

IN-DEPTH ANALYSIS ON THE BIOECONOMY

MAIN STAKEHOLDERS AND SYSTEMS

JOINT REPORT – OVERVIEW (D1.1)

elaborated in the frame of the project

"New Master's Degree Curricula for Sustainable Bioeconomy
in Uzbekistan" (BioEcUz)

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AUTHORS

Tashkent State Agrarian University (Uzbekistan)

Sanjar Adilov
Aziz Abduvasikov
Feruza Galimova

Tashkent Institute of Irrigation and Agricultural Mechanization Engineers (Uzbekistan)

Sherzod Rakhmonov
Anvar Anarbaev
Bakhtiyor Karimov
Kosimdjon Rakhmonov
Bekjon Uspankulov

Bukhara State University

Makhmud Oripov
Ziyodulla Nurov
Abror Juraev
Odil Sharipov

Samarkand Branch of Tashkent State Agrarian University (Uzbekistan)

Shavkat Hasanov
Sherzod Babakholov
Khusniddin Parдав

Latvia University of Life Sciences and Technologies (Latvia)

Līga Proškina
Sandija Rivža
Irīna Kulitāne
Umed Aslanov

Vytautas Magnus University (Lithuania)

Vilija Aleknevičienė

JAMK University of Applied Sciences (Finland)

Kirsi Knuuttila
Laura Vertainen
Hannariina Honkanen
Jaana Auer

Ministry of Agriculture of Republic of Uzbekistan

Husniddin Mardanov

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INTRODUCTION

The analysis was done with the aim to identify preconditions and challenges to be considered while elaborating the new bioeconomy-focused master level study programme (further referred to as the curricula) in Uzbekistan. The analysis has helped partners to understand the type and scope of the required resources, knowledge and competence, internal and external factors to be weighed during the elaboration of the new master level study programme (curricula), the purpose of which is to prepare professionals for development of a national knowledge-driven bioeconomy ecosystem.

The report includes analysis of three key components of the ecosystem of education in bioeconomy:

1. Evaluation of the involved higher education institutions (HEIs) and short overview of other higher education establishments, which provide education in the bioeconomy sectors in Uzbekistan.
2. Analysis of the bioeconomy and the related industries in Uzbekistan and short overview of Central Asia.
3. Analysis of the public sector in Uzbekistan, including public bodies dealing with the bioeconomy sectors responsible for development, adoption and monitoring of national strategies, policies and development plans related to the bioeconomy.

The analysis was done by the consortium of partners within project “New Master’s Degree Curricula for Sustainable Bioeconomy in Uzbekistan” (BioEcUz), No 619294-EPP-1-2020-1-LV-EPPKA2-CBHE-JP, financed by the European Union Erasmus+ Programme. The key beneficiaries of the new curricula will be four Uzbekistan’s universities – partners of the project, which will implement the results created within the project in their study content both during the project and in the future.

CONTENTS

AUTHORS	1
INTRODUCTION	2
CONTENTS	3
1. BIOECONOMY, ITS ECOSYSTEM AND AREAS COVERED	4
1.1. DEFINITION OF THE BIOECONOMY AND ITS ECOSYSTEM	4
1.2. ECONOMIC AREAS ASSOCIATED WITH THE BIOECONOMY	5
2. IN-DEPTH ANALYSIS OF INVOLVED HIGHER EDUCATION INSTITUTIONS and HIGHER EDUCATION ECOSYSTEM	6
2.1. Analysis of the Tashkent State Agrarian University (TSAU)	11
2.2. Analysis of Tashkent Institute of Irrigation and Agricultural Mechanization Engineers (TIAME)	27
2.3. Analysis of the Bukhara State University (BukhsU)	44
2.4. Analysis of Samarkand branch of the Tashkent State Agrarian University (SAM TSAU)	62
2.5. Other Uzbekistan’s higher education institutions providing master and/or doctoral level studies in the fields of science associated to the bioeconomy	71
2.6. Requirements for structure and composition of master level study programmes in Uzbekistan	73
2.6. SWOT of bioeconomy related higher education ecosystem, conclusions and recommendations	74
3. IN-DEPTH ANALYSIS OF BIOECONOMY RELATED INDUSTRIES	76
3.1. Overview of the bioeconomy related sectors	76
3.2. Development perspectives and trends from point of view of the bioeconomy sectors	83
3.3. Knowledge, skills, and competence needs of the associated sectors of the bioeconomy	86
3.4. Overview of university-research and industry-university relation	87
3.5. Overview of the bioeconomy sectors in Central Asia countries	88
3.6. SWOT of the bioeconomy related industries, conclusions and recommendations	88
4. IN-DEPTH ANALYSIS OF POLICY FRAMEWORK and PUBLIC SECTOR BODIES ASSOCIATED with the BIOECONOMY	92
4.1. Description of the bioeconomy related fields/areas and their knowledge needs	92
4.2. Strategies, policies, development programmes	96
4.3. International treaties, agreements, memorandums, and other understandings having impact on Uzbekistan initiatives associated to areas/fields of the bioeconomy	101
4.4. Other public sector stakeholders involved in strategic and policy planning and implementation or monitoring	103
4.5. SWOT analysis of policy framework and public sector stakeholders, conclusions and recommendations	104
5. SUMMARY, MAIN CONCLUSIONS and RECOMMENDATIONS	105
6. ANNEXES	107

1. BIOECONOMY, ITS ECOSYSTEM AND AREAS COVERED

1.1. DEFINITION OF THE BIOECONOMY AND ITS ECOSYSTEM

Bioeconomy is a new model for the economy. It covers all sectors and systems that rely on **biological/natural resources (animals, plants, micro-organisms, and derived biomass, including organic waste), their functions and principles**. Besides the use of renewable biological/natural resources sustainably, it also exploits the untapped potential stored within biological waste and residual materials.

The bioeconomy includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources, all industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy, and services.

The bioeconomy strongly respects **sustainability principles**, namely, approaches applied in the bioeconomy always make sure that they do not create negative impact on the wealth of present and future generations to ensure a fair share of scarce resources to everybody and to not induce serious damages that go beyond the carrying capacity of the environment.

Circularity has a great role in sustaining resources because it helps to eliminate and reuse waste streams thus ensuring the efficient use of resources and environmental impact of reducing waste.

In addition to the term '*bioeconomy*', there are several related terms, such as '*bio-based economy*', '*green economy*' and '*circular economy*'.

The green economy is generally considered to be an umbrella concept¹ and is understood to “result in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive”². The bioeconomy is generally considered to be a part of the green economy.

The concept of the bioeconomy has been linked with the concepts of the bio-based and circular economy. **The bio-based economy** is seen as a part of the bioeconomy and relates to the conversion of biological resources into products and materials. This is also referred to as bio-based production. Further, many novel developments allow the conversion of and extraction from biological resources to biopolymers that can be used as a building block for a wide range of products including food, feed and other products.

Substitution of non-renewables with sustainable produced biomass is also an important part of **the circular economy**. The European Commission defines the circular economy as an economy “where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised is an essential contribution to develop a sustainable, low carbon, resource efficient and competitive economy”. The circular economy includes all kind of material streams with different utilization routes. Organic recycling or biodegradation and the capture and utilization of CO₂ from industrial processes or the atmosphere are included.

¹ D. D'Amato, N. Droste, B. Allen, M. Kettunen, K. Lähtinen, J. Korhonen, P. Leskinen, B.D. Matthies, A. Toppinen. Green, circular, bio economy: A comparative analysis of sustainability avenues. J. Clean. Prod., 168 (2017), pp. 716-734

² UNEP, 2011, p. 1

Bioeconomy ecosystem is a complex network of resources, interconnected systems and stakeholders, which are as follow:

1. **Natural resources**, including biotic resources (relating to or resulting from living organisms, for example, plants, animals), and abiotic resources (not derived from living organisms, for example, soil).
2. **Systems** such as the legal basis, structure and processes, networks and supporting measures.
3. **Stakeholders**: enterprises, researchers, organisations of enterprises, support organisations, such as innovation centres, business incubators and other, national authorities planning and adopting national policies and their implementation mechanisms, regional and local public authorities, who create and ensure preconditions for business and increase of living conditions, as well civil society.

1.2. ECONOMIC AREAS ASSOCIATED WITH THE BIOECONOMY

The new curricula content will be aimed at supporting the three main areas of economics being associated with the bioeconomy:

a) Primary production sectors using biological/natural resources and producing from them products and providing services:

- Agriculture
- Forestry
- Fisheries and aquaculture

b) Sectors producing bio-based products³ for which production of biological/natural resources are used:

- Manufacture of food, beverages
- Manufacture of bio-based textiles
- Manufacture of wood products and furniture
- Manufacture of paper
- Manufacture of bio-based chemicals, pharmaceuticals, plastics, and rubber (excluding biofuels)
- Manufacture of liquid biofuels
- Production of bioelectricity

Bio-based products are those wholly or partly derived from materials of biological origin excluding materials embedded in geological formations and/or fossilised. In industrial processes, enzymes are used in the production of chemical building blocks, detergents, pulp and paper, textiles, etc. By using fermentation and bio-catalysis instead of traditional chemical synthesis, a higher process efficiency can be obtained, resulting in a decrease in energy and water consumption, and reduction of toxic waste. As they are derived from renewable raw materials such as plants, bio-based products can help reduce CO₂ and offer other advantages such as lower toxicity or novel product characteristics (e.g. biodegradable plastic materials).

Biorefinery is a process, where biomass is upgraded to one or several valuable products such as transport fuels, materials, chemicals, electricity and, as a by-product, heat. All types of biomass can be used, e.g. wood, straw, starch, sugars, waste, algae, and other.

³ Sectors are defined according to classification applied at the EU: <https://www.mdpi.com/2071-1050/10/6/1745/htm>;
https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_actions_2018.pdf#view=fit&pagemode=none

2. IN-DEPTH ANALYSIS OF INVOLVED HIGHER EDUCATION INSTITUTIONS and HIGHER EDUCATION ECOSYSTEM

This section includes an in-depth analysis of the involved Uzbekistan's universities, which will take part in the development, piloting, and further implementation of the new bioeconomy-focused curricula, as well as an overview of other higher education establishments providing bioeconomy-related studies.

The analysis of education ecosystem is done in compliance with classification of fields of sciences laid down in the OECD Frascati manual: <http://www.oecd.org/science/inno/38235147.pdf>, and significant for the sectors of bioeconomy listed in the section 1.2. These fields are classified as follows:

Natural sciences:

- Earth and related environmental sciences (1.5⁴):
 - Geosciences, multidisciplinary
 - Geochemistry and geophysics
 - Environmental sciences (*social aspects to be 5.7*)
 - Meteorology and atmospheric sciences; climatic research
 - Hydrology, water resources
- Biological sciences classified under the natural sciences (1.6)
 - Cell biology, microbiology; virology; biochemistry and molecular biology; biochemical research methods; mycology; biophysics
 - Genetics and heredity (*medical genetics to be 3*); reproductive biology (*excluding medical aspects*)
 - Developmental biology
 - Plant sciences, botany
 - Zoology, ornithology, entomology, behavioural sciences biology
 - Freshwater biology, limnology; ecology; biodiversity conservation
 - Biology (theoretical, mathematical, thermal, cryobiology, biological rhythm), evolutionary biology; other biological topics

Engineering and technologies:

- Electrical engineering, electronic engineering, information engineering (2.2)
 - Electrical and electronic engineering
 - Robotics and automatic control
 - Automation and control systems
 - Communication engineering and systems; telecommunications
- Chemical engineering (2.4)
 - Chemical engineering (plants, products)
 - Chemical process engineering
- Materials engineering (2.5)
 - Materials engineering
 - Ceramics
 - Composites (including laminates, reinforced plastics, combined natural and synthetic fibre fabrics; filled composites)
 - Paper and wood; textiles; including synthetic dyes, colours, fibres
- Environmental engineering (2.6)
 - Environmental and geological engineering, geotechnics

⁴ The number in brackets here and below shows relevant number in the OECD Frascati manual.

- Petroleum engineering, (fuel, oils)
- Energy and fuels
- Remote sensing
- Environmental biotechnology (2.7)
 - Environmental biotechnology
 - Bioremediation, diagnostic biotechnologies (DNA chips and biosensing devices) in environmental management; environmental biotechnology related ethics
- Industrial biotechnology (2.8)
 - Industrial biotechnology
 - Bioprocessing technologies (industrial processes relying on biological agents to drive the process), bio catalysis, fermentation; bioproducts (products that are manufactured using biological material as feedstock), biomaterials, bioplastics, biofuels, bioderived bulk and fine chemicals, bio-derived novel materials
- Other engineering and technologies (2.10)
 - Food and beverages
 - Other engineering and technologies

Agricultural sciences:

- Agriculture, forestry, and fisheries (4.1)
 - Agriculture
 - Forestry
 - Fishery
 - Soil science
 - Horticulture, viticulture
 - Agronomy, plant breeding and plant protection (*agricultural biotechnology to be 4.4*)
- Animal and dairy science (4.2)
 - Animal and dairy science (*animal biotechnology to be 4.4*)
 - Husbandry; Pets
- Veterinary science (4.3)
- Agricultural biotechnology (4.4)
 - Agricultural biotechnology and food biotechnology
 - GM technology (crops and livestock), livestock cloning, marker-assisted selection, diagnostics (DNA chips and biosensing devices for the early/accurate detection of diseases) biomass feedstock production technologies, biopharming, agricultural biotechnology related ethics
- Other agricultural sciences (4.5)

Social sciences:

- Economics and business (5.2)
 - Economics, econometrics; industrial relations
 - Business and management
- Social and economic geography (5.7)
 - Environmental sciences (social aspects)
 - Cultural and economic geography
 - Urban studies (planning and development)
 - Transportation planning and social aspects of transportation (*excluding transportation engineering*)

Universities, regarding which the in-depth analysis is done, and their specialization areas relevant to the bioeconomy are as following:

P2 Tashkent State Agrarian University (TSAU)
Natural sciences:

- Ecology and environmental protection (in agriculture)

Engineering and technologies:

- Storage technologies and primary processing of agricultural products (by type of product)
- Biotechnology (by industry)
- Automation and control of technological processes and production (in agriculture)
- Metrology, standardization and product quality management (by industry)

Agricultural sciences:

- Agronomy (by types of agricultural products)
- Technology of cultivation and processing of medicinal plants
- Sericulture and mulberry production
- Landscaping and gardening
- Fruit and viticulture
- Forestry
- Plants and crops quarantine
- Plant protection (by crop type)
- Selection and production of seeds (by type of crop)
- Growing vegetables, melons and potatoes
- Zoo engineering: beekeeping
- Animal engineering: Fish farming
- Agro-chemistry and agro-soil science

Social sciences:

- Agribusiness and investment activities
- Accounting and auditing (in agriculture)
- Economy (in agriculture)
- Logistics (agro-logistics)
- Marketing (in agriculture)
- Tourism (agrotourism)
- Organizing and running a greenhouse

P3 Tashkent Institute of Irrigation and Agricultural Mechanization Engineers (TIAME)
Natural sciences:

- Water resource management and amelioration
- Ecology
- Reclamation and irrigated agriculture
- Use of hydro-ameliorative systems
- Ecological safety in water management
- Environmental management

Engineering and technologies:

- Electrification and Automation of agriculture
- Geodesy, cartography and cadastre
- Hydrotechnical construction and pump station
- Hydrotechnical construction
- Water energy use in irrigation system
- Technological processes and automatization of production
- Water energetics
- Electricity supply
- Energy supply in agriculture and water management
- Smart sensors in water management



- Water-saving irrigation technologies
- Mechanization of hydro-meliorative works
- Use of hydraulic structures, their reliability and safety
- Use and diagnosis of pumping stations and devices
- Energy saving and energy audit (in water management)
- Alternative energy sources
- Hydraulics and engineering hydrology
- Mini and micro hydropower plants
- Intelligent sensors and technologies

Agricultural sciences:

- Hydrology
- Precision agriculture
- Mechanization of agriculture

Social sciences:

- Land resource management
- Economics
- Management (water resources)
- Accounting and auditing
- Life safety
- Marketing (agriculture)
- Organization and management of water resources
- Geodesy and geoinformatics
- Water quality management
- Entrepreneurship in agriculture
- Agricultural economics
- Digital economy

