydalanish samaradorligini oshirish, ishlab chiqarish barqarorligini ta’minlash va oziq-ovqat ta’minotidagi xavflarni kamaytirish o‘zaro bog‘liq jarayonlar sifatida qaraladi. Mazkur konsepsiya oziq-ovqat xavfsizligini faqat ishlab chiqarish hajmi bilan emas, balki

resurslarning uzoq muddatli qayta tiklanishi va ishlab chiqarish tizimining iqlimiy barqarorligi bilan bog‘lash imkonini beradi.

Chorvachilik va agrifood tizimlaridagi sirkulyarlik masalalarini Pugliese, Puvača, Passantino, Perillo, Laudadio, Tateo, Piemontese, Dimuccio, Lauriola, Tufarelli va Losacco [9] tadqiq qilgan. Mualliflar resurslardan foydalanish samaradorligi, ozuqa elementlarini qayta aylantirish, go‘ngni boshqarish va hayvonot mahsulotlari hamda ularning yon mahsulotlaridan qayta foydalanishni sirkulyar oziq-ovqat zanjirining muhim elementlari sifatida ko‘rsatadi. Mazkur yondashuv ekin yetishtirish va chorvachilik o‘rtasidagi biologik va iqtisodiy aloqalarni kuchaytirish orqali resurslarning yopiq aylanishini ta’minlash mumkinligini ko‘rsatadi.

Nazariy jihatdan sirkulyar bioiqtisodiyot “yashil”, sirkulyar va bioiqtisodiyot konsepsiyalarining kesishmasida shakllangan. D. D’Amato va hammualliflari ushbu uch yondashuvni barqarorlikka erishish yo‘llari sifatida qiyosiy tahlil qilib, ularning umumiy va farqli jihatlarini ko‘rsatgan [1]. J. Kirchherr, D. Reike va M. Hekkert sirkulyar iqtisodiyotning 114 ta ta’rifini tahlil qilib, u ko‘pincha faqat chiqindilarni qayta ishlash bilan cheklab talqin qilinishini, holbuki kamaytirish, qayta foydalanish va qayta tiklashni ham qamrab olishi lozimligini ta’kidlagan [7]. P. Stegmann, M. Londo va M. Junginger sirkulyar bioiqtisodiyot elementlarini aniqlab, uning Yevropa bioiqtisodiyot klasterlaridagi o‘rnini ko‘rsatgan [10]. Bu xulosa hududiy agroklasterlarni shakllantirish g‘oyasi uchun muhim asos bo‘ladi.

Raqamli texnologiyalarning ahamiyati S. Wolfert va hammualliflari tadqiqotida yoritilgan bo‘lib, unda katta ma’lumotlar va smart farming vositalari qishloq xo‘jaligida qaror qabul qilish va butun ta’minot zanjirini boshqarishni o‘zgartirayotgani ko‘rsatilgan [11]. Xalqaro tashkilotlar ham sirkulyar bioiqtisodiyotni iqlim kun tartibi va agrooziq-ovqat tizimlarini transformatsiya qilish vositasi sifatida ko‘radi [2], Yevropa va Markaziy Osiyo mamlakatlarida esa bioiqtisodiyotni qishloq xo‘jaligi amaliyotlari orqali rivojlantirish tajribalari umumlashtirilgan [5]. Biroq O‘zbekiston hududlari, xususan, Qashqadaryo viloyati misolida sirkulyar bioiqtisodiyotning aholini qishloq xo‘jaligi mahsulotlari bilan ta’minlashga ta’siri yetarlicha miqdoriy baholanmagan. Mazkur tadqiqot ana shu bo‘shliqni to‘ldirishga qaratilgan.