P4 Bukhara State University (BukhsU)

Natural sciences:

- Chemistry
- Geography
- Ecology and environmental protection

MA course:

- Chemistry
- Geography

Engineering and technologies:

- Mathematics
- Physics
- Applied mathematics and computer science
- Mathematical and software support for information systems
- Computer science and programming technology
- Information systems and technology

MA course:

- Mathematics
- Applied mathematics
- Physics
- Renewable energy sources and sustainable environmental physics

Agricultural sciences:

- Biology
- Biotechnology



- Agro-chemistry and soil science
- Soil science
- Plant protection
- Storage and primary processing technology for agricultural products
- Fruit and vine growing
- Vegetable growing
- Greenhouse farm arrangement and management

MA course:

- Biology
- Soil science
- Ichthyology and hydrobiology

Social sciences:

- Processing-oriented education
- Economics
- Marketing
- Business and management
- Statistics
- Logistics (agro-logistics)
- Agribusiness and investment
- Service industry
- Hotel industry arrangement and management
- Tourism

MA course:

- Economics
- Computer science and programming technology
- Tourism (by activities)

P8 Samarkand branch of the Tashkent State Agrarian University (SAMTSAU)

Engineering and technologies:

- Primary processing of agricultural commodities, storage and technologies (by type of product)
- Automation and control of technological processes and production (in agriculture)
- Smart agriculture

Agricultural sciences:

- Agronomy (by types of agricultural products)
- Agro-chemistry and soil science
- Fruit and viticulture
- Plant protection and quarantine
- Selection and seed sciences (by type of crop)
- Vegetables, melons and potato growing
- Greenhouse production
- Organic agriculture
- Technologies of growing herbal crops

Social sciences:

- Agribusiness and investment
- Accounting and auditing (in agriculture)
- Agricultural economics
- Tourism (agrotourism)
- Econometrics
- Sustainable development of rural areas

2.1. Analysis of the Tashkent State Agrarian University (TSAU)

Overview of study programmes and related measures to be associated to the bioeconomy (for the last 5 study years)

Field of science	NATURAL SCIENCES				
	Study years				
Type of data	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Total number of study programmes, inter alia	4	4	4	7	9
<i>Doctoral level</i>	1	1	1	2	3
<i>Master level</i>	2	2	2	4	4
<i>Bachelor level</i>	1	1	1	1	2
<i>Professional studies</i>	-	-	-	-	-
Total number of students in study programmes, inter alia	412	468	333	338	254
<i>Doctoral level</i>	1	1	2	2	4
<i>Master level</i>	10	10	12	14	18
<i>Bachelor level</i>	344	393	261	254	200
<i>Professional studies</i>	57	64	58	68	32
Number of academic staff members, inter alia	72	82	90	95	98
<i>Having doctoral degree</i>	24	26	26	28	38
<i>Having master's degree</i>	26	32	44	45	42
<i>Lecturers</i>	22	24	20	22	18
Number of academic staff holding title of a professor or an associate professor	30	38	42	42	44
Annual budget in EUR allocated to bioeconomy-related study programmes, inter alia:	x	x	x	x	x
<i>Budget for studies, in EUR</i>	160,316	1,771,448	2,134,566	2,904,445	2,994,055
<i>Budget for research, in EUR</i>	880,852	915,569	1,154,525	1,550,355	2,321,234
Number of scientific publications, published in internationally indexed scientific journals	25	32	44	56	62
Number of applied research and technological development initiatives with industries (e.g., contracts)	3	3	6	4	2
Number of offered lifelong education programmes related to the fields of the bioeconomy	1	1	1	2	2
Number of students/learners in the above-mentioned lifelong education programmes	8	14	16	18	12
Number of students' international mobilities	3	3	4	12	4
Number of academic staff international mobilities	6	7	12	16	4

Number of international events (conferences, congresses) attended with a presentation or poster	12	10	11	16	18
<i>Domestic events (organised in the own country)</i>	11	21	12	18	19
<i>Regional events (organised in Central Asia)</i>	1	3	3	4	5
<i>Events organised in other countries of the world</i>	1	2	3	3	3

Field of science	ENGINEERING AND TECHNOLOGY				
	Study years				
Type of data	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Total number of study programmes, inter alia	13	14	16	18	24
<i>Doctoral level</i>	2	3	6	8	8
<i>Master level</i>	6	6	6	6	10
<i>Bachelor level</i>	5	5	4	4	6
<i>Professional studies</i>	-	-	-	-	-
Total number of students in study programmes, inter alia	1,346	1,470	1,351	1,021	942
<i>Doctoral level</i>	4	6	8	14	16
<i>Master level</i>	68	62	62	74	88
<i>Bachelor level</i>	1,204	1,336	1,246	908	812
<i>Professional studies</i>	70	66	35	25	26
Number of academic staff members, inter alia	108	118	108	118	128
<i>Having doctoral degree</i>	42	48	44	49	52
<i>Having master's degree</i>	36	38	32	44	42
<i>Lecturers</i>	30	32	32	25	34
Number of academic staff holding title of a professor or an associate professor	48	52	56	61	65
Annual budget in EUR allocated to bioeconomy-related study programmes, inter alia:	x	x	x	x	x
<i>Budget for studies, in EUR</i>	160,316	1,771,448	2,134,66	2,904,445	2,994,055
<i>Budget for research, in EUR</i>	880,852	915,569	1,154,525	1,550,355	2,321,234
Number of scientific publications, published in internationally indexed scientific journals	25	25	33	42	96
Number of applied research and technological development initiatives with industries (e.g., contracts)	12	10	8	8	6
Number of offered lifelong education programmes related to the fields of the bioeconomy	2	3	6	8	8



Number of students/learners in the above-mentioned lifelong education programmes	48	42	42	44	62
Number of students' international mobilities	6	7	8	11	12
Number of academic staff international mobilities	4	4	3	12	17
Number of international events (conferences, congresses) attended with a presentation or poster	33	43	51	52	34
<i>Domestic events (organised in the own country)</i>	11	21	12	18	19
<i>Regional events (organised in Central Asia)</i>	1	3	3	4	5
<i>Events organised in other countries of the world</i>	1	2	3	3	3

Field of science	AGRICULTURAL SCIENCES				
	Study years				
Type of data	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Total number of study programmes, inter alia	29	34	37	41	48
<i>Doctoral level</i>	4	8	12	16	18
<i>Master level</i>	17	17	17	17	20
<i>Bachelor level</i>	8	9	8	8	10
<i>Professional studies</i>	-	-	-	-	-
Total number of students in study programmes, inter alia	4,651	3,932	3,460	3,175	3,511
<i>Doctoral level</i>	6	16	14	38	42
<i>Master level</i>	124	132	112	142	436
<i>Bachelor level</i>	4,344	3,693	3,261	2,960	2,997
<i>Professional studies</i>	177	91	73	35	36
Number of academic staff members, inter alia	171	181	204	212	224
<i>Having doctoral degree</i>	72	78	86	96	102
<i>Having master's degree</i>	56	58	62	78	82
<i>Lecturers</i>	43	45	56	38	40
Number of academic staff holding title of a professor or an associate professor	83	86	95	101	113
Annual budget in EUR allocated to the bioeconomy related study programmes, inter alia:	x	x	x	x	x
<i>Budget for studies, in EUR</i>	160,316	1,771,448	2,134,566	2,904,445	2,994,055
<i>Budget for research, in EUR</i>	880,852	915,569	1,154,525	1,550,355	2,321,234
Number of scientific publications, published in internationally indexed scientific journals	85	205	243	290	320

Number of applied research and technological development initiatives with industries (e.g., contracts)	26	24	22	19	16
Number of offered lifelong education programmes related to the fields of the bioeconomy	4	10	18	19	23
Number of students/learners in the above-mentioned lifelong education programmes	142	147	133	203	445
Number of students' international mobilities	6	7	8	11	12
Number of academic staff international mobilities	4	4	3	12	17
Number of international events (conferences, congresses) attended with a presentation or poster	33	43	51	52	34
<i>Domestic events (organised in the own country)</i>	11	21	12	18	19
<i>Regional events (organised in Central Asia)</i>	1	3	3	4	5
<i>Events organised in other countries of the world</i>	1	2	3	3	3

Field of science	SOCIAL SCIENCES				
	Study years				
	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Type of data					
Total number of study programmes, inter alia	10	12	13	13	19
<i>Doctoral level</i>	3	4	4	4	6
<i>Master level</i>	3	4	4	4	6
<i>Bachelor level</i>	4	4	5	5	7
<i>Professional studies</i>	-	-	-	-	-
Total number of students in study programmes, inter alia	922	877	854	748	735
<i>Doctoral level</i>	4	6	6	12	14
<i>Master level</i>	62	64	72	76	92
<i>Bachelor level</i>	844	795	766	650	621
<i>Professional studies</i>	12	12	10	10	8
Number of academic staff members, inter alia	98	109	115	121	136
<i>Having doctoral degree</i>	38	41	44	48	52
<i>Having master's degree</i>	32	36	35	38	40
<i>Lecturers</i>	28	32	36	35	44
Number of academic staff holding title of a professor or an associate professor	44	46	48	53	61

Annual budget in EUR allocated to the bioeconomy related study programmes, inter alia:	x	x	x	x	x
<i>Budget for studies, in EUR</i>	160,316	1,771,448	2,134,566	2,904,445	2,994,055
<i>Budget for research, in EUR</i>	880,852	915,569	1,154,525	1,550,355	2,321,234
Number of scientific publications, published in internationally indexed scientific journals	80	88	146	162	204
Number of applied research and technological development initiatives with industries (e.g., contracts)	8	6	4	4	2
Number of offered lifelong education programmes related to the fields of the bioeconomy	3	4	4	4	6
Number of students/learners in the above-mentioned lifelong education programmes	84	92	90	106	129
Number of students' international mobilities	6	7	8	11	12
Number of academic staff international mobilities	4	4	3	12	17
Number of international events (conferences, congresses) attended with a presentation or poster	14	16	19	22	18
<i>Domestic events (organised in the own country)</i>	11	21	12	18	19
<i>Regional events (organised in Central Asia)</i>	1	3	3	4	5
<i>Events organised in other countries of the world</i>	1	2	3	3	3

2.1.1. Academic staff to be involved in the project: capacity-building activities, development and further implementation of the new curricula.

○ Already pre-selected academic staff – teachers

Name and surname	Title, degree	Field of science	Thematic, subjects in academic work	Field/area in the new curricula
Aziz Abduvasikov	Associate professor, PhD	Social sciences (agricultural economics)	Agricultural economics, regional economics	Development of bioeconomy sector Bio-resources based manufacturing and processing
Sanjar Adilov	MSc	Social sciences (agricultural economics)	Agricultural economics, rural development	Development of bioeconomy sector Bio-resources based engineering

Baxtiyor Menglikulov	Professor, PhD	Social sciences (agricultural economics)	Agricultural economics, investment activities in agriculture, accounting, finance	Development of bioeconomy sector Sustainable food production and consumption Innovation and investment in the bioeconomy sector
Iroda Rustamova	Professor, PhD	Social sciences (agricultural economics)	Agricultural economics, investment and innovation activities in agriculture, logistics	Development of bioeconomy sector Sustainable food production and consumption Innovation and investment in the bioeconomy sector
Farrux Yakubov	MSc	Agricultural sciences (agricultural management)	Agricultural economics	Development of bioeconomy sector Bio-resources based engineering
Firyuza Galimova	PhD	Agricultural economics	Agricultural economics, investment and innovation activities in agriculture, logistics	Development of bioeconomy sector Sustainable food production and consumption Innovation in the bioeconomy sector – markets and international trade of bio-based products

- **Other academic staff – teachers, potentially to be involved in the development and further implementation of the new curricula**

Name and surname	Title, degree	Field of science	Thematic, subjects in academic work	Field/area in the new curricula
Nilufar Dexkanova	MSc	Agricultural economics	Agricultural economics, investment and innovation activities in agriculture, food security	Sustainable food production and consumption Innovation and investment in the bioeconomy sector
Gulnora Narinbaeva	MSc	Agricultural economics	Agricultural economics, innovation activities in agriculture	Development of bioeconomy sector Bio-resources based manufacturing and processing
Nafisa Abdullaeva	MSc	Agricultural economics	Agricultural economics, investment and innovation activities in agriculture	Development of bioeconomy sector Bio-resources based engineering
Giyos Ergashev	MSc	Agricultural sciences (agricultural management)	Agricultural economics	Development of bioeconomy sector Bio-resources based engineering
Botir Ulmasov	MSc	Animal science	Animal science, veterinary	Sustainable crop and livestock production and consumption
Equbjon Yakubov	PhD	Agricultural sciences	Forestry	Sustainable forestry
Mansur Kholmuratov	PhD	Agricultural sciences	Forestry	Sustainable forestry
Bakhtiyor Komilov	PhD	Agriculture sciences	Fishery and aquaculture	Sustainable fisheries and aquaculture

Boymahamat Kahramonov	PhD	Agriculture sciences	Fishery and aquaculture	Sustainable fisheries and aquaculture
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2.1.2. Detailed information on the master and/or doctoral level study programmes associated with the bioeconomy

Master level study programmes

Data, information required	Information
Title of the study programme	Agribusiness and Investment Activities
Faculty/unit providing the study programme	Agribusiness and Investment Activities / Agro-logistics and Business
Credits in UZ /credits in ECTS	120/120
Duration (in years)	2 years
Degree or qualification to be obtained	MSc
Main subjects	Research methodology Research methods in agribusiness Agricultural economics Storage and processing of agricultural products etc.

Data, information required	Information
Title of the study programme	Economy (agriculture)
Faculty/unit providing the study programme	Agro-logistics / Agro-logistics and Business
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Accounting and audit Economics of farm management Scientific-research methodology Scientific research in agricultural economics Management in agricultural management

Doctoral level study programmes

Data, information required	Information
Title of the study programme	Agricultural Economics
Faculty/unit providing the study programme	Agribusiness and Investment Activities / Agro-logistics and Business
Credits in UZ /credits in ECTS	-
Duration (in years)	3 years
Degree or qualification to be obtained	PhD or DSc
Main subjects	Agricultural economics Management

Data, information required	Information
Title of the study programme	Management
Faculty/unit providing the study programme	Agribusiness and Investment Activities / Agro-logistics and Business
Credits in UZ /credits in ECTS	-
Duration (in years)	3 years
Degree or qualification to be obtained	PhD or DSc
Main subjects	Management Farm management Agricultural economics Regional ecological management

2.1.3. Existing study, innovation, and research infrastructures (acquired during the last 10 years and fully functional)

Description	Structural unit of HEI holding the infrastructure
Laboratories available for studies:	
<ul style="list-style-type: none"> The laboratory of microbiological analyses of food production. The laboratory of storage and processing of agricultural products. The laboratory of sensory evaluation food products. Biological laboratory. The laboratory “Agro Vitro Clone”. Plant protection laboratory “Bio Markaz”. 	Faculty of agrology and business
Laboratories available for research:	
We can use the laboratories for study, scientific research, and practical issues. There are digital microscope and spectrophotometer. Research on innovative developments in the field of plant protection. Preparation of planting material for agricultural crops.	Faculty of Storage and Processing of Agricultural Products
Digital resources available:	
<p>Moodle is used as an online platform to upload and share educational materials.</p> <p>Telegram is used to receive practical exercise and assessment.</p> <p>Videoconference room is used to participate at online (Zoom) conferences and seminars.</p> <p>All auditoriums have a projector or TV-set to connect to a PC or laptop.</p> <p>Computer classes are available at library or dormitories.</p> <p>Online library is available at https://tdau.uz/.</p>	Faculty of Agrology and Business

2.1.4. Available knowledge sources

Description	Structural unit of HEI responsible for knowledge storage and maintenance
Scientific data bases used by academic staff and students (available in long -term for regular study process):	
<ul style="list-style-type: none"> https://stat.uz/en/official-statistics/agriculture - all statistics are available in most major sectors and categories. Forestry, fisheries, agriculture, food production and consumption, energy 	There are libraries containing a 1 million database and information Resources centre equipped

<ul style="list-style-type: none"> • https://opendata.gov.uz/en - open data provided from many ministries in Uzbekistan. Forestry, fisheries, agriculture, food production. • www.agriculture.uz - database of innovative developments in the field of agriculture, an electronic library, recommendations for agricultural producers and other information in the field of bioeconomy • www.agro.uz - Ministry of Agriculture of the Republic of Uzbekistan • www.agromart.uz - free, qualified advice in the field of bioeconomy, obtaining advanced theoretical and practical knowledge in the field of bioeconomy, a trading platform for agricultural producers • www.agrowebcee.net/awuz - the Republic of Uzbekistan, a part of the AgroWeb Network is created to collect and provide information on agricultural institutions and other important agriculture-related subjects to help users to find information and contacts in Central Asia and European countries. 	with modern IT technologies.
<p>List the latest literature, provide explanation on its relation to curricula topics, e.g. forestry, fisheries, agriculture, food production and consumption, other bio-based production, energy and bioenergy consumption etc.</p>	
<ul style="list-style-type: none"> • Ronald D. Kay, William M. Edwards, Patricia A. Duffy. <i>Farm management. Eighth edition.</i> – USA: Texas and M University, 2016. – 466 p. • <i>The Bioeconomy Approach Constraints and Opportunities for Sustainable Development.</i> Edited By Udaya Sekhar Nagothu • Debertin, Dr David L: <i>Agricultural Production Economics. Second Edition 2012, Greate Spase.</i> • Mikhalev S.V, Galieva R.I. <i>Fundamentals of the organization of agribusiness: a tutorial.</i> – Irkutsk: GBPOU “Irkutsk Agricultural College”, 2015. – 189 pg. • Stevi Woodward. <i>Forest Pathology.</i> Wiley-VGH GmbH. • Donnell Hunt. <i>Farm Power and Machinery Management Tenth Edition.</i> Waveland Press, Incorporated USA 2015 • Bauer ON and other <i>Ichthyopathology.</i> - Moscow 2017. • Arinzhonov A.E. <i>Fisheries hydraulic engineering.</i> 2014, Orenburg, Russia. • Juan Carlos Contreras-Esquivel, Laxmikant S. Badwaik, Porteen Kannan, A. • K. Haghi. <i>Food Product Optimization for Quality and Safety Control.</i> Published November 26, 2020 by Apple Academic Press 418 Pages 21 Color & 49 B/W Illustrations. 	

2.1.5. Research activities and international research projects in the field (completed within 2016-2020 and ongoing)

The list of the most significant bioeconomy related publications of the HEI for the respective period!

No	Title of publication	Names of the main authors	Year of publishing	Title of a scientific journal, where published	Link to the publication (if available)
1.	Estimation of influence of innovative	Menglikulov Bakhtiyor,	2019	International Journal of Recent	https://www.ijrte.org/wp-content/uploads/papers/v8i4/D5354118419.pdf



	development on growth of agriculture	Dekhkanova Nilufar		Technology and Engineering	
2.	Theoretical and methodical approaches of innovative processes management in silk production	Alieva Nodira Abdumalikovna	2020	International Journal of Scientific & Engineering Research	https://www.ijser.org/onlineResearchPaperViewer.aspx?THEORETICAL-AND-METHODICAL-APPROACHES-OF-INNOVATIVE-PROCESSES-MANAGEMENT-IN-SILK-PRODUCTION.pdf
3.	Strategic priorities of intellectual capital management in the enterprise	Abduvosikov Abduaziz Abdulazizovich	2019	Academy of Strategic Management Journal	https://www.abacademies.org/journals/academy-of-strategic-management-journal-home.html
4.	Digitalization of agricultural complex will allow to ensure food security	Azimov Rustam, Ergashev Giyos	2020	International Journal of Innovations in Engineering Research and Technology	https://www.ijert.org/paper-details.php?paper_id=141715
5.	Theoretical and methodical approaches of innovative processes management in silk production	Alieva Nodira Abdumalikovna	2020	International Journal of Scientific & Engineering Research	https://www.ijser.org/onlineResearchPaperViewer.aspx?THEORETICAL-AND-METHODICAL-APPROACHES-OF-INNOVATIVE-PROCESSES-MANAGEMENT-IN-SILK-PRODUCTION.pdf
6.	The ways of fishing farms management and developing the production activity	Beglaev Uchkun	2020	International Journal of Scientific & Technology Research	http://www.ijstr.org/final-print/feb2020/The-Ways-Of-Fishing-Farms-Management-And-Developing-The-Production-Activity.pdf
7.	Current status and prospects for protection of walnut trees from diseases	Boltaev Nurali Shiramatovich	2020	Solid State Technology	http://solidstatetechnology.us/index.php/JSST/article/view/1167
8.	Organizational and economic mechanism for the development of innovative processes in agriculture in Uzbekistan	Galimova Firyuza Rafikovna	2020	International Journal of Research Culture Society	https://ijrcs.org/wp-content/uploads/IJRCs202001026.pdf
9.	Estimation of influence of innovative development on growth of agriculture	Dekhkanova Nilufar	2019	International Journal of Recent Technology and Engineering (IJRTE)	https://www.ijrte.org/wp-content/uploads/papers/v8i4/D5354118419.pdf

10.	Efficiency of the technology of propagation of cherries under conditions of in vitro	Rustamova Iroda, Galimova Firyuza Rafikovna	2020	International Journal of Academic Multidisciplinary Research (IJAMR)	http://ijeais.org/wp-content/uploads/2020/9/IJAMR200917.pdf
11.	The current state and development trends of the agricultural products and food market in Uzbekistan	Dekhkanova Nilufar Sagdullaevna, Tonkikh Olga Viktorovna, Yakubov Farrukh Kamiljanovich	2020	International Journal of Research Culture Society	https://ijrcs.org/wp-content/uploads/2020/9/IJRC202001027.pdf
12.	Innovations and analysis of their use in the agricultural sector of the economy of Uzbekistan	Galimova Firyuza Rafikovna, Dekhkanova Nilufar Sagdullaevna	2020	International Journal for Innovative Research in Multidisciplinary Field	https://www.ijirmf.com/wp-content/uploads/IJIRMF202004056.pdf

2.1.6. Innovation capacity, performance and achievements

Describe innovation activities carried by your HEI in the respective field! Nature of innovation. Its application possibilities (sectors of economy, geographic areas, etc.). Users (potential and current).

- We are going to implement innovations in the following fields:
 - 1) Using innovative methods for storage of agricultural products: cold chain system, using capsules, using biopolymer covering system;
 - 2) Using innovative methods for drying of agricultural products. For example, special pre-treatment before drying, using infrared lights, etc.;
 - 3) Using innovative technologies in the processing agriculture products
- Using renewable energy resources in the processing and storage of agriculture products, the management of quality food and agricultural products.
- The information and consulting centre of TGAU conducts innovative research on the cultivation of agricultural crops, develops new varieties of agricultural crops, develops preparations for plant protection and performs other work in the field of bioeconomy.

Does your HEI support creation and development of start-ups? Which? In what way the support is provided?

- Of course, for example, cold chain system was supported by exporters and they already use the system.
- In addition, start-ups for the development and implementation of ICT in the bioeconomy.
- Projects for the introduction of innovative technologies in the development of agriculture.

Does your HEI develop new products, technologies and services and transfer them to the industry?

- Cold storage owners and exporters have been using the system.
- New technologies for plant protection.
- Implementation of planting material for various crops.

2.1.7. Internal and external collaboration in relation to bioeconomy

○ Collaboration within own university

<i>Name of partnering unit</i>	Higher and secondary vocational education, manufacturers
<i>Short description of collaboration</i>	<ul style="list-style-type: none"> • Joint curricula • Joint multidisciplinary study programme (name science directions covered) • Joint research • Sharing of study and research infrastructures • Other (provide information)
<i>Results, benefits of the collaboration</i>	
Integrated achievement of science and industry, preparing competitive staff for the industry.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science providing academic mobility of students and teaching staff.	

○ Collaboration with other Uzbekistan's universities and research institutions

<i>Name of partnering university</i>	Bukhara Institute of Engineering and Technology, the Academician Makhmud Mirzaev Scientific-research institute of Horticulture, Viticulture and Wine-Making, the Institute of Genetics and Plant Experimental Biology
<i>Short description of collaboration</i>	<ul style="list-style-type: none"> • Joint curricula • Joint multidisciplinary study programme (name science directions covered) • Joint research • Exchange of academic staff • Sharing of study and research infrastructures • Other (provide information)
<i>Results, benefits of the collaboration</i>	
Integrated achievement of science and industry, preparing competitive staff for the industry.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science, providing academic mobility of students and teaching staff	

○ Collaboration with foreign universities and other higher education establishments

<i>Name of partnering university and country</i>	Kazakh National Agrarian University, Saratov State Agrarian University
<i>Short description of collaboration</i>	<ul style="list-style-type: none"> • Joint curricula • Joint multidisciplinary study programme (name science directions covered) • Foreign university/ies provide guest lecturers (name science directions) • Joint research • Other (provide information)
<i>Results, benefits of the collaboration</i>	
Integrated achievement of science and industry, preparing competitive staff for the industry.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science, providing academic mobility of students and teaching staff	
<i>Name of partnering university and country</i>	Leibniz Institute of Agricultural Development in Transition Economies (IAMO) (Germany)

Short description of collaboration	<ul style="list-style-type: none"> • Joint curricula • Joint multidisciplinary study programme (name science directions covered) • Foreign university/ies provide guest lecturers (name science directions) • Joint research • Other (provide information)
<i>Results, benefits of the collaboration</i>	
Interdisciplinary lab “Agrarian innovation and resources”.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Lab can be used for teaching Bioeconomy master students.	
Name of partnering university and country	University of Pisa (Italy)
Short description of collaboration	<ul style="list-style-type: none"> • Joint projects in the field of agro-economics
<i>Results, benefits of the collaboration</i>	
Integrated achievement of science and industry, preparing competitive staff for the industry.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science, providing academic mobility of students and teaching staff	
Name of partnering university and country	Leibniz Institute of Agricultural Development in Transition Economies (IAMO)
Short description of collaboration	<ul style="list-style-type: none"> • Joint Educational Program (Phd) • Joint interdisciplinary training program • Agricultural Economics
<i>Results, benefits of the collaboration</i>	
Integrated achievement of science and industry, preparing competitive staff for the industry.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science, providing academic mobility of students and teaching staff	
Name of partnering university and country	Dombrovo Gurchini Polish Higher Academy (Poland)
Short description of collaboration	<ul style="list-style-type: none"> • Joint Educational Program • Joint interdisciplinary training program
<i>Results, benefits of the collaboration</i>	
Preparing competitive staff for the industry	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science, providing academic mobility of students and teaching staff	

○ **Collaboration with public sector institutions**

Names of partners and their field/sector of activity	Ministry of Agriculture
Short description of collaboration	<ul style="list-style-type: none"> ○ Involves business sector in definition of degree paper topics, elaboration and defending theses (any level) ○ Provides lifelong education for specialists working in business sector ○ Conducts researches on demand or for benefit of the business sector entities ○ Provides practices in enterprises ○ Organises study visits of academic staff to enterprises ○ Other (provide information)

<i>Results, benefits of the collaboration</i>
TSAU long-term cooperation with the Ministry of Agriculture: <ul style="list-style-type: none"> • 37–40 % funding of the University comes from the Ministry of Agriculture • Demand for prepared professionals • Coordination of projects, e.g., scholarship, practical and scientific projects
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>

○ **Collaboration with industries**

Names of partners and their field/sector of activity	Galla-Alteg, a flour-making joint stock company, GDF (Gold Dried Fruits) and other enterprises
Short description of collaboration	<ul style="list-style-type: none"> ○ Involve public sector in definition of degree paper topics, elaboration and defending theses (any level) ○ Educate and train specialists on behalf of the sector represented by partner/s ○ Research on demand of the public sector ○ Other (provide information)
<i>Results, benefits of the collaboration</i>	
Integrated achievement of science and industry, preparing competitive staff for the industry.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science, providing academic mobility of students and teaching staff	

Overview on partners, networks and organisations the institution is actively collaborating or is being involved and which are associated to any field of the bioeconomy.

<p>We plan to cooperate with the following establishments:</p> <ul style="list-style-type: none"> • Bukhara Institute of Engineering and Technology • The Academician Makhmud Mirzaev Scientific-research institute of Horticulture, Viticulture and Wine-making • Institute of Genetics and Plant Experimental Biology • Kazakh National Agrarian university • Saratov State Agrarian University • Dombrovo Gurchini Polish Higher Academy • Leibniz Institute of Agricultural Development in Transition Economies <p>The above-mentioned institutions are the leaders on their fields. They have own prestige and tradition both at local and international level. Furthermore, they have gained many achievements on their fields. For example, Galla-Alteg enterprise has been equipped with German technologies. The works are organized at international level. The Kazakh National Agrarian University is placed among 1,000 best universities in the world ranking system and pays a high attention to education and scientific research.</p>
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2.1.8. Pedagogic approaches and study methods used

<i>Describe, what kind of study methods do students normally use during their studies?</i>
<ul style="list-style-type: none"> • Lectures are delivered in lecture halls. Practical works are carried out in labs. Some practical work is carried out in computer classes. • Students have to work independently 6–8 hours a week. Depending on subject, some course works must be completed by the end of the semester. • Interactive study methods such as case study, boomerang, problematic teaching, cluster, assessment technologies, role-play, etc. are applied.
<i>Describe, what kind of study materials are used?</i>
<ul style="list-style-type: none"> • Paperback books, e-book, e-library, Moodle, YouTube, presentation materials, study labs, information technologies, etc.
<i>Which national and international research databases are available for teachers, researchers and students</i>
<ul style="list-style-type: none"> • Academic Search (EBSCO), Web of Science, Scopus, Science Direct, ПИИЦ, Uzbekistan Research Online (uzjournals.edu.uz),
<i>Name and describe teaching methods used currently</i>
<ul style="list-style-type: none"> • Lectures (onsite/online), exercises, laboratory work, etc.
<i>What modern/new methodology would need to be introduced as a part of the teacher training?</i>
<ul style="list-style-type: none"> • Sensory assessment of the quality
<i>What expectations are related to online teaching/learning methodology and technologies?</i>
<ul style="list-style-type: none"> • Unlimited use of the resources of a comprehensive data base

2.1.9. SWOT analysis of the higher education institution

Strengths (internal factors)	Weaknesses (internal factors)
<ul style="list-style-type: none"> ▪ Strong financial support of the state ▪ High-quality research staff ▪ Strong network at national and international level ▪ Experience in participation in various projects, e.g. Erasmus+, other national and international projects ▪ Scientific staff comprises researchers involved in policy making in the sector at the national level 	<ul style="list-style-type: none"> ▪ Less autonomous university ▪ Not fully implemented ECTS system ▪ Smaller academic mobility ▪ Lack of knowledge and expertise in commercialization and intellectual property issues ▪ The greater part of the scientific staff overloaded with work unrelated to research, thus the research capacity is reduced
Opportunities (external factors)	Threats (external factors)
<ul style="list-style-type: none"> ▪ Starting to apply ECTS allows tuning on international level ▪ Considerable research capacity increase is observed due to the increase of PhD students and finalising PhD papers ▪ Improving the image of university (progressive, dynamic, innovative) ▪ Public and other donor programs for education, research, technology development and governance improvement 	<ul style="list-style-type: none"> ▪ Global catastrophe (pandemic, earthquake) changing the strategy of the development university, issues related to cuts in funding ▪ Uncertainty, inconsistency and unpredictability are observed in agricultural management

2.1.10. Conclusions and recommendations

The TSAU is getting a strong financial support of the state; compared to other profiles, the capacity of the agricultural research is higher than the one of other sectors. The TSAU has a strong network at national and international level. Since study year 2020-2021 it applies ECTS, which allows to decrease the volume of curriculum and to modernize it. The TSAU has many applied labs related to agricultural production, young teachers improving capacity to survive at the competition and reach the international level.

2.1.11. Quality assurance procedures and mechanisms for master level studies and curricula

Quality assurance provider (structural unit/s)	University has the following units: 1) internal control and monitoring unit (mostly focuses on the university assignments) 2) quality assurance unit (focuses on teaching and has more autonomy)
Quality assurance procedures and their application frequency	A survey is taken among students to understand the quality of the classes of the previous semester. Based on the survey results, teachers either continue their work or leave the job. If, according to the survey, students are not happy with a teacher, students can write anonymously in the survey. Commission will decide whether the teacher will continue work or not.
Quality assurance criteria	Periodically, a “guest teacher” comes to classes to analyse teaching materials, methodology and quality.