METODOLOGIYA

Tadqiqot obyekti sifatida Qashqadaryo viloyatining qishloq xo‘jaligi tizimi, predmeti sifatida esa sirkulyar bioiqtisodiyot asosida aholini qishloq xo‘jaligi mahsulotlari bilan ta’minlash samaradorligini oshirish bilan bog‘liq iqtisodiy munosabatlar tanlandi. Axborot bazasini O‘zbekiston Respublikasi Qishloq xo‘jaligi vazirligining rasmiy tahliliy ma’lumotlari, qishloq xo‘jaligi va “yashil” iqtisodiyotga oid me’yoriy-huquqiy hujjatlar, xalqaro tashkilotlar hisobotlari hamda xorijiy olimlarning ilmiy ishlari tashkil etdi.

Tadqiqotda tizimli yondashuv, qiyosiy tahlil, mantiqiy umumlashtirish, korrelyatsion-regression tahlil va prognozlash usullari qo‘llanildi. Sirkulyar bioiqtisodiyotning hududiy modeli va klasterlar sxemasi tizimli yondashuv asosida ishlab chiqildi. Qishloq xo‘jaligi mahsulotlari ishlab chiqarish hajmiga ta’sir etuvchi

omillar 2000-2024-yillar ma'lumotlari asosida ko'p omilli chiziqli regressiya modeli yordamida baholandi. Model parametrlari eng kichik kvadratlar usulida hisoblandi. Modelning umumiy ko'rinishi quyidagicha:

$$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_5X_5 + \varepsilon \quad (1)$$

Bu yerda Y - qishloq xo'jaligi mahsulotlarini ishlab chiqarish hajmi; X_1 - qishloq xo'jaligi mahsulotlari eksporti; X_2 - importi; X_3 - qayta ishlash hajmi; X_5 - aholining o'rtacha umumiy xarajatlari; a_0 - ozod had; a_1, a_2, a_3, a_5 - regressiya koeffitsiyentlari; ε - tasodifiy xato. Koeffitsiyent ishorasi omilning natijaga ta'sir yo'nalishini, uning qiymati esa ta'sir kuchini ko'rsatadi.

Omillarning natijaviy ko'rsatkichga nisbiy ta'sirini solishtirish uchun elastiklik koeffitsiyenti hisoblandi [3]:

$$E_i = \frac{a_i \cdot \bar{X}_i}{\bar{Y}} \quad (2)$$

Bu yerda E_i - i-omil bo'yicha elastiklik koeffitsiyenti; a_i - regressiya koeffitsiyenti; $\bar{X}_i$ va $\bar{Y}$ - mos ravishda omil va natijaviy ko'rsatkichning o'rtacha qiymatlari. Elastiklik omil 1 foizga o'zgarganda ishlab chiqarish hajmi necha foizga o'zgarishini bildiradi. Modelning sifati determinatsiya koeffitsiyenti (R^2), Fisher mezoni, Styudent t-statistikasi va Durbin-Watson mezoni orqali tekshirildi. Prognoz ko'rsatkichlari trend modeli va ko'p omilli ekonometrik model asosida 2030-yilgacha hisoblandi.

TAHLIL VA NATIJALAR

Qashqadaryo viloyatida qishloq xo'jaligi ishlab chiqarishining yuqori hajmi sirkulyar bioiqtisodiyot uchun katta xomashyo bazasini yaratadi. 2024-yilning yanvar-sentabr oylarida viloyatda qishloq xo'jaligi mahsulotlari 30 409,1 mlrd so'mlik hajmda ishlab chiqarilgan. Ushbu hajmning 12 106,4 mlrd so'mi dehqonchilik, 18 302,7 mlrd so'mi esa chorvachilik mahsulotlariga to'g'ri keladi [17]. Bu nisbat hududda ikki asosiy sirkulyar qiymat zanjirini shakllantirish imkoniyatini beradi [6]; [12]: "O'simlikchilik → biologik qoldiq → yem/kompost/bioenergiya → qayta ishlab chiqarish" hamda "Chorvachilik → organik chiqindi → biogaz/organik o'g'it → o'simlikchilik".