2.2. Analysis of Tashkent Institute of Irrigation and Agricultural Mechanization Engineers (TIAME)

2.2.1. Overview on study programmes and related measures to be associated to the bioeconomy (for the last 5 study years)

Field of science	NATURAL SCIENCES				
	Study years				
Type of data	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Total number of study programmes, inter alia	8	9	10	10	11
<i>Doctoral level</i>	2	2	2	2	2
<i>Master level</i>	4	4	5	5	6
<i>Bachelor level</i>	2	3	3	3	3
<i>Professional studies</i>	-	-	-	-	-
Total number of students in study programmes, inter alia	364	400	437	399	445
<i>Doctoral level</i>	2	3	4	4	7
<i>Master level</i>	29	24	16	20	20
<i>Bachelor level</i>	333	373	417	375	418
<i>Professional studies</i>	-	-	-	-	-
Number of academic staff members, inter alia	64	66	67	66	66
<i>Having doctoral degree</i>	12	16	16	18	19
<i>Having master's degree</i>	37	32	30	31	29
<i>Lecturers</i>	19	15	12	13	14
Number of academic staff holding title of a professor or an associated professor	14	15	16	18	19
Annual budget in EUR allocated to the bioeconomy related study programmes, inter alia:	516,064	558,005	646,764	885,049	1,061,347
<i>Budget for studies, in EUR</i>	344,043	372,004	431,176	626,980	636,808
<i>Budget for research, in EUR</i>	172,021	186,002	215,588	258,068	424,539
Number of scientific publications, published in internationally indexed scientific journals	12	20	25	51	83
Number of applied research and technological development initiatives with industries (e.g. contracts)	2	2	5	2	2
Number of offered lifelong education programmes related to the fields of the bioeconomy	1	1	1	2	1
Number of students/learners in the above mentioned lifelong education programmes	9	13	17	21	11
Number of students' international mobilities	2	2	5	14	3

Number of academic staff international mobilities	5	6	10	14	3
Number of international events (conferences, congresses) attended with a presentation or poster	10	11	12	18	19
<i>Domestic events (organised in the own country)</i>	0	0	1	2	2
<i>Regional events (organised in Central Asia)</i>	0	1	1	1	1
<i>Events organised in other countries of the world</i>	2	4	6	7	7

Field of science	ENGINEERING AND TECHNOLOGIES				
	Study years				
Type of data	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Total number of study programmes, inter alia	19	20	31	32	39
<i>Doctoral level</i>	4	6	8	9	13
<i>Master level</i>	6	5	11	11	14
<i>Bachelor level</i>	9	9	12	12	12
<i>Professional studies</i>	-	-	-	-	-
Total number of students in study programmes, inter alia	573	620	926	952	974
<i>Doctoral level</i>	8	11	16	23	31
<i>Master level</i>	9	31	38	50	45
<i>Bachelor level</i>	556	578	872	879	898
<i>Professional studies</i>	-	-	-	-	-
Number of academic staff members, inter alia	329	332	336	331	331
<i>Having doctoral degree</i>	70	74	81	91	94
<i>Having master's degree</i>	169	151	144	142	124
<i>Lecturers</i>	90	71	69	61	58
Number of academic staff holding title of a professor or an associated professor	70	74	81	91	94
Annual budget in EUR allocated to the bioeconomy related study programmes, inter alia:	2,580,322	2,790,027	3,233,821	4,425,243	5,306,733
<i>Budget for studies, in EUR</i>	1,720,215	1,860,018	2,155,881	3,134,901	3,184,040
<i>Budget for research, in EUR</i>	860,107	930,009	1,077,940	1,290,342	2,122,693
Number of scientific publications, published in internationally indexed scientific journals	61	101	123	254	413
Number of applied research and technological development initiatives with industries (e.g. contracts)	8	9	24	10	11

Number of offered lifelong education programmes related to the fields of the bioeconomy	6	6	6	8	4
Number of students/learners in the above mentioned lifelong education programmes	44	64	86	106	56
Number of students' international mobilities	8	8	24	68	14
Number of academic staff international mobilities	24	31	49	70	17
Number of international events (conferences, congresses) attended with a presentation or poster	49	53	59	90	94
<i>Domestic events (organised in the own country)</i>	1	2	4	8	9
<i>Regional events (organised in Central Asia)</i>	1	3	3	4	5
<i>Events organised in other countries of the world</i>	9	20	30	34	37

Field of science	AGRICULTURAL SCIENCES				
Type of data	Study years				
	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020
Total number of study programmes, inter alia	-	-	-	-	-

Field of science	SOCIAL SCIENCES				
Type of data	Study years				
	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Total number of study programmes, inter alia	10	11	11	12	8
<i>Doctoral level</i>	1	1	1	1	1
<i>Master level</i>	2	4	4	5	1
<i>Bachelor level</i>	7	6	6	6	6
<i>Professional studies</i>	-	-	-	-	-
Total number of students in study programmes, inter alia	314	252	248	154	257
<i>Doctoral level</i>	2	0	1	1	2
<i>Master level</i>	34	20	19	33	27
<i>Bachelor level</i>	278	232	228	120	228
<i>Professional studies</i>	-	-	-	-	-
Number of academic staff members, inter alia	67	66	67	66	66
<i>Having doctoral degree</i>	16	14	16	18	19
<i>Having master's degree</i>	30	28	28	26	21
<i>Lecturers</i>	17	13	16	12	9

Number of academic staff holding title of a professor or an associated professor	14	15	16	18	19
Annual budget in EUR allocated to the bioeconomy related study programmes, inter alia	516,064	558,005	646,764	885,049	1,061,347
<i>Budget for studies, in EUR</i>	344,043	372,004	431,176	626,980	636,808
<i>Budget for research, in EUR</i>	172,021	186,002	215,588	258,068	424,539
Number of scientific publications, published in internationally indexed scientific journals	12	20	25	51	83
Number of applied research and technological development initiatives with industries (e.g., contracts)	2	2	5	2	2
Number of offered lifelong education programmes related to the fields of the bioeconomy	1	1	1	2	1
Number of students/learners in the above-mentioned lifelong education programmes	9	13	17	21	11
Number of students' international mobilities	2	2	5	14	3
Number of academic staff international mobilities	5	6	10	14	3
Number of international events (conferences, congresses) attended with a presentation or poster	10	11	12	18	19
<i>Domestic events (organised in the own country)</i>	1	1	2	2	2
<i>Regional events (organised in Central Asia)</i>	0	1	1	1	1
<i>Events organised in other countries of the world</i>	1	5	5	7	7

2.2.2. Academic staff to be involved in the project: capacity building activities, the development and further implementation of the new curricula

- **Already pre-selected academic staff – teachers**

Name and surname	Title, degree,	Field of science	Thematic, subjects in academic work	Field/area in the new curricula
Sherzod Rakhmonov	PhD	Social sciences (agricultural economics)	Land use planning, agricultural economics	Development of bioeconomy sector
Anvar Anarbaev	PhD	Engineering and technology	Biogas production in farms, electro and	Bio-resources based engineering

			bioprocessing of soils, solar energy, energy efficiency in buildings, effective use of energy and materials in agriculture, cultivation of energy forests, using wood pellets in energy boilers	Bio based materials Bioenergy production and use
Bakhtiyor Karimov	Prof., PhD	Natural sciences	Aquatic ecology, agroecology, water quality, ecotoxicology, bio-diversity	Sustainable fisheries and aquaculture Sustainable food production and consumption
Rashid Khakimov	PhD	Social sciences	Agricultural economics	Bio-resources based manufacturing and processing Development of bioeconomy sector
Kasimdjon Rakhmonov	PhD	Social sciences	Agricultural economics	Bioproducts and bio-based value chains Sustainable food production and consumption
Bakhodir Sultonov	PhD	Social science	Agricultural economics	Development of bioeconomy sector Bioeconomy policy Bioproducts and bio-based value chains Analysis an statistics
Azamat Akhmedov	PhD	Social science	Agricultural economics	Bioproducts and bio-based value chains Principles of econometrics, microeconomics with calculus Bioeconomy policy
Akbarjon Khamraliev	MSc	Social sciences	Urban and regional planning, land use planning, agricultural economics	Development of bioeconomy sector

- **Other academic staff – teachers, potentially to be involved in the development and further implementation of the new curricula**

Name and surname	Title, degree	Field of science	Thematic, subjects in academic work	Field/area in the new curricula
Sharofatdin Narbaev	PhD	Social sciences	Agricultural economics	Sustainable food production and consumption Sustainable crop and livestock production and consumption
Rustam Oymatov	MSc	Social sciences	Geographic information systems, cartography	Sustainable crop and livestock production and consumption

Detailed information on the master and or doctoral level study programmes associated with the bioeconomy

Master level study programmes

Data, information required	Information
Title of the study programme	5A230102 - Agricultural Economics
Faculty/unit providing the study programme	Economics
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Accounting and audit Economics of farm management Scientific-research methodology Scientific research in agricultural economics Management in agricultural management

Data, information required	Information
Title of the study programme	5A410701 - Land Resource Management
Faculty/unit providing the study programme	Land Management
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Land management GIS and remote sensing in land use planning State cadastres Research in land cadastre Cartography

Data, information required	Information
Title of the study programme	5A310101-Energy Saving and Energy Audit (in water pump stations)
Faculty/unit providing the study programme	Electric Supply to Agriculture and Water Pump Stations
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Energy saving in power systems Power energy production, transportation and distribution Power grids and systems Scientific-research methodology Energy audit in water pump stations Accumulating of electric and heat energies Scientific research in power engineering

Data, information required	Information
Title of the study programme	5A312401 - Renewable Energy Sources (by the types)
Faculty/unit providing the study programme	Electric Supply to Agriculture and Water Pump Stations
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Renewable energy sources Scientific-research methodology Power energy production, transportation and distribution Power grids and systems Accumulating of electric and heat energies Scientific research in power engineering Demand for experiment works in electric grid

Data, information required	Information
Title of the study programme	5A310106 - Mini and Micro Hydroelectric Power Stations
Faculty/unit providing the study programme	Electric Supply to Agriculture and Water Pump Stations
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Power energy production, transportation and distribution Protection and automation of electric supply systems Renewable energy sources Scientific-research methodology Energy audit in water pump stations Accumulating of electric and heat energies Scientific research in power engineering

Data, information required	Information
Title of the study programme	5A310201 - Power Supply (for grid)
Faculty/unit providing the study programme	Electric Supply to Agriculture and Water Pump Stations
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Power energy production, transportation and distribution Scientific-research methodology Relay protection and automation of electric supply systems Renewable energy sources Power grids and systems Energy audit in water pump stations Scientific research in power engineering

Doctoral level study programmes

Data, information required	Information
Title of the study programme	Agricultural Economics
Faculty/unit providing the study programme	Economics
Credits in UZ /credits in ECTS	180
Duration (in years)	3
Degree or qualification to be obtained	PhD
Main subjects	Economics of agriculture Management in farming Economics in horticulture

Data, information required	Information
Title of the study programme	Electric Technologies and Electric Equipment in Agriculture
Faculty/unit providing the study programme	Electric Supply to Agriculture and Water Pump Stations
Credits in UZ /credits in ECTS	180
Duration (in years)	3
Degree or qualification to be obtained	PhD
Main subjects	Research of the electrical properties of food products and materials as objects of electrical technologies Study of electric and magnetic influences on the properties of products, materials and biological objects in crop and livestock production Justification and development of technical requirements for electrical and energy devices for crop production, animal husbandry, storage and processing of products Research and development of electrical and energy technologies in crop and livestock farming of agricultural enterprises, farms and subsidiary plots, including electrified household processes Development of methods of application, research of means of electrical technologies and modes of operation of electric lighting, irradiation, heating, air-conditioning units in plant growing and animal husbandry

Data, information required	Information
Title of the study programme	Land Management, Cadastre and Monitoring
Faculty/unit providing the study programme	Land Management
Credits in UZ /credits in ECTS	180
Duration (in years)	3
Degree or qualification to be obtained	PhD
Main subjects	Land management

	Land cadastre Land monitoring Land use planning Land allotment
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Data, information required	Information
Title of the study programme	Environmental Management
Faculty/unit providing the study programme	Water Resource Management
Credits in UZ /credits in ECTS	180
Duration (in years)	3
Degree or qualification to be obtained	PhD
Main subjects	Ecology Environmental management Regional ecological management

2.2.3. Existing study, innovation, and research infrastructures (acquired during the last 10 years and fully functional)

Description	Structural unit of HEI holding the infrastructure
Laboratories available for studies:	
<ul style="list-style-type: none"> • Interdisciplinary lab “Agrarian innovation and resources” • Ecological expertise • Geoinformatics • Physics • Automated remote control of water flow • Digital cluster for natural resource management • Agricultural mechanization (tractors, mechanisms, equipment) • Pump station labs • Water wave control lab 	Faculty of Economics, Faculty of Hydromelioration Faculty of Land Management Faculty of Hydromelioration, Faculty of Hydromelioration EcoGIS Centre Faculty of Agricultural Mechanization Faculty of Hydrotechnical Construction Faculty of Hydromelioration
Laboratories available for research:	
<ul style="list-style-type: none"> • Digital cluster for natural resource management • Automated remote control of water flow • Water wave control lab • Interdisciplinary lab “Agrarian innovation and resources” • Integrated water resource management • Physics lab 	EcoGIS Centre Energy Supply unit Faculty of Hydromelioration Faculty of Economics Faculty of Hydromelioration Faculty of Hydromelioration
Digital resources available:	
<ul style="list-style-type: none"> • Moodle is used as an online platform to upload and share educational materials • Telegram is used to receive practical exercise and assessment • Videoconference room is used to participate at online (Zoom) conferences and seminars 	Unit of Information Technologies



<ul style="list-style-type: none"> • All auditoriums have a projector or TV-set to connect to a PC or laptop • Computer classes are available at library or dormitories • Online library is available at https://library.tiame.uz/en 	
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2.2.4. Available knowledge sources

Description	Structural unit of HEI responsible for knowledge storage and maintenance
Scientific data bases used by academic staff and students (available in long-term for regular study process)	
<ul style="list-style-type: none"> • https://stat.uz/en/official-statistics/agriculture - all statistics are available in most major sectors and categories. Forestry, fisheries, agriculture, food production and consumption, energy 	Unit of Research
<ul style="list-style-type: none"> • https://opendata.gov.uz/en - open data provided from many ministries in Uzbekistan. Forestry, fisheries, agriculture, food production. 	Unit of Research
<ul style="list-style-type: none"> • Library at the TIAME - library.tiame.uz • Dissertation database - diss.natlib.uz 	Library of the TIAME
Literature related to bioeconomy (in English, acquired during last 10 years)	
<ul style="list-style-type: none"> • Novel measurement and assessment tools for monitoring and management of land and water resources in agricultural landscapes of Central Asia: Environmental Science/ ed. L. Mueller, ed. A. Saparov, ed. G. Lischeid. - Cham Heidelberg: Springer International Publishing, 2014. - 716 p. - ISSN 1431-6250 • Chepel, S.V. System analysis and modeling of the prospects for sustainable development of the national economy of Uzbekistan: manuscript. - Tashkent: IFMR, 2014. - 311 p. • Assessment of the economic feasibility of the rational use of agricultural land.: manuscript/ State Cadaster. – Moscow State University of Land Management, 2014. - 160 p. • The Bioeconomy Approach Constraints and Opportunities for Sustainable Development. Edited By Udaya Sekhar Nagothu • Debertin, Dr David L: Agricultural Production Economics. Second Edition 2012, Greate Spase • Stevi Woodward. Forest Pathology. Wiley-VGH GmbH. • Donnell Hunt. Farm Power and Machinery Management Tenth Edition. Waveland Press, Incorporated USA 2015 • Juan Carlos Contreras-Esquivel, Laxmikant S. Badwaik, Porteen Kannan, A. K. Haghi. Food Product Optimization for Quality and Safety Control. Published November 26, 2020 by Apple Academic Press 418 p. 21 Color & 49 B/W Illustrations. • Varlamov A.A. Economics and ecology of land use: Moscow State University of Land Management, 2015. - 204 p. • Land management support for the implementation of state programs and priority national projects for the development of the agro-industrial complex and other sectors of the economy: monography/ Moscow State University of Land Management. -, 2017. - 568 p. 	Library of the TIAME