Qashqadaryoda suv ta'minoti bilan bog'liq muammolar agrar ishlab chiqarishning uzoq muddatli barqarorligi uchun muhim cheklovlardan biridir. Shuning uchun sirkulyar bioiqtisodiyotning hududiy modeli suvni ham iqtisodiy aylanish nuqtayi nazaridan boshqarishi lozim. Tadqiqot materiallarida tomchilatib sug'orish, aniq sug'orish, irrigatsiya tarmoqlarini modernizatsiya qilish hamda GIS va SCADA asosida suv monitoringini joriy etish taklif qilingan. Bu texnologiyalarni sirkulyar modelga integratsiya qilish natijasida: suv sarfi → real vaqt monitoringi → optimal taqsimot → hosildorlik → suv birligiga mahsulot zanjiri shakllanadi. Shu sababli kelgusida suv samaradorligini baholashda faqat 1 gektarga sarflangan suv emas, balki 1 m^3 suv hisobiga yaratilgan qo'shimcha qiymat asosiy KPIlardan biri bo'lishi kerak.

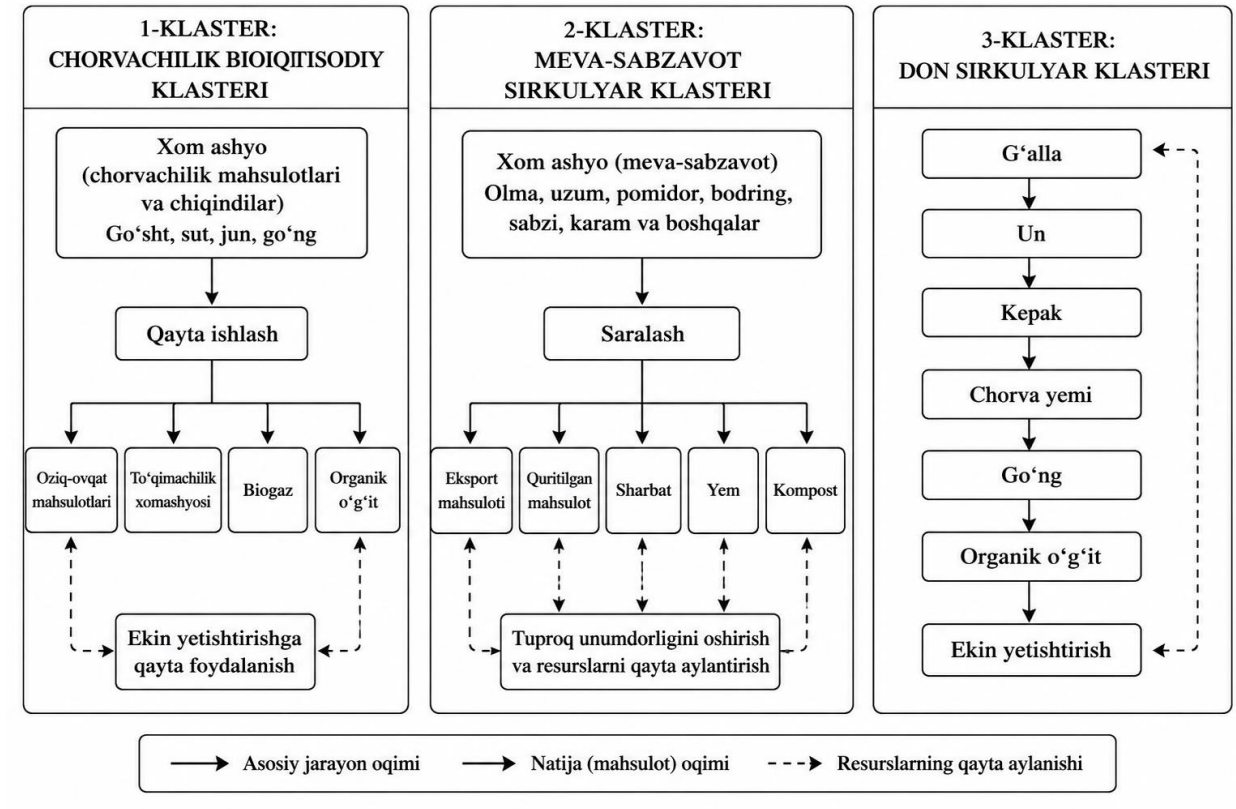
Qashqadaryo uchun IoT sensorlar, tuproq va atmosfera parametrlarini monitoring qilish, dronlar, masofadan zondlash va Agro-MIS tizimlarini joriy etish taklif qilingan [11]. Masalan, raqamli platforma quyidagi ma'lumotlarni birlashtirishi mumkin (1-jadval).

1-jadval

Sirkulyar bioiqtisodiyotni monitoring qilishning asosiy yo‘nalishlari va ko‘rsatkichlari[1]

Yo‘nalish	Monitoring ko‘rsatkichi
Yer	Sho‘rlanish, namlik, degradatsiya
Suv	1 gektarga suv sarfi
Ekin	Hosildorlik
Biologik chiqindi	Chiqindi hajmi
Qayta ishlash	Qayta ishlangan ulush
Logistika	Yo‘qotishlar
Energiya	Qayta tiklanuvchi energiya ulushi
Iqtisodiyot	Qo‘shimcha qiymat
Ekologiya	Ekologik bosim

1-jadvalda sirkulyar bioiqtisodiyot monitoringi to‘qqizta yo‘nalishni - yer, suv, ekin, biologik chiqindi, qayta ishlash, logistika, energiya, iqtisodiyot va ekologiyani qamrab oladi. Har bir yo‘nalish uchun bittadan asosiy ko‘rsatkich belgilangan: masalan, yer uchun sho‘rlanish, namlik va degradatsiya, suv uchun 1 gektarga suv sarfi, qayta ishlash uchun qayta ishlangan ulush. Bu ko‘rsatkichlar yagona raqamli platformada birlashtirilsa, resurslar aylanishini ishlab chiqarishdan iqtisodiy va ekologik natijagacha kuzatish imkoni paydo bo‘ladi.



1-rasm. Sirkulyar klasterlarning ko‘rinishi[2]

[1] Manba: muallif ishlanmasi.
[2] Manba: muallif ishlanmasi.

Qishloq xo‘jaligida hosil bo‘ladigan biologik chiqindilarni iqtisodiy aylanishga qaytarish sirkulyar bioiqtisodiyotning asosiy shartidir. Tadqiqot materiallarida fermer va dehqon xo‘jaliklarini chorvachilik mahsulotlarini qayta ishlovchi mini-texnologiyalar bilan ta’minlash, kooperatsiya munosabatlarini rivojlantirish taklif etilgan [9];[12].

Mazkur taklifni kengaytirib, Qashqadaryoda quyidagi sirkulyar klasterlarni tashkil etish mumkin (1-rasm).

Mazkur klasterlar iqtisodiy faoliyatni “ishlab chiqarish-iste’mol-chiqindi” modelidan “ishlab chiqarish-qayta ishlash-qayta foydalanish-qayta ishlab chiqarish” modeliga o‘tkazadi. 1-rasmda uchta klaster aks ettirilgan: chorvachilik bioiqtisodiy klasteri, meva-sabzavot sirkulyar klasteri va don sirkulyar klasteri. Birinchi klasterda chorvachilik xomashyosi qayta ishlanib, oziq-ovqat mahsulotlari, to‘qimachilik xomashyosi, biogaz va organik o‘g‘it olinadi, ularning bir qismi ekin yetishtirishga qaytariladi. Ikkinchi klasterda meva-sabzavot saralanib, eksport mahsuloti, quritilgan mahsulot, sharbat, yem va kompostga ajratiladi. Uchinchi klasterda esa g‘alla - un - kepak - chorva yemi - go‘ng - organik o‘g‘it - ekin yetishtirish zanjiri orqali resurslar yopiq aylanadi.

Global integratsiyalashuv sharoitida sirkulyar bioiqtisodiyotni rivojlantirish jarayoni bir nechta o‘zaro bog‘liq yo‘nalishlar asosida amalga oshirilishi maqsadga muvofiq. Mazkur tadqiqotda global integratsiyalashuvni texnologik, investitsion, bozor va institutsional integratsiya kabi to‘rtta asosiy yo‘nalishga ajratish taklif etiladi.