2.2.5. Research activities and international research projects in the field (completed within 2016-2020 and ongoing)

No	Title of publication	Names of the main authors	Year of publishing	Title of a scientific journal, where published	Link to the publication (if available)
1.	The mechanism for the development of public-private partnerships in agriculture (on the example of the Republic of Uzbekistan)	Dustmurodov, G.G., Yunusov, I.O., Ahmedov, U.K., Murodov, S.M., Iskandarov, S.T.	2021	E3S Web of Conferences	https://www.e3s-conferences.org/articles/e3sconf/pdf/2020/84/e3sconf_TPACEE2020_04042.pdf
2.	Method for calculating and evaluating the total energy capacity of cotton fibre	Isakov, A., Tukhtamishev, B., Choriev, R.	2020	IOP Conference Series: Earth and Environmental Science 614(1),012006	https://iopscience.iop.org/article/10.1088/1755-1315/614/1/012006/pdf
3.	Study on ion generators for fruit and vegetable storehouses	Rakhmatov, A., Ibragimov, M., Ximmataliev, D.	2020	IOP Conference Series: Earth and Environmental Science 614(1),012033	https://iopscience.iop.org/article/10.1088/1755-1315/614/1/012033/pdf
4.	Electric pulse treatment of trees as an environmentally friendly mechanism for protection of orchards	Bozorov, E.	2020	IOP Conference Series: Earth and Environmental Science 614(1),012043	https://iopscience.iop.org/article/10.1088/1755-1315/614/1/012043/pdf
5.	Modelling of heat exchange processes in the Metanetka bioenergy plant for individual use	Sharipov, L.A., Imomov, S.J., Majitov, J.A., (...), Pulatova, F., Abdisamatov, O.S.	2020	IOP Conference Series: Earth and Environmental Science 614(1),012035	https://iopscience.iop.org/article/10.1088/1755-1315/614/1/012035/pdf
6.	Econometric methods for solving problems of analysis and forecasting dynamics of yield of agricultural crops	Rakhmanov, S., Turgunov, T.T., Kusharov, Z.K., Mengnorov, A.A.	2020	IOP Conference Series: Earth and Environmental Science 614(1),012165	https://iopscience.iop.org/article/10.1088/1755-1315/614/1/012165/pdf
7.	Economic efficiency in the use of solar energy: a case study of agriculture in Uzbekistan	Kodirov, D., Tursunov, O., Ahmedov, A., Khakimov, R., Rakhmataliev, M.	2020	IOP Conference Series: Earth and Environmental Science 614(1),012031	https://iopscience.iop.org/article/10.1088/1755-1315/614/1/012031/pdf
8.	Calculation the dynamic stability zone of the distribution grid with generating sources based on renewable energy	Anarbaev, A., Tursunov, O., Zakhidov, R., (...), Namozov, S., Sabirov, E.	2020	IOP Conference Series: Earth and Environmental Science 614(1),012004	https://iopscience.iop.org/article/10.1088/1755-1315/614/1/012004/pdf

9.	Laser biotechnology for nutritional health, sustainable environment and development	Dobrowolski, J.W., Tursunov, O., Pirimov, O., Nazarova, O.J.	2020	IOP Conference Series: Earth and Environmental Science 614(1),012108	https://iopscience.iop.org/article/10.1088/1755-1315/614/1/012108/pdf
10.	The use of renewable energy sources in integrated energy supply systems for agriculture	Kodirov, D., Muratov, K., Tursunov, O., Ugwu, E.I., Durmanov, A.	2020	IOP Conference Series: Earth and Environmental Science 614(1),012007	https://iopscience.iop.org/article/10.1088/1755-1315/614/1/012007/pdf
11.	Sustainability considerations in water-energy-food nexus research in irrigated agriculture	Hamidov, A., Helming, K.	2020	Sustainability (Switzerland) 12(15),6274	https://www.e3s-conferences.org/articles/e3sconf/pdf/2020/75/e3sconf_bft2020_02001.pdf
12.	Priority directions of labour market development in rural areas of Uzbekistan	Maksumhanova, A.M., Saidova, M.K., Shafkarov, B.X.	2020	IOP Conference Series: Earth and Environmental Science 421(2),022004	https://iopscience.iop.org/article/10.1088/1755-1315/421/2/022004/pdf
13.	Energy consumption and economic growth: Evidence from post-communist countries	Umurzakov, U., Mirzaev, B., Salahodjaev, R., Isaeva, A., Tosheva, S.	2020	International Journal of Energy Economics and Policy 10(6), pp. 59-65	https://iopscience.iop.org/article/10.1088/1748-9326/aa650b/pdf
14.	Pollution, energy and growth: evidence from post-communist countries	Sadikov, A., Kasimova, N., Isaeva, A., Khachaturov, A., Salahodjaev, R.	2020	International Journal of Energy Economics and Policy 10(6), pp. 656-661	https://iopscience.iop.org/article/10.1088/1748-9326/aa650b/pdf
15.	Engineering design calculation of a biogas unit recuperator	Imomov, Sh.Zh.	2007	Applied Solar Energy (English translation of Geliotekhnika) 43(3), pp. 196-197	https://www.researchgate.net/publication/225748657_Engineering_design_calculation_of_a_biogas_unit_recuperator

2.2.6. Innovation capacity, performance and achievements

Describe innovation activities carried by your HEI in the respective field! Nature of innovation. Its application possibilities (sectors of economy, geographic areas, etc.). Users (potential and current).

- Automated remote control of water flow – a mobile app can control remotely water flow using device/sensor installed in Karakalpakistan (1200 km away).
- Water level and content monitor – tens of sensors were installed in several parts of Karakalpakistan.
- A person from the TIAME can monitor the situation and analyse data online.
- Drip irrigation was installed in educational-practical polygon to water agriculture with optimal use of water.

Does your HEI support creation and development of start-ups? Which? In what way the support is provided?

- The TIAME has an innovative cluster where teachers/students can practice or test their start-ups.
- When teacher needs more time, the head of the department gives more flexibility to provide the time for start-up.

<ul style="list-style-type: none"> The TIIAME announces a call for the best ideas or start-ups with award in amount of 3,000–10,000 euro twice a year.
<i>Does your HEI develop new products, technologies and services and transfer them to the industry?</i>
<ul style="list-style-type: none"> Automated remote water flow control.

2.2.7. Internal and external collaboration in relation to bioeconomy

○ Collaboration within own university

Name of partnering unit	Unit of Research
Short description of collaboration	<ul style="list-style-type: none"> Joint research Sharing of study and research infrastructures
<i>Results, benefits of the collaboration</i>	
Unit of Research shares research outputs of various projects conducted within the TIIAME	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Some data or research outputs can be gained from it	
Name of partnering unit	Department of Economics
Short description of collaboration	<ul style="list-style-type: none"> Joint curricula
<i>Results, benefits of the collaboration</i>	
Department of Economics	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Cooperation with the Department of Economics might be helpful for development of a joint curricula.	
Name of partnering unit	Department of Electricity and Renewable Energy
Short description of collaboration	<ul style="list-style-type: none"> Joint curricula
<i>Results, benefits of the collaboration</i>	
Department of Electricity and Renewable Energy will join the team of the project BioEcUz	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Cooperation with the Department of Electricity and Renewable Energy might be helpful for development of a joint curricula.	

○ Collaboration with other Uzbekistan's universities and research institutions

Name of partnering university	Tashkent State Agrarian University
Short description of collaboration	<ul style="list-style-type: none"> Joint curricula Joint multidisciplinary study programme (name science directions covered) Joint research Exchange of academic staff Sharing of study and research infrastructures Other (provide information)
<i>Results, benefits of the collaboration</i>	
In the framework of Erasmus+ projects.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
We have mutual interest as both universities have bachelor and master programmes related to the agriculture.	

Name of partnering university	National University of Uzbekistan
Short description of collaboration	<ul style="list-style-type: none"> ○ Joint curricula ○ Joint multidisciplinary study programme (name science directions covered) ○ Joint research ○ Exchange of academic staff ○ Sharing of study and research infrastructures ○ Other (provide information)
Results, benefits of the collaboration	
In the framework of Erasmus+ and USAID projects.	
Vision on how this collaboration can be used for the new curricula development and provision	
We have mutual interest as both universities have bachelor and master programmes related to the engineering.	
Name of partnering university	Research Institute of Agricultural Economics (Uzbekistan)
Short description of collaboration	<ul style="list-style-type: none"> ○ Joint curricula ○ Joint multidisciplinary study programme (name science directions covered) ○ Joint research ○ Exchange of academic staff ○ Sharing of study and research infrastructures ○ Other (provide information)
Results, benefits of the collaboration	
In the framework of UNDP and USAID projects.	
Vision on how this collaboration can be used for the new curricula development and provision	
We have mutual interest as the interest of our research is related to agricultural economics.	

○ **Collaboration with foreign universities and other higher education establishments**

Name of partnering university and country	University of Giessen (Germany)
Short description of collaboration	<ul style="list-style-type: none"> ○ Joint research ○ Foreign university/ies provide guest lecturers (water resource management)
<i>Results, benefits of the collaboration</i>	
SDGnexus Network is a global community of universities, research centres and stakeholders promoting the UN's 2030 Sustainable Development Plans. One Pakistani PhD Sana Ilyas has been hired.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Pakistani PostDoc fellow, Sana Ilyas, as an international expert can be invited for collaborative research in water resource management. She will work at the TIAME till November 2023.	
Name of partnering university and country	Technische Universität Berlin (Germany)
Short description of collaboration	<ul style="list-style-type: none"> ○ Joint curricula ○ Joint multidisciplinary study programme (precision agriculture)
<i>Results, benefits of the collaboration</i>	
NICoPA: New and Innovative Courses for Precision Agriculture. A joint curricula on precision agriculture will be developed.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Joint curricula with an European partner can share experience to open a new master's program.	

Name of partnering university and country	Leibniz Institute of Agricultural Development in Transition Economies (IAMO) (Germany)
Short description of collaboration	<ul style="list-style-type: none"> ○ Foreign university/ies provide guest lecturers (name science directions) ○ Joint research
<i>Results, benefits of the collaboration</i>	
SUSADICA: Sustainable Agricultural Development in Central Asia. Nine PhD students study various aspects of agriculture economics and do research.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Nine PhDs can be invited to propose subjects to be included in the curricula. Their research outputs can be used for analysis of bioeconomy. SUSADICA project invites foreigners to deliver seminars at the TIAME.	

○ **Collaboration with public sector institutions**

Names of partners and their field/sector of activity	Ministry of Water Resources
Short description of collaboration	<ul style="list-style-type: none"> ○ Provides practices in enterprises ○ Organises study visits to enterprises
<i>Results, benefits of the collaboration</i>	
The demand for graduating students, integrating with study courses, field trips, financial support to some research and applied projects	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Experts can be invited to the water resource management programme	
Names of partners and their field/sector of activity	Ministry of Agriculture
Short description of collaboration	<ul style="list-style-type: none"> ○ Provides practices in enterprises ○ Organises study visits to enterprises
<i>Results, benefits of the collaboration</i>	
The TIAME long-term cooperation with the Ministry of Agriculture	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Experts can be invited to the agricultural management programme.	

○ **Collaboration with industries**

Names of partners and their field/sector of activity	Tashkent regional and district <i>khokimiyats</i> (local authorities), regional government agencies and representatives of the private sector
Short description of collaboration	<p>In the study of the problems related to the regional development, attracting foreign investment, using the potential of the regional production, soil research, environmental management, in particular, water and land use, and other issues of agricultural development and issues related to socio-economic development of the region in general, doctoral and master's theses and final qualification papers are drawn up. The public sector is involved in the definition of the theses' (of any level) subjects and their development and defence.</p> <p>Public sector demand research. In Tashkent region, there is a great demand for research on improving management at all levels of the economy and the rational management of natural resources (particularly land and water, wind and solar energy) and biomass, including waste.</p>

Results, benefits of the collaboration

As a result of cooperation, production management efficiency is improved and mechanisms for the rational management of natural, productive and waste resources are established.

Vision on how this collaboration can be used for the new curricula development and provision

The Institute cooperates with 22 countries: Russia, USA, Slovenia, Slovakia, Croatia, Czech Republic, Germany, Hungary, Austria, Spain, Italy, Latvia, Lithuania, Great Britain, France, Poland, Netherlands, Sweden, the People's Republic of China, Korea, Japan, Ukraine, Kazakhstan, Afghanistan, Kyrgyzstan, and Tajikistan. 85 bilateral treaties, agreements and memorandums have been signed with more than 90 universities, about 20 research centres, companies and organizations. Close relations have been established in the direction of science and technology. For example, the Korea International Cooperation Agency of the Republic of Korea, Slovakia, Czech Republic, Switzerland, Germany, Hungary and the USA, the Japan International Cooperation Centre (JICC) and the Japan International Cooperation Agency (JICA) in Japan, the German Corporation for International Cooperation (GAIC) and the German Agency for Technical Cooperation (GATC), Goethe Institute in Germany (GIG), the British Council in the UK, MASHAV Ministry of Foreign Affairs, Israel's Agency for International Development Cooperation, and others. Close cooperation with the UNESCO, the United Nations Organizations (UN), the International Water Management Institute (IWMI), the United Nations Development Program (UNDP), the International Water Management Institute (IWMI), the Volkswagen Foundation, the Central Asia Regional Economic Cooperation Institute (CARECI), and the Science For Livelihoods in Dry Area (SLDA) has been established as well.

2.2.8. Pedagogic approaches and study methods used

Describe, what kind of study methods do students normally use during their studies?

- Lectures are delivered in lecture halls. The practical tasks are carried out in labs. Some practical tasks are carried out in computer classes.
- Students have to work independently 6–8 hours a week. Depending on subject, some course works have to be completed by the end of the semester.

Describe, what kind of study materials are used?

- Paperback books, e-book, e-library, Moodle, YouTube

Which national and international research databases are available for teachers, researchers and students

- Scopus, PИHЦ, Uzbekistan Research Online (uzjournals.edu.uz), Google Scholar

Name and describe teaching methods used currently

- Due to the stable coronavirus situation, all classes are held on regular basis. All classes are delivered onsite. Computer classes are used to deliver computing-related classes (GIS, remote sensing, 3D modelling, etc.)

What modern/new methodology would need to be introduced as a part of the teacher training?

- Flipped Classrooms, Personalized Learning, Inquiry-based Learning, Game-based learning

What expectations are related to online teaching/learning methodology and technologies?

- Easy to access, accessible via mobile phone (many students prefer to use mobile phone for internet data)

2.2.9. SWOT analysis of the higher education institution

Strengths (internal factors)	Weaknesses (internal factors)
<ul style="list-style-type: none"> ▪ 40 % of the university budget obtains funding from the Ministry of Agriculture and the Ministry of Water Resources. 	<ul style="list-style-type: none"> ▪ Not implementing ECTS. ▪ Less academic mobility.

<ul style="list-style-type: none"> ▪ The rating at national level in attracting students to admission and international partners to collaborate in educational and research projects. ▪ The TIIAME is a focus on technology and engineering, which gives a closer integration with business sector. ▪ High-quality scientific staff. ▪ Working experience in Erasmus+ projects for more than 15 years. 	<ul style="list-style-type: none"> ▪ Formalism of internal system and processes and slow implementation of the changes needed for the improvement.
<p>Opportunities (external factors)</p>	<p>Threats (external factors)</p>
<ul style="list-style-type: none"> ▪ High ranking of the university in attracting local and international students for BSc, MSc, PhD programs. ▪ Increasing local and international networks ensuring academic mobility of staff and students. ▪ Opportunities to increase cooperation with the technology incubators, competence centres and research clusters. 	<ul style="list-style-type: none"> ▪ Insufficient preparation of potential students. ▪ Lack of a predictable medium- and long-term research system at the national level.

2.2.10. Conclusions and recommendations

The TIIAME has many priorities such as the support of various governmental organizations and ministries. The TIIAME researchers closely work with many research organizations in Uzbekistan and abroad. The TIIAME has many labs related to water and land resource management as well as electricity. The work at the TIIAME is organized centrally. The TIIAME has a high scientific potential: only in 2020, the TIAME researchers published 578 papers in Scopus journals and conferences. The TIIAME has an extensive experience in Erasmus+ projects for more than 15 years. Young teachers are eager to learn bioeconomy.