Birinchi yo‘nalish - texnologik integratsiya bo‘lib, bunda xalqaro kompaniyalar, ilmiy-tadqiqot markazlari va texnologik hamkorlar bilan hamkorlikni kuchaytirish orqali sirkulyar bioiqtisodiyot uchun zamonaviy texnologiyalarni hududiy iqtisodiyotga joriy etish nazarda tutiladi [11].

Ikkinchi yo‘nalish - investitsion integratsiya. Sirkulyar bioiqtisodiyotga o‘tish katta hajmdagi moliyaviy resurslar va zamonaviy ishlab chiqarish infratuzilmasini talab qilganligi sababli xorijiy investitsiyalarni strategik yo‘naltirish muhim ahamiyatga ega. Bunda investitsiyalarni qishloq xo‘jaligi mahsulotlarini qayta ishlash korxonalarini tashkil etish, bioenergetika loyihalarini amalga oshirish, sovutkichli logistika infratuzilmasini rivojlantirish, suv tejovchi texnologiyalarni joriy etish hamda biologik va qishloq xo‘jaligi chiqindilarini qayta ishlash loyihalariga yo‘naltirish maqsadga muvofiq.

Uchinchi yo‘nalish - bozor integratsiyasi bo‘lib, bunda mahalliy ishlab chiqaruvchilarni xalqaro bozorlar bilan bog‘lash, eksport salohiyatini oshirish va ekologik talablarga javob beradigan yangi mahsulotlar bozorini shakllantirish nazarda tutiladi.

To‘rtinchi yo‘nalish - institutsional integratsiya hisoblanadi. Mazkur yo‘nalishda davlat tashkilotlari, xalqaro tashkilotlar, moliya institutlari, ilmiy-tadqiqot markazlari, oliy ta’lim muassasalari, xususiy sektor va texnologik kompaniyalar o‘rtasidagi hamkorlikni tizimli ravishda rivojlantirish talab etiladi.

Sirkulyar bioiqtisodiyotning hududiy samaradorligini faqat biologik chiqindilar hajmi yoki qayta ishlash ulushi orqali baholash yetarli emas. Uning qishloq xo‘jaligi

ishlab chiqarishi va aholini mahsulot bilan ta'minlashga real iqtisodiy ta'sirini aniqlash uchun ekonometrik baholashdan foydalanish zarur [3]. Shu maqsadda Qashqadaryo viloyatida 2000-2024-yillar uchun 24 ta kuzatuv asosida qishloq xo'jaligi mahsulotlari ishlab chiqarish hajmiga ta'sir etuvchi omillar bo'yicha ko'p omilli ekonometrik model ishlab chiqilgan. Natijaviy ko'rsatkich sifatida qishloq xo'jaligi mahsulotlarini ishlab chiqarish hajmi Y, ta'sir etuvchi omillar sifatida esa qishloq xo'jaligi mahsulotlari eksporti X_1, importi X_2, qayta ishlash hajmi X_3 va aholining o'rtacha umumiy xarajatlari X_5 tanlangan. Dissertatsiyada aholi daromadi X_4 ham dastlabki omillar qatorida ko'rib chiqilgan, biroq ishlab chiqarish hajmi bilan bog'liqligi va modeldagi ahamiyatidan kelib chiqib yakuniy modeldan chiqarilgan.

Korrelyatsion tahlil natijalarida qishloq xo'jaligi mahsulotlari ishlab chiqarish hajmi bilan eksport o'rtasidagi korrelyatsiya koeffitsiyenti 0,952995, qayta ishlash bilan esa 0,966472 ni tashkil etgan. Bu ko'rsatkichlar mazkur omillar bilan ishlab chiqarish hajmi o'rtasida kuchli ijobiy bog'liqlik mavjudligini ko'rsatadi. Import bilan bog'liqlik esa 0,736604 darajasida qayd etilgan. Omillar ta'sirini baholash natijalari 2-jadvalda keltirilgan. Bu natijalar sirkulyar bioiqtisodiyot nuqtayi nazaridan muhim: ayniqsa qayta ishlash hajmining ishlab chiqarish bilan yuqori darajadagi bog'liqligi biologik xomashyoni chuqur qayta ishlash va uni iqtisodiy aylanishga qaytarish mexanizmlarini rivojlantirish zarurligini ko'rsatadi.

2-jadval

Qashqadaryo viloyatida qishloq xo'jaligi mahsulotlari ishlab chiqarish hajmiga ta'sir etuvchi omillarning ekonometrik baholash natijalari[1]

Omil	Belgilanishi	Koeffitsiyent	t-Statistikasi	p-qiymat	Elastiklik
Eksport hajmi	X_1	0,134165	4,583485	0,0002	0,193588
Import hajmi	X_2	-0,170780	-2,655077	0,0152	-0,038433
Qayta ishlash hajmi	X_3	0,533125	2,662430	0,0154	0,264257
Aholining o'rtacha umumiy xarajati	X_5	0,465061	4,947677	0,0001	0,784107
Konstanta	C	-2360,144	-2,965755	0,0079	-

Model natijalarida barcha tanlangan omillar statistik jihatdan ahamiyatli bo'lib, ularning p-qiymatlari 0,05 dan kichik. Modelning determinatsiya koeffitsiyenti R^2=0,994326, tekislangan determinatsiya koeffitsiyenti esa Adjusted R^2=0,993132 ni tashkil etgan. Bu natija qishloq xo'jaligi mahsulotlari ishlab chiqarish hajmidagi o'zgarishlarning asosiy qismi modelga kiritilgan omillar bilan izohlanishini ko'rsatadi. Model bo'yicha Fisher mezoni 832,4134, uning ehtimollik qiymati esa 0,000000 ga teng. Durbin-Watson mezoni 1,810548 ni tashkil qilgan.

Elastiklik hisob-kitoblariga ko'ra:

a) qishloq xo'jaligi mahsulotlari eksporti 1% oshganda, ishlab chiqarish hajmi 0,194% oshadi;

b) qishloq xo'jaligi mahsulotlari importi 1% oshganda, ishlab chiqarish hajmi 0,038% kamayadi;

[1] Manba: muallif hisob-kitoblari.

c) qishloq xo‘jaligi mahsulotlarini qayta ishlash hajmi 1% oshganda, ishlab chiqarish hajmi 0,264% oshadi;

d) aholining o‘rtacha umumiy xarajatlari 1% oshganda, qishloq xo‘jaligi mahsulotlari ishlab chiqarish hajmi 0,784% oshadi.

Bu yerda sirkulyar bioiqtisodiyot uchun eng muhim natija - qayta ishlash elastikligining 0,264 ga tengligidir. Ya’ni boshqa omillar o‘zgarmagan sharoitda qayta ishlash hajmining 1 foizga oshishi qishloq xo‘jaligi mahsulotlari ishlab chiqarish hajmining 0,264 foizga oshishi bilan bog‘liq.

Ekonometrik modelning amaliy ahamiyati uning prognoz imkoniyatlari orqali yanada kuchayadi. Tadqiqotda trend modeli va ko‘p omilli ekonometrik model asosida Qashqadaryo viloyatida qishloq xo‘jaligi mahsulotlari ishlab chiqarish hajmining 2030-yilgacha prognozi ishlab chiqilgan.

Prognoz jadvalida 2024-yilda ishlab chiqarish hajmi 44 293,5 mln so‘m sifatida qayd etilgan. Ko‘p omilli model asosida 2026-yilda ushbu ko‘rsatkich 53 554,49 mln so‘m, 2030-yilda esa 81 786,79 mln so‘m bo‘lishi prognoz qilingan. 2026/2024 nisbati 1,209082, 2030/2024 nisbati esa 1,846474 ni tashkil etadi.

Tadqiqotning umumiy prognoz xulosasiga ko‘ra, ko‘p omilli ekonometrik model asosida 2024-yilga nisbatan 2026-yilda ishlab chiqarish hajmining 1,21 baravar, 2030-yilga kelib esa 1,85 baravar oshishi va o‘rtacha o‘sish sur’ati 10,77% bo‘lishi kutilmoqda.