2.2.11. Quality assurance procedures and mechanisms for master level studies and curricula

Quality assurance provider (structural unit/-s)	Quality assurance unit
Quality assurance procedures and their application frequency	A survey is taken among students to understand the quality of the classes of the previous semester. Based on the survey results, teachers either continue their work or leave the job. If, according to the survey, students are not happy with a teacher, students can write anonymously in the survey. Commission will decide whether the teacher will continue work or not.
Quality assurance criteria	Periodically, a “guest teacher” comes to classes to analyse teaching materials, methodology and quality.

2.3. Analysis of the Bukhara State University (BukhsU)

2.3.7. Overview on study programmes and related measures to be associated to the bioeconomy (for the last 5 study years)

Field of science	NATURAL SCIENCES				
	Study years				
	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Total number of study programmes, inter alia	2	2	3	4	5
<i>Doctoral level</i>	-	-	-	1	1
<i>Master level</i>	1	1	1	1	2
<i>Bachelor level</i>	1	1	2	2	2
<i>Professional studies</i>	-	-	-	-	-
Total number of students in study programmes, inter alia	672	731	862	1561	2176
<i>Doctoral level</i>	3	2	5	8	15
<i>Master level</i>	11	14	12	14	28
<i>Bachelor level</i>	658	715	845	1539	2133
<i>Professional studies</i>	-	-	-	-	-
Number of academic staff members, inter alia	118	128	139	163	166
<i>Having doctoral degree</i>	21	24	26	30	33
<i>Having master's degree</i>	66	71	77	94	89
<i>Lecturers</i>	31	33	36	39	44
Number of academic staff holding title of a professor or an associated professor	24	27	28	33	37
Annual budget in EUR allocated to the bioeconomy related study programmes, inter alia:	x	x	x	x	x
<i>Budget for studies, in EUR</i>	116,846	127,105	149,883	271,424	370,882
<i>Budget for research, in EUR</i>	192,482	208,794	226,337	265,315	270,890
Number of scientific publications, published in internationally indexed scientific journals	31	33	41	52	57
Number of applied research and technological development initiatives with industries (e.g. contracts)	7	9	8	12	11
Number of offered lifelong education programmes related to the fields of the bioeconomy	-	1	3	3	6
Number of students/learners in the above mentioned lifelong education programmes	-	11	24	33	58
Number of students' international mobilities	2	3	2	10	2
Number of academic staff international mobilities	5	4	6	11	2

Number of international events (conferences, congresses) attended with a presentation or poster	21	19	22	31	24
<i>Domestic events (organised in the own country)</i>	11	9	13	15	18
<i>Regional events (organised in Central Asia)</i>	1	1	2	3	2
<i>Events organised in other countries of the world</i>	1	-	2	1	1

Field of science	ENGINEERING AND TECHNOLOGY				
	Study years				
Type of data	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Total number of study programmes, inter alia	6	8	11	12	14
<i>Doctoral level</i>	1	2	3	3	4
<i>Master level</i>	2	3	3	4	4
<i>Bachelor level</i>	3	3	5	5	6
<i>Professional studies</i>	-	-	-	-	-
Total number of students in study programmes, inter alia	1,005	1,084	1,285	2,342	3,257
<i>Doctoral level</i>	5	4	6	11	17
<i>Master level</i>	13	7	12	22	41
<i>Bachelor level</i>	987	1,073	1,267	2,309	3,199
<i>Professional studies</i>	-	-	-	-	-
Number of academic staff members, inter alias	206	223	263	305	299
<i>Having doctoral degree</i>	29	34	41	43	47
<i>Having master's degree</i>	99	105	116	141	134
<i>Lecturers</i>	78	84	106	121	118
Number of academic staff holding title of a professor or an associated professor	34	39	47	49	53
Annual budget in EUR allocated to the bioeconomy related study programmes, inter alia:	x	x	x	x	x
<i>Budget for studies, in EUR</i>	173,865	187,532	222,305	405,166	563,461
<i>Budget for research, in EUR</i>	336,027	363,758	428,953	497,455	527,632
Number of scientific publications, published in internationally indexed scientific journals	46	54	62	65	78
Number of applied research and technological development initiatives with industries (e.g. contracts)	13	17	18	24	22
Number of offered lifelong education programmes related to the fields of the bioeconomy	2	4	5	7	11

Number of students/learners in the above mentioned lifelong education programmes	22	46	56	68	103
Number of students' international mobilities	3	4	2	12	2
Number of academic staff international mobilities	6	5	7	13	3
Number of international events (conferences, congresses) attended with a presentation or poster	39	37	42	56	53
<i>Domestic events (organised in the own country)</i>	21	23	26	30	27
<i>Regional events (organised in Central Asia)</i>	2	2	4	7	3
<i>Events organised in other countries of the world</i>	1	1	3	2	2

Field of science	AGRICULTURAL SCIENCES				
	Study years				
	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Type of data					
Total number of study programmes, inter alia	10	11	12	14	17
<i>Doctoral level</i>	2	3	3	3	5
<i>Master level</i>	2	2	2	3	3
<i>Bachelor level</i>	6	6	7	8	9
<i>Professional studies</i>	-	-	-	-	-
Total number of students in study programmes, inter alia	1,653	1,793	2,121	3,865	5,361
<i>Doctoral level</i>	4	3	4	10	15
<i>Master level</i>	4	2	6	7	14
<i>Bachelor level</i>	1,645	1,788	2,111	3,848	5,332
<i>Professional studies</i>	-	-	-	-	-
Number of academic staff members, inter alia	131	144	155	188	190
<i>Having doctoral degree</i>	20	22	24	26	29
<i>Having master's degree</i>	59	64	69	85	83
<i>Lecturers</i>	52	58	62	77	78
Number of academic staff holding title of a professor or an associated professor	22	26	29	31	35
Annual budget in EUR allocated to the bioeconomy related study programmes, inter alia:	x	x	x	x	x
<i>Budget for studies, in EUR</i>	287,622	311,982	369,054	672,510	932,814
<i>Budget for research, in EUR</i>	212,351	233,424	251,255	404,748	507,990
Number of scientific publications, published in internationally indexed scientific journals	77	90	103	108	130

Number of applied research and technological development initiatives with industries (e.g. contracts)	27	32	37	39	46
Number of offered lifelong education programmes related to the fields of the bioeconomy	3	6	7	9	14
Number of students/learners in the above mentioned lifelong education programmes	32	72	76	82	125
Number of students' international mobilities	2	3	4	9	2
Number of academic staff international mobilities	6	4	8	10	2
Number of international events (conferences, congresses) attended with a presentation or poster	58	54	63	83	81
<i>Domestic events (organised in the own country)</i>	31	27	32	37	36
<i>Regional events (organised in Central Asia)</i>	3	3	5	6	6
<i>Events organised in other countries of the world</i>	2	2	3	3	3

Field of science	SOCIAL SCIENCES				
	Study years				
	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Type of data					
Total number of study programmes, inter alia	60	66	73	82	92
<i>Doctoral level</i>	11	11	13	17	21
<i>Master level</i>	16	16	18	21	23
<i>Bachelor level</i>	33	39	42	44	48
<i>Professional studies</i>	-	-	-	-	-
Total number of students in study programmes, inter alia	3,344	3,590	4,266	7,791	10,833
<i>Doctoral level</i>	10	9	10	26	36
<i>Master level</i>	43	6	33	68	132
<i>Bachelor level</i>	3,291	3,575	4,223	7,697	10,665
<i>Professional studies</i>	-	-	-	-	-
Number of academic staff members, inter alias	404	439	470	606	585
<i>Having doctoral degree</i>	74	79	90	101	109
<i>Having master's degree</i>	216	235	248	309	284
<i>Lecturers</i>	114	125	132	196	192
Number of academic staff holding title of a professor or an associated professor	77	85	96	105	114

Annual budget in EUR allocated to the bioeconomy related study programmes, inter alia:	x	x	x	x	x
<i>Budget for studies, in EUR</i>	581,856	624,660	742,284	1,355,634	1,884,942
<i>Budget for research, in EUR</i>	654,884	711,619	761,870	982,326	948,285
Number of scientific publications, published in internationally indexed scientific journals	81	88	94	121	117
Number of applied research and technological development initiatives with industries (e.g. contracts)	27	29	31	40	39
Number of offered lifelong education programmes related to the fields of the bioeconomy	7	7	8	10	10
Number of students/learners in the above mentioned lifelong education programmes	65	68	73	87	91
Number of students' international mobilities	5	8	8	32	5
Number of academic staff international mobilities	15	12	16	33	6
Number of international events (conferences, congresses) attended with a presentation or poster	116	108	126	166	162
<i>Domestic events (organised in the own country)</i>	62	54	64	74	72
<i>Regional events (organised in Central Asia)</i>	6	6	10	14	12
<i>Events organised in other countries of the world</i>	4	4	6	7	6

2.3.8. Academic staff to be involved in the project: capacity building activities, the development and further implementation of the new curricula

o Already pre-selected academic staff – teachers

Sustainable fisheries and aquaculture
Sustainable food production and consumption
Bio-resources based manufacturing and processing
Development of bioeconomy sector
Bioproducts and bio-based value chains
Sustainable food production and consumption
Development of bioeconomy sector
Bioeconomy policy
Bioproducts and bio-based value chains
Analysis and statistics
Bioproducts and bio-based value chains
Principles of econometrics, microeconomics with calculus
Bioeconomy policy, development of bioeconomy sector

Name and surname	Title, degree	Field of science	Thematic, subjects in academic work	Field/area in the new curricula
Makhmud Oripov	PhD	Economics (in agriculture)	Microeconomics, agricultural sector economics, national economics, etc.	Development of bioeconomy sector Bioeconomy policy
Abror Juraev	PhD	Economics (international)	World and international relations economics, enterprise economics.	Markets and international trade of bio-based products
Feruz Rakhmatulloeva	PhD	Economics (industry)	Enterprise economics, logistics, management.	Sustainable logistics
Hulkar Turopova	MSc	Economics (agriculture) Economics	Agricultural sector economics, agricultural enterprise management.	Sustainable forestry, sustainable food production and consumption
Dilshod Yavmuotov	PhD	Regional economics	Uzbekistan regional economics, environmental economics	Sustainable food production and consumption
Ziodilla Nurov	PhD	Economics	Statistics, econometrics	Bioeconomy data analysis and statistics
Olimjon Rakhimov	MSc	Agricultural economics	Agricultural economics, enterprise innovation activities	Bio-based RTD, innovations and business models, bioeconomy policy
Hafiza Artikova	PhD	Biology	Soil science	Bioproducts and bio-based value chains
Odil Sharipov	PhD	Biology	Soil science, soil biology	Bio-based RTD, innovations and business models, bioeconomy policy
Yoqib Holov	PhD	Biology	Ecology, bioenergy, biochemistry	Bioenergy production and use, Bio based materials
Shaxnoza Sharipova	MSc	Ichthyology and Hydrobiology	Hydrobiology, ichthyology, biotechnology	Sustainable fisheries

- **Other academic staff – teachers, potentially to be involved in the development and further implementation of the new curricula**

Name and surname	Title, degree	Field of science	Thematic, subjects in academic work	Field/area in the new curricula
Anvar Xodjaev	MSc	Marketing	Econometrics, statistics, management	Bioeconomy data analysis and statistics
Aziz Kudratov	MSc	Economics (water sector)	Regional economics, innovation economics	Bio-based RTD, innovations and business models, bioeconomy policy

Dilafruz Narzieva	MSc	Economics (international)	World and international relations economics, enterprise economics	Markets and international trade of bio-based products
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2.3.9. Detailed information on the master and or doctoral level study programmes associated with the bioeconomy

Master level study programmes

Data, information required	Information
Title of the study programme	5A230102 - Economics
Faculty/unit providing the study programme	Faculty of Economics and Tourism
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Research methodology Microeconomics Econometrics Industrial organizations Corporative strategy and organizational design

Data, information required	Information
Title of the study programme	5A140103 - Ichthyology and Hydrobiology
Faculty/unit providing the study programme	Faculty of Agronomy
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	General hydrobiology Ichthyological research methods Fish diseases Intensive aquaculture Fish biology Fish ecology Limnology

Data, information required	Information
Title of the study programme	5A141001 - Soil Science
Faculty/unit providing the study programme	Faculty of Agronomy
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Research methodology



	Modern problems and concepts of soil science Innovative technologies in soil science Soil reclamation
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Data, information required	Information
Title of the study programme	5A140204 – Renewable Energy Sources and Sustainable Environmental Physics
Faculty/unit providing the study programme	Faculty of Agronomy
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Renewable energy sources Scientific research methodology Power energy production, transportation and distribution Power grids and systems Accumulating of electric and heat energies Scientific research in power engineering

Doctoral level study programmes

Data, information required	Information
Title of the study programme	03.01.07 – Plant Physiology and Biochemistry
Faculty/unit providing the study programme	Agronomy
Credits in UZ /credits in ECTS	180
Duration (in years)	3
Degree or qualification to be obtained	PhD
Main subjects	

Data, information required	Information
Title of the study programme	08.00.04 – Agricultural Economics
Faculty/unit providing the study programme	Economics and Tourism
Credits in UZ /credits in ECTS	180
Duration (in years)	3
Degree or qualification to be obtained	PhD
Main subjects	Economics of agriculture Management in farming Economics in horticulture

Data, information required	Information
Title of the study programme	03.00.12 – Biotechnology



Faculty/unit providing the study programme	Agronomy
Credits in UZ /credits in ECTS	180
Duration (in years)	3
Degree or qualification to be obtained	PhD
Main subjects	03.00.12 – Biotechnology

2.3.10. Existing study, innovation, and research infrastructures (acquired during the last 10 years and fully functional)

Description	Structural unit of HEI holding the infrastructure
Laboratories available for studies:	
1. Soil science laboratories - Soil biology - Soil science	Faculty of Natural Sciences
2. Biology laboratories - Human and animal physiology (analysis of various physiological processes in humans and animals) - Biotechnology (biotechnological analysis of fish and algae reproduction and feed quality) - Ichthyology and hydrobiology (analysis of the role and importance of aquatic organisms in fish fry reproduction and care)	Faculty of Biotechnology
Laboratories available for research:	
1. Soil science laboratories - Soil biology - Soil science	Faculty of Natural Sciences
2. Biology laboratories - Human and animal physiology (analysis of various physiological processes in humans and animals) - Biotechnology (biotechnological analysis of fish and algae reproduction and feed quality) - Ichthyology and hydrobiology (analysis of the role and importance of aquatic organisms in fish fry reproduction and care)	
Digital resources available:	
The university uses Moodle, Zoom, Teams, and Google Meet systems. Moodle is the main system; others are used in various dual diploma programmes based on the request of a foreign partner. All faculties and departments have access to the Internet of the quality sufficient for distance learning.	All departments

2.3.11. Available knowledge sources

Description	Structural unit of HEI responsible for knowledge storage and maintenance
Scientific data bases used by academic staff and students (available in long-term for regular study process)	
<ul style="list-style-type: none"> https://stat.uz/en/official-statistics/agriculture - all statistics are available in most major sectors and categories. Forestry, fisheries, agriculture, food production and consumption, energy 	

<ul style="list-style-type: none"> • https://opendata.gov.uz/en - open data provided from many ministries in Uzbekistan. Forestry, fisheries, agriculture, food production. 	
<i>Literature directly related to bioeconomy (in English, acquired during last 10 years)</i>	
<ul style="list-style-type: none"> • Bryanskikh, S.P. Agricultural Economics / S.P. Bryanskikh. - M.: Agropromizdat, 2017 .-- 326 p. • Busel, I.P. Agricultural Economics: (There are no problems with literature in English, it can be found on the Internet and downloaded from the websites of partner universities.) Study guide / I.P. Busel, P.I. Malikhtarovich. - Minsk: Republican Institute of Professional Education, 2018 .-- 447 p. • Dobrynin, V.A. Actual problems of the economy of the agro-industrial complex. Uch. allowance / V.A. Dobrynin. - M.: Publishing house of the Moscow Agricultural Academy, 2015 .-- 280 p. • Ermalinskaya, N.V. Economics and organization of the infrastructure of the agro-industrial complex: a course of lectures / N. V. Ermalinskaya. - M: GSTU, 2018 .-- 163 p. • Zapolsky, M.I. Economy of the agro-industrial complex: manual / M.I. Zapolsky. - M: GSTU, 2018 .-- 175 p. • Kolesnev, V.I. Computer modeling for analysis and planning in the agro-industrial complex: monograph / V.I. Kolesnev, BSAA, 2018 .-- 292 p. • Kuznetsov, V.V. Agricultural Economics / V.V. Kuznetsov - Rostov-on-Don: Phoenix, 2018 .-- 352 p. • Alexandrov S.N. Cage fish farming / S.N. Alexandrov. M .: AST; Donetsk: Stalker, 2005.270 p. • Hoichi D. Guidelines for artificial reproduction of trout in small reservoirs / D. Hoichi, A. Voinarovich, T. Mot-Poulsen. Budapest, 2012.20 p. 	