Bu prognozlar sirkulyar bioiqtisodiyot uchun muhim strategik xulosaga asos bo‘ladi: kelgusi davrda ishlab chiqarish hajmining o‘sishi faqat an’anaviy resurslarni ko‘proq jalb qilish hisobiga emas, balki qayta ishlash, biologik chiqindilarni qayta foydalanish, resurslardan samarali foydalanish va global texnologik integratsiyani kuchaytirish orqali ta’minlanishi lozim.

Tadqiqotning ilmiy yangiligi quyidagi yo‘nalishlarda ifodalanadi.

Birinchidan, global integratsiyalashuv, qishloq xo‘jaligi va sirkulyar bioiqtisodiyotni yagona hududiy iqtisodiy tizimga birlashtiruvchi global integratsiyalashgan sirkulyar agro-bioiqtisodiy model ishlab chiqildi.

Ikkinchidan, biologik resurslardan foydalanish samaradorligini iqtisodiy va ekologik ko‘rsatkichlar bilan birgalikda baholashga imkon beruvchi Sirkulyar bioiqtisodiyotni nazorat qilish integrallashgan indeksi (SBII) taklif qilindi.

Uchinchidan, Qashqadaryo viloyatida biologik chiqindilarni iqtisodiy resursga aylantirish uchun o‘simlikchilik-chorvachilik-qayta ishlash-bioenergetika o‘rtasidagi yopiq qiymat zanjirlarini shakllantirish mexanizmi asoslandi.

To‘rtinchidan, smart farming texnologiyalari hosildorlikni oshirish vositasidan tashqari, biologik resurslarning aylanishini nazorat qiluvchi raqamli boshqaruv vositasi sifatida talqin qilindi.

Beshinchidan, xalqaro integratsiya eksport bilan chegaralanmasdan, texnologiya transferi, investitsiya, bilim, ekologik standartlar va xalqaro bozorlar bilan bog‘langan ko‘p komponentli mexanizm sifatida asoslandi.

XULOSA VA TAKLIFLAR

Qashqadaryo viloyatida sirkulyar bioiqtisodiyotni rivojlantirish uchun quyidagi amaliy mexanizmni joriy etish maqsadga muvofiq, deb hisoblaymiz:

Birinchi bosqich - 2026-2027-yillar. Bunda, biologik resurslarning hududiy elektron reyestrini yaratish; qishloq xo‘jaligi chiqindilarini hisobga olish; tumanlar bo‘yicha SBII bazaviy qiymatini aniqlash; 2-3 ta pilot sirkulyar agroklasterni tashkil etish kabi masalalar hal etiladi.

Ikkinchi bosqich - 2027-2029-yillar. Bunda biologik chiqindilarni qayta ishlash mini-korxonalarini ko‘paytirish; biogaz va organik o‘g‘it loyihalarini kengaytirish; smart farming va IoT monitoringini kengaytirish; xalqaro investitsiyalarni jalb qilish kabilarga urg‘u beriladi.

Uchinchi bosqich - 2029-2030-yillar. Ushbu bosqichda esa barcha tumanlarni raqamli sirkulyar monitoring tizimiga ulash; eksportga yo‘naltirilgan bioasosli mahsulotlar ishlab chiqarishni kengaytirish; ekologik sertifikatlash tizimini rivojlantirish; hududning xalqaro sirkulyar bioiqtisodiyot qiymat zanjirlariga integratsiyasini kuchaytirish kabi masalalar hal etiladi.

Global iqtisodiy integratsiya sharoitida qishloq xo‘jaligini rivojlantirishning yangi paradigmasi iqtisodiy o‘sish va ekologik barqarorlikni qarama-qarshi maqsadlar sifatida emas, balki yagona tizimning o‘zaro bog‘liq elementlari sifatida ko‘rishni talab etmoqda. Qashqadaryo viloyati misolida olib borilgan tadqiqot shuni ko‘rsatadiki, hududning yuqori agrar salohiyati sirkulyar bioiqtisodiyot uchun yetarli biologik xomashyo bazasini shakllantiradi. 2024-yil yanvar-sentabrida qishloq xo‘jaligi mahsulotlari hajmining 30 409,1 mlrd so‘mga yetgani hududning ishlab chiqarish salohiyati yuqoriligini ko‘rsatadi. Biroq suv ta’minoti, yerlarning sho‘rlanishi, yerosti suvlarining ifloslanishi va mahsulot yo‘qotishlari mavjudligi ushbu salohiyatdan ekologik jihatdan barqaror foydalanish mexanizmini talab qiladi.

Tadqiqotda taklif etilgan global integratsiyalashgan sirkulyar agro-bioiqtisodiy model ushbu muammolarni ishlab chiqarish, qayta ishlash, logistika, raqamli monitoring va xalqaro integratsiya orqali kompleks hal qilishga qaratilgan. Modelning asosiy iqtisodiy natijasi biologik chiqindilarni ikkilamchi resursga aylantirish orqali qo‘shimcha qiymat yaratishdan iborat. Ekologik natijasi esa suv, yer va biologik resurslarga bosimni kamaytirish, chiqindilarni qisqartirish va resurslardan takroriy foydalanishni kengaytirish bilan belgilanadi. Institutsional natija esa fermer xo‘jaliklari, qayta ishlash korxonalari, logistika kompaniyalari, davlat organlari, ilmiy tashkilotlar va xalqaro hamkorlar o‘rtasida yangi integratsiyalashgan iqtisodiy aloqalarni shakllantirishdan iborat. Shu asosda maqolada taklif etilgan SBII - Sirkulyar bioiqtisodiyotni nazorat qilish integrallashgan indeksi hududning sirkulyar rivojlanish darajasini miqdoriy baholash va davlat siyosati uchun monitoring vositasi sifatida qo‘llanishi mumkin.

Sirkulyar bioiqtisodiyot Qashqadaryo uchun faqat ekologik konsepsiya emas. U qishloq xo‘jaligi ishlab chiqarish samaradorligini oshirish, oziq-ovqat xavfsizligini mustahkamlash, yangi daromad manbalarini yaratish, eksportni diversifikatsiya qilish,

resurslardan foydalanish samaradorligini oshirish va ekologik barqarorlikni ta'minlashning yangi iqtisodiy modeli sifatida qaralishi lozim.

Tadqiqot natijalari asosida quyidagi takliflar ilgari suriladi:

1. Qashqadaryo viloyatida hududiy "sirkulyar agroiqtisodiy monitoring" tizimini shakllantirish va unda 1-jadvalda keltirilgan to‘qqiz yo‘nalish bo‘yicha ko‘rsatkichlarni muntazam kuzatib borish.

2. Fermer va dehqon xo‘jaliklari ishtirokida qishloq xo‘jaligi chiqindilarini qayta ishlash kooperatsiyasini rivojlantirish, biogaz va organik o‘g‘it ishlab chiqaruvchi mini-korxonalarni ko‘paytirish.

3. Chorvachilik, meva-sabzavot va don yo‘nalishlarida 1-rasmda keltirilgan sirkulyar klasterlarni pilot loyihalar sifatida tashkil etish.

4. Qayta ishlash hajmini oshirishni ustuvor vazifa sifatida belgilash, chunki uning elastikligi 0,264 ga teng bo‘lib, ishlab chiqarish hajmining o‘sishiga ijobiy ta'sir ko‘rsatadi.

5. IoT sensorlar, masofadan zondlash va Agro-MIS tizimlariga asoslangan raqamli monitoring platformasini joriy etish hamda suv samaradorligini 1 m^3 suv hisobiga yaratilgan qo‘shimcha qiymat orqali baholash.

6. Texnologik, investitsion, bozor va institutsional integratsiyani kuchaytirish orqali xalqaro texnologiya transferi va investitsiyalarni qayta ishlash, bioenergetika va sovutkichli logistika loyihalariga yo‘naltirish.

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