2.3.12. Research activities and international research projects in the field (completed within 2016-2020 and ongoing)

No	Title of publication	Names of the main authors	Year of publishing	Title of a scientific journal, where published	Link to the publication (if available)
1.	Biotechnology of biological and chemical treatment of water from the factory of Bukhara oil refinery	Turaev Muhtor Murodovich	2020	NOVATEUR PUBLICATIONS JournalINX- A Multidisciplinary Peer Reviewed Journal	https://journalinx.com/ https://media.neliti.com/media/publications/335788-biotechnology-of-biological-and-chemical-dffd4ad7.pdf
2.	Distribution and taxonomy of high plant species in lake Karakir Bukhara Region	Buriev Sulaimon Burievich, Esanov Husniddin Kurbonovich	2020	American Journal of Plant Sciences	https://www.scirp.org/journal/ajps https://www.researchgate.net/publication/340889996_Distribution_and_Taxonomy_of_High_Plant_Species_in_Lake_Karakir_Bukhara_Region
3.	Addition to the flora of the Bukhara region (Uzbekistan)	Esanov Husniddin Kurbonovich	<u>2020</u>	Turczaninowia	http://turczaninowia.asu.ru https://www.researchgate.net/publication/340964872_Dopolnenie_k_flore_Buharskoj_oblasti_Uzbekistan_Addition_to_the_flora_of_Bukhara_region_Uzbekistan



4.	Current state of coenopopulations of some rare species of the genus calligonum l. (polygonaceae) in the Bukhara region, Uzbekistan	Esanov Husniddin Kurbonovich	2020	Asia Life Sciences	https://www.elibrary.ru/item.asp?id=43254613
5.	About the globalization of ecological problems	Halimova Shahina	2020	Austrian Journal of Technical and Natural Sciences	http://ppublishing.org/journals/62/issue/58612/articles/4843/
6.	Biology of commercial predatory fish, lower reaches of the Zarafshan river basin	Alimova Luisa Halilovna	2020	EPRA International Journal of Research and Development (IJRD)	https://www.eprajournals.com/jpanel/upload/146am_47.EPRA%20JOURNALS%204709.pdf
7.	Promotion of the use and planting of medicinal plants among the public	Hodzhaniazova Barno	2020	International Journal of Fauna and Biological Studies	http://www.faunajournal.com https://www.faunajournal.com/archives/?year=2020&vol=7&issue=3&part=B&articleId=701
8.	Main sources of increasing the productivity of alluvial soils of medium salt grazine of Bukhara region	Togaeva Muhaiyo	2020	NOVATEUR PUBLICATIONS JournalINX- A Multidisciplinary Peer Reviewed Journa	http://journalnx.com/journal-article/20151048
9.	Analysis of summer nutrient content in the south – West Kyzylkum region of acridotheres tristis	Raiimov Avaz Rustamovich	2020	Solid State Technology	http://www.solidstatetechnology.us http://solidstatetechnology.us/index.php/SST/article/view/5946
10.	Biological treatment of wastewater from production enterprises	Yldoshov Laziz Tolibovich	2020	International Journal of Biology	http://www.ccsenet.org/journal/index.php/ijb/article/view/0/42675 doi: 10.5539/ijb.v12n3p14
11.	Effect of siderites on soil agrochemical properties	Egambedriev Sh.K., Bobobekov I.N., Nafetdinov Sh.Sh., Sattorova M.M.	2020	International Journal of Advanced Science and Technology.	http://sersc.org/journals/index.php/IJAST/article/view/25479
12.	The formation of water collector-resources drainage network of Zarafshan oasis and the questions of recycling	HayitovYozil Kosimovich, Nazarova Firuza Ahmedjanovna	2020	TEST Engineering & Management	https://www.usajournalshub.com/index.php/tajas/article/view/986
13.	Assessment of local water resource in Kuljuktov mountain system	Gulshan Halimova Subxonovna, Anvar Nematov Narzullayevich	2020	TEST Engineering & Management	https://scholar.google.com/citations?hl=ru&view_op=list_works&gmla=AJsN-f7HqvR2pzh5WKcFQzAOLbq8YjgVWobw4L-NtPIT6jx9FhSqPIVxvFGRP861-N14YfhlIibrCeR9c2bCVVW8o_MjgHh53yY8Pj4oQA5j-jh8_3rK0v84T9HgTC4Tj-vVa78BhdRYBaSxr1VYp7tgRtNMOW6Q&user=LXGx8dEAAAAJ
14.	Evolution of landscape teaching and its theoretical fundamentals	Toshov Khudoynazar Ramazonovich	2020	Academia	https://www.indianjournals.com/ijor.aspx?target=ijor:aca&volume=10&issue=5&article=131



15.	Natural geographical description, land and water fund of Bukhara region, its usage problems	Toshov Khudoynazar Ramazonovich	2020	International Journal of Advanced Science and Technology	http://sersc.org/journals/index.php/IJAST/article/view/18551
16.	Effects of microelements on drought resistance of cotton plant	Kholliyev Askar Ergashovich, Norboyeva Umida Toshtemirovna, Adizova Hamida Raximovna, Fayzieva Flora Abdullayevna	2020	International Journal of Psychosocial Rehabilitation,	https://www.psychosocial.com/article/PR200379/9958/.

2.3.13. Innovation capacity, performance and achievements

Describe innovation activities carried by your HEI in the respective field! Nature of innovation. Its application possibilities (sectors of economy, geographic areas, etc.). Users (potential and current).

Individual scientific, innovative and applied projects in the Bukhara State University (BukhsU):

- Development of optimal models for growing competitive products in farms based on cooperative and integration relations.
- Improvement of the economic efficiency of livestock production by developing a livestock forage base (as in the case of Bukhara region)
- Development of strategic areas for sustainable tourism development in Uzbekistan at the national level through the formation of competitive tourist zones and clusters.

Does your HEI support creation and development of start-ups? Which? In what way the support is provided?

- Development and expansion of start-ups supported by the BukhsU and financed by the Ministry of Innovation Development of the Republic of Uzbekistan for 2021-2022 (proposal):
 - 1) Project for the production of granular animal feed in Bukhara region.
 - 2) Production of oxidised starch utilising resource-saving technology.
 - 3) Creation of an international zone free of e-commerce.
 - 4) Creation of a security system with invisible laser beams.
 - 5) Biological treatment of wastewater.
 - 6) Chemical treatment of wastewater from textile plants.

Does your HEI develop new products, technologies and services and transfer them to the industry?

- Animal feed in the form of pellets for cattle.
- Combined dryer that utilises renewable energy.
- Production of green animal feed.
- Polymer composition.
- Industrial starch.

2.3.14. Internal and external collaboration in relation to bioeconomy

o Collaboration within own university

Name of partnering unit	Inter-faculty and inter-department cooperation on curriculum programme and research work implementation
Short description of collaboration	Faculties and departments jointly develop and implement curriculum programmes and conduct research and innovation activities. For example, along with teachers from the primary Faculty of Economics and Tourism, teachers from the faculties of History, Philology, Physical Education and Sports, Mathematics, etc. also participate in the education of the Bachelor of Economics and implementation of the curriculum programme.
<i>Results, benefits of the collaboration</i>	
The main benefit of cooperation between the faculties and departments of the university is to improve the level of training and conducting of the research and innovation work at the university.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	

o Collaboration with other Uzbekistan's universities and research institutions

Name of partnering university	<ul style="list-style-type: none"> • National University of Uzbekistan • Tashkent State University of Economics • Tashkent Institute of Finance • Tashkent State Agrarian University • Bukhara Branch of the Tashkent Institute of Irrigation and Agricultural Mechanization Engineers
Short description of collaboration	<ul style="list-style-type: none"> • Joint training programmes • Joint interdisciplinary training programme (indicate the research areas covered) • Joint research • Exchange of academic staff • Joint utilisation of learning and research infrastructure
<i>Results, benefits of the collaboration</i>	
Joint curricula modernisation, increasing network, joint educational and research projects and outreach events	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
To minimize the lack of data and content of models, to implement and disseminate the project results	

o Collaboration with foreign universities and other higher education establishments

Name of partnering university and country	Vatel Hotel and Tourism Business School
Short description of collaboration	<ul style="list-style-type: none"> • Joint training programmes. Currently, "Joint Curriculum Programmes -3+1" are available at the BukhSU. Students in this programme learn at the BukhSU for 3 years and for 1 year – in partner universities; and, after successful completion of the university programme, they receive a BukhSU diploma from this major programme and diplomas from foreign partner universities.

	<p>Below are the names of the major programmes and the type of Joint Curriculum Programmes -3+1 from foreign partners:</p> <ul style="list-style-type: none"> • International hotel management (Bachelor - 4 years): student admission was started in academic year 2019/2020, the Vatel Hotel and Tourism Business School.
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Results, benefits of the collaboration

The result of joint training of specialists is the sharing of teaching experience and skills, as well as the application of advanced student teaching technology. *Students are expected to graduate in academic year 2022/2023.*

Vision on how this collaboration can be used for the new curricula development and provision

One of the acceptable ways to develop a new curricula is to study the curriculum of the world's leading universities and adopt their curricula in an adapted manner. For example, the experience of Baltic universities in the field of bioeconomy, in particular, the experience of Finnish universities.

Name of partnering university and country	Holon Institute of Technology
Short description of collaboration	<ul style="list-style-type: none"> • Joint training programmes. Currently, “Joint Curriculum Programmes -3+1” are available at the BukhSU. Students in this programme learn at the BukhSU for 3 years and for 1 year – in partner universities; and, after successful completion of the university programme, they receive a BukhSU diploma from this major programme and diplomas from foreign partner universities. Below are the names of the major programmes and the type of Joint Curriculum Programmes -3+1 from foreign partners: • Computer Science and Information Technology (Bachelor - 4 years) and Applied Mathematics and Computer Science (Bachelor - 4 years): student admission was started in academic year 2019/2020, the Holon Institute of Technology.

Results, benefits of the collaboration

The result of joint training of specialists is the sharing of teaching experience and skills, as well as the application of advanced student teaching technology. *Students are expected to graduate in academic year 2022/2023.*

Vision on how this collaboration can be used for the new curricula development and provision

One of the acceptable ways to develop a new curriculum is to study the curriculum of the world's leading universities and adopt their curricula in an adapted manner. For example, the experience of Baltic universities in the field of bioeconomy, in particular the experience of Finnish universities.

Name of partnering university and country	Kazan Federal University of the Russian Federation
Short description of collaboration	<ul style="list-style-type: none"> • Joint training programmes. Currently, “Joint Curriculum Programmes -3+1” are available at the BukhSU. Students in this programme learn at the BukhSU for 3 years and for 1 year – in partner universities; and, after successful completion of the university programme, they receive a BukhSU diploma from this major programme and diplomas from foreign partner universities. Below are the names of the major programmes and the type of Joint Curriculum Programmes -3+1 from foreign partners: • Economics by Industries and Sectors (Bachelor - 4 years): student admission was started in academic year 2019/2020, the Kazan Federal University of the Russian Federation.

<i>Results, benefits of the collaboration</i>
<i>Students are expected to graduate in academic year 2022/2023.</i> The result of joint training of specialists is the sharing of teaching experience and skills, as well as the application of advanced student teaching technology.
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>
One of the acceptable ways to develop a new curricula is to study the curriculum of the world's leading universities and adopt their curricula in an adapted manner. For example, the experience of Baltic universities in the field of bioeconomy, in particular, the experience of Finnish universities

Name of partnering university and country	Moscow State University (MSU)
Short description of collaboration	<ul style="list-style-type: none"> ○ Joint Curriculum Programme 1+1: Psychology (MA course - 2 years); student admission was started in academic year 2019/2020. Joint use of learning and research infrastructure, etc.

<i>Results, benefits of the collaboration</i>
<i>Students are expected to graduate in academic year 2020/2021.</i> The result of joint training of specialists is the sharing of teaching experience and skills, as well as the application of advanced student teaching technology.
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>
One of the acceptable ways to develop a new curricula is to study the curriculum of the world's leading universities and adopt their curricula in an adapted manner. For example, the experience of Baltic universities in the field of bioeconomy, in particular the experience of Finnish universities.

○ **Collaboration with public sector institutions**

Names of partners and their field/sector of activity	<p>In Uzbekistan, all higher education institutions cooperate with governmental and non-governmental entities regarding the compliance of the training programme and research subjects.</p> <p>For example, the BukhSU cooperates with Bukhara regional and district <i>khokimiyats</i> (local authorities), regional government agencies and representatives of the private sector.</p>
Short description of collaboration	<ul style="list-style-type: none"> • In the study of the problems related to the regional development, attracting foreign investment, using the potential of the regional production, soil research, environmental management, in particular, water and land use, and other issues of agricultural development and issues related to socio-economic development of the region in general, doctoral and master's theses and final qualification papers are drawn up. The public sector is involved in the definition of the theses' (of any level) subjects and their development and defence • Teaching and training of specialists needed for the industry represented by partners. The university trains specialists in economics (Russian Federation) and tourism (France). • Public sector demand research. In Bukhara region, there is a great demand for research on improving management at all levels of the economy and the rational management of natural resources (particularly land and water, wind and solar energy) and biomass, including waste.
<i>Results, benefits of the collaboration</i>	
Benefit: As a result of cooperation, production management efficiency is improved and mechanisms for the rational management of natural, productive and waste resources are established.	

Vision on how this collaboration can be used for the new curricula development and provision

The training of masters in bioeconomy in Bukhara region contributes to the development of the bioeconomy field in the region and provides more efficient use of biological resources in the region, as well as improves management in the field of bioeconomy.

o **Collaboration with industries**

Names of partners and their field/sector of activity	The system of enterprises and organisations operating in the field of bioeconomy, in particular agriculture, forestry, fisheries, food and processing industry, electric power supply industry, etc.
Short description of collaboration	<ul style="list-style-type: none"> • The business sector is involved in the definition of the theses' (of any level) subjects and their development and defence • Providing continuing education to professionals involved in the business. • Demand research for or in favour of business sector subjects • Practical classes are held at farms and factories • Introductory visits to the production facilities are arranged
<i>Results, benefits of the collaboration</i>	
High-quality staff training is provided and future employees are trained in accordance with employers' demand.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Such collaboration ensures improvements to curriculum programmes based on the demands of employers and the business sector because the considering the staff consumers' demand is important in the development of curriculum programmes of any level.	

The BSU has entered into more than 100 international cooperation agreements with foreign partners. The number of international students has reached 324. The Bukhara State University ranks among the top universities in Uzbekistan and Central Asia with developed international partners network. The university is a constant member of international educational projects such as Erasmus+, UNICEN and others, it has established close ties with numerous international organizations, e.g. JICA, KOICA, the British Council, etc. Special attention is given to double degree programs.

Starting from academic year 2019/2020, seven double degree programs were opened in cooperation with leading universities such as the Moscow State University, the Kazan Federal University, the Holon Institute of Technologies, the Gunadarma University and the Vatel Hotel and Tourism Business School. In 2021, four bachelor and four master double degree programs are operating in cooperation with high-ranked foreign universities.

Our prestigious international partners: the Wakayama University (Japan), the University of Pisa, the University of Padua and the University of Aquila (Italy), the Valencia Polytechnic University, the University of Alicante, the Cantabria University (Spain), the Free University of Brussels (Belgium), the Anhalt Institute, the Potsdam University, the Munster-Westfallen University (Germany), the Moscow M. V. Lomonosov State University, the Kazan Federal University (Russia), the Karabük University, the Bandirma University, the Istanbul University (Turkey), the Gunadarma University (Indonesia), and the Vatel Hotel and Tourism Business School, etc.

One of the main aspects of international cooperation of the BukhSU is the participation in various international programmes and projects. Below there are the names of individual projects participated by the BukhSU

The names of individual projects participated by the BukhSU			
Programme or initiative	Reference number	Beneficiary organisation	Title of the project
TEMPUS	511172	Gottingen University, DE	CIBELES: Curriculum Invoking Bologna-aligned Education Leading to Reform in Environmental Studies
TEMPUS	530666	Kaunas University of Technology, LT	UZWATER : Master Program in Environmental Science and Sustainable Development with Focus on Water Management for Uzbekistan Higher Education
TEMPUS	543746	Universitat Autònoma de Barcelona, ES	INOCAS: InnoLabs in Central Asia for a Sustainable Catalysation of Innovation in the Knowledge Triangle
ERASMUS+	561539	Universidad Las Palmas de Gran Canaria, ES	MIND – Management-Innovation-Development
ERASMUS+	561624	Rēzekne Technological Academy, LV	Internationalisation and Modernisation of Education and Processes in the Higher Education of Uzbekistan

2.3.15. Pedagogic approaches and study methods used

<i>Describe, what kind of study methods do students normally use during their studies?</i>
<ul style="list-style-type: none"> Lectures are given in classrooms. Project works are carried out in laboratories. Some practical studies are carried out in computer classes. Students must work independently 6–8 hours a week. Depending on the subject, some term papers must be completed by the end of the semester. Interactive studying methods such as case study, boomerang, problem-based learning, cluster, evaluation technology, role-playing games, etc.
<i>Describe, what kind of study materials are used?</i>
<ul style="list-style-type: none"> E-book, e-library, Moodle, YouTube, illustrative materials, training labs, information technology, etc.
<i>Which national and international research databases are available for teachers, researchers and students</i>
<ul style="list-style-type: none"> The BukhSU has access to some international scientific data bases such as ProQuest, Elsevier, ScholarVox. In addition, students of economics use mostly graphic and statistical data sources such as ChartsBin, E-report, as well as databases of the World Bank, IMF and others. There is a need to provide licenses to WoS.
<i>Name and describe teaching methods used currently</i>
<ul style="list-style-type: none"> Flipped classroom Project-based learning Collaborative learning Gamification Problem-based learning Design thinking Thinking-based learning
<i>What modern/new methodology would need to be introduced as a part of the teacher training?</i>
<ul style="list-style-type: none"> We will study teaching methods in our partner universities and adopt them in the course of teaching at our university.
<i>What expectations are related to online teaching/learning methodology and technologies?</i>
<ul style="list-style-type: none"> MOODLE platform, MOOC lectures

2.3.16. SWOT analysis of the higher education institution

Strengths (internal factors)	Weaknesses (internal factors)
<ul style="list-style-type: none"> ▪ Great growth potential as a university. At the moment, the number of students has reached 22,000. ▪ Accumulated scientific experience in the field of agriculture economics. ▪ Support from management. ▪ Special attention and support of the state on food safety matters. ▪ A financially stable university. ▪ Experience in international projects. ▪ Experience in creating new educational programmes. 	<ul style="list-style-type: none"> ▪ English proficiency of some of the working group members is not sufficient.
Opportunities (external factors)	Threats (external factors)
<ul style="list-style-type: none"> ▪ The University has developed and submitted the Agropolis (agricultural town) project to higher authorities, which should become a base for research and training processes on the sustainable development of the agricultural economy. At the moment, the project is being considered by the regional government. ▪ Granting academic and financial independence to the university is expected. ▪ Grants from various foundations, including the El-Yurt Umidi Foundation. 	<ul style="list-style-type: none"> ▪ The threat of quarantine extension for an indefinite period of time.

2.3.17. Conclusions and recommendations

The bioeconomy is a new field of science and national economy and at the starting point of its development; therefore, in the elaboration and implementation of the master's programme in bioeconomy, the entire accumulated experience of the project participants in developing joint training and research programmes with foreign and national higher education and other institutions should be used. When training personnel, it is also necessary to strengthen the relationship between employers and universities, as in staff training in bioeconomy it is necessary to consider the employers' requirements to the future specialists. In preparation of training and educational materials, advanced and effective methods and skills from both foreign and national universities should be adopted. In addition, it is also important for teachers to pay attention to improving their English proficiency.

2.3.18. Quality assurance procedures and mechanisms for master level studies and curricula

Quality assurance provider (structural unit/-s)	Teaching quality assurance.
Quality assurance procedures and their application frequency	The quality of training and curriculum implementation is monitored via teaching quality assurance inspection.
Quality assurance criteria	<ol style="list-style-type: none"> 1. Teaching quality 2. Availability of educational materials and teaching laboratories to students 3. Student achievement level 4. Student attendance level 5. Innovation development and implementation 6. Publication of scientific developments, etc.

2.4. Analysis of Samarkand branch of the Tashkent State Agrarian University (SAMTSAU)

2.4.1. Overview on activities, study programmes and measures to be associated to the bioeconomy

Samarkand branch of the Tashkent State Agrarian University offers 18 BSc, 14 master and four PhD programmes focusing on agricultural sciences (fruit and vegetables growing, crop protection, soil sciences, agricultural economics, food and resources economics, foodstuff management, ag. commodities processing, bookkeeping and auditing in agriculture, digital farming, agribusiness and investment, etc.) at bachelor studies, similar and advance courses in master, also PhD courses in fruit sciences, horticulture and agricultural economics. Also, starting from academic year 2021-2022, it is planned to launch three new master courses: 'organic agriculture', 'sustainable rural development', 'herbal plants' which relate to the bioeconomy.

The CARIS (Samarkand Centre for Agricultural Reform and Innovative Studies) focuses on innovative studies at master level (agriculture and related sciences), in PhD course in agricultural economics, scientific research in agriculture and related sciences, training courses for agricultural administrative staff, etc. Also, according to the strategy, in two years later the branch should become an university of applied sciences and technologies.

2.4.2. Academic staff to be involved in the project: capacity building activities, the development and further implementation of the new curricula.

- Already pre-selected academic staff – teachers

Name and surname	Title, degree	Field of science	Thematic, subjects in academic work	Field/area in the new curricula
Shavkat Hasanov	PhD	Agricultural economics, natural resource economics, sustainable rural development	Peasant economics, micro and macroeconomics, environmental and natural resources economics	Scientific writing and reporting, bioeconomy research design and methods
Khusniddin Khonkulov	PhD	Plant science	Horticulture, vegetable and plant growing	Sustainable crop and livestock production and consumption
Bobur Eshonkulov	PhD	Plant science	Plant science, plant breeding and seed growing, organic agriculture	Bioproducts and bio-based value chains, sustainable crop and livestock production and consumption
Sherzod Babakholov	MSc	Agricultural & resource economics	Climate change, rural development and efficiency analysis	Bioeconomy research design and methods, empirical research methods in bioeconomy, principles of econometrics, microeconomics with calculus

Abdusame Tadjiev	PhD	Agricultural economics, sustainable development of areas	Technology adoption for sustainable agriculture, agricultural economics	Bio-based RTD, innovations and business models, bioeconomy policy
Nodirjon Nurmatov	PhD	Organic agriculture, renewable energies, experience in supply chain management	Renewable energies, recycling of urban and agricultural residuals, long experience in sales of organic cereals in Germany	Bioenergy production and use, sustainable food production and consumption
Yigitali Tashpulatov	PhD	Biology, ecology, medicinal plants	Biology, ecology, medicinal plants	Sustainable forestry, sustainable food production and consumption
Bekzod Tashtemirov	PhD	Operation and repair of agricultural machinery	Agricultural machinery and environmental science	Bioenergy production and use, bio-based materials
Fotima Saydullaeva	MSc	Agricultural economics	Agriculture and food policy, agricultural economics, sustainable development, food security	Bioeconomy policy
Khusniddin Pardaev	MSc	Agricultural economics	Agricultural economics; agrarian policy and food security, risk management	Bioeconomy policy, markets and international trade of bio-based products
Sodikjon Mamasoliev	MSc	International rural development	Agricultural economics, theory of economics	Sustainable logistics, bioproducts and bio-based value chains
Shukrullo Muratov	MSc	International environmental and agricultural science, agricultural economy	Rural development and population well-being	Bioeconomy data analysis and statistics

- **Other academic staff – teachers, potentially to be involved in the development and further implementation of the new curricula**

Name and surname	Title, degree	Field of science	Thematic, subjects in academic work	Field/area in the new curricula
Alisher Botirov	PhD	Pomology	Apple growing and storage	Sustainable forestry
Shakista Ishniyazova	PhD	Processing and storage of	Vine and vegetable processing	Bio based materials

		agricultural products		
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2.4.3. Detailed information on the master and or doctoral level study programmes associated with the bioeconomy

Master level study programmes

Data, information required	Information
Title of the study programme	Agribusiness and Investment
Faculty/unit providing the study programme	Agribusiness and Logistics
Credits in UZ /credits in ECTS	120/120
Duration (in years)	2 years
Degree or qualification to be obtained	MSc
Main subjects	Research methodology Research methods in agribusiness Agricultural economics Storage and processing of agricultural products, etc.

Data, information required	Information
Title of the study programme	Agricultural Economics
Faculty/unit providing the study programme	Agribusiness and Logistics
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Agricultural economics Farm management Scientific-research methodology Scientific researches in agricultural economics Agricultural production

Data, information required	Information
Title of the study programme	Organic Agriculture
Faculty/unit providing the study programme	Agrobiology
Credits in UZ /credits in ECTS	120
Duration (in years)	2
Degree or qualification to be obtained	MSc
Main subjects	Scientific-research methodology Agricultural production Sustainable agriculture

2.4.4. Existing study, innovation, and research infrastructures (acquired during the last 10 years and fully functional)

Description	Structural unit of HEI holding the infrastructure
Laboratories available for studies:	
<ul style="list-style-type: none"> Laboratory of microbiological analyses of food production Biological laboratory 	Faculty of Agrolgy and Business Agribusiness and Investment Activities
Laboratories available for research:	
<ul style="list-style-type: none"> There is a digital microscope analyse, spectrophotometric analyse. 	Faculty of Agrobiology
Digital resources available:	
<ul style="list-style-type: none"> Moodle is used as an online platform to upload and share educational materials Telegram is used to receive practical exercises and assessment Videoconference room is used to participate at online (Zoom) conferences and seminars All auditoriums have a projector or TV-set to connect to a PC or laptop Computer classes are available at library or dormitories Online library is available at https://samagini.uz/ All faculties and departments have access to the Internet, the quality of which allows for distance learning 	Agribusiness and Investment Agrobiology

2.4.5. Available knowledge sources

Description	Structural unit of HEI responsible for knowledge storage and maintenance
<i>Scientific data bases used by academic staff and students (available in long-term for regular study process)</i>	
<ul style="list-style-type: none"> https://stat.uz/en/official-statistics/agriculture - all statistics are available in most major sectors and categories. Forestry, fisheries, agriculture, food production and consumption, energy https://opendata.gov.uz/en - open data provided from many ministries in Uzbekistan. Forestry, fisheries, agriculture, food production. www.agriculture.uz - database of innovative developments in the field of agriculture, an electronic library, recommendations for agricultural producers and other information in the field of bioeconomy www.agro.uz - Ministry of Agriculture of the Republic of Uzbekistan 	There are libraries containing a 1 million database and information resources centre equipped with modern IT technologies.
<i>Literature directly related to bioeconomy (in English, acquired during last 10 years)</i>	
<ul style="list-style-type: none"> Tom Tietenberg, Lynne Lewis. Environmental & Natural Resource Economics. Ninth Edition, 2012 Ronald D. Kay, William M. Edwards, Patricia A. Duffy. Farm management. Eighth edition. – USA: Texas and M Universitu, 2016. – 466 p. The Bioeconomy Approach Constraints and Opportunities for Sustainable Development. Edited By Udaya Sekhar Nagothu Debertin, Dr David L: Agricultural Production Economics. Second Edition 2012, Greate Spase. 	

2.4.6. Research activities and international research projects in the field (completed within 2016-2020 and ongoing)

No	Title of publication	Names of the main authors	Year of publishing	Title of a scientific journal, where published	Link to the publication (if available)
1.	Farmers' export market participation decisions in transition economies: a comparative study between Armenia and Uzbekistan	Ihtiyor Bobojonov, Ramona Teuber, Shavkat Hasanov, Vardan Urutyun, Thomas Glauben	2016	Development Studies Research	https://www.tandfonline.com/doi/pdf/10.1080/21665095.2016.1262272
2.	The state of doctoral research in Uzbekistan: results of a survey of doctoral students in agricultural economics (No 164)	Ganiev, Ibragim; Djanibekov, Nodir; Hasanov, Shavkat; Petrick, Martin	2017	Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle (Saale)	https://www.econstor.eu/bitstream/10419/168313/1/89345317X.pdf
3.	Non-farm employment trends and policy in rural areas of Samarkand region (Uzbekistan)	Hasanov, Shavkat; Sanaev, Golib	2018	Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle (Saale)	https://www.econstor.eu/bitstream/10419/189961/1/1042175292.pdf
4.	Fine-mapping of the Fusarium head blight resistance QTL Qfhs. ifa-5A identifies two resistance QTL associated with anther extrusion	Barbara Steiner, Maria Buerstmayr, Christian Wagner, Andrea Danler, Babur Eshonkulov, Magdalena Ehn, Hermann Buerstmayr	2019	Theoretical and applied genetics	https://link.springer.com/article/10.1007/s00122-019-03336-x
5.	Genetic mapping of the common and dwarf bunt resistance gene Bt12 descending from the wheat landrace PI119333	David Hole & Hermann Buerstmayr, Almuth Elise Muellner, Babur Eshonkulov, Julia Hagenguth, Bernadette Pachler, Sebastian Michel, Maria Buerstmayr	2020	Euphytica	https://link.springer.com/article/10.1007/s10681-020-02614-w
6.	Agricultural transition and technical efficiency: An empirical analysis of wheat-cultivating farms in Samarkand region, Uzbekistan	Babakholov Sherzod, Kyung-Ryang Kim, Sang Hyeon Lee	2018	Sustainability	https://www.mdpi.com/2071-1050/10/9/3232
7.	Taxonomic analysis of algal flora of the Akdarya reservoir	Tashpulatov Y.Sh.	2018	Hydrobiological Journal	http://www.dl.begellhouse.com/journals/38cb2223012b73f2,17469431350d5a37,3f894e65606f03d1.html

	(basin of the Zarafshan River, Uzbekistan)				
8.	Water and coastal water vegetation of various types of waters in the Samarkand region	Tashpulatov Y.Sh., Khamdamov I.Kh., Nurniyozo A.A.	2019	EurAsian Journal of BioSciences	http://www.ejobios.org/download/water-and-coastal-water-vegetation-of-various-types-of-waters-in-the-samarkand-region-7273.pdf
9.	Environmental features formation of algo flora in the middle flow of Zarafshan River (Uzbekistan)	Tashpulatov, Y.Sh.; Kobulova, B.B	2020	Bio Science Research Bulletin- Biological Sciences	https://scholar.google.com/citations?hl=ru&user=_7485IYAAAJ
10.	Assessment of the impact of Covid-19 pandemic on family income from non-farm activities	Muratov Sh., Pardaev Kh., Hasanov Sh.	2020	Irrigation and Melioration	https://uzjournals.edu.uz/cgi/viewcontent.cgi?article=1440&context=tiame

2.4.7. Innovation capacity, performance and achievements

Describe innovation activities carried by your HEI in the respective field! Nature of innovation. Its application possibilities (sectors of economy, geographic areas, etc.). Users (potential and current).

- Using innovative methods for organic agricultural products: cold chain system, using capsules, using biopolymer covering system.
- The information and consultancy centre (AKIS) conducts innovative research on the cultivation of agricultural crops, develops new varieties of agricultural crops, develops preparations for plant protection and performs other work in the field of bioeconomy.

Does your HEI support creation and development of start-ups? Which? In what way the support is provided?

- Earthworm growing for organic agriculture and waste management, pilot plant breeding project, aquaculture production

Does your HEI develop new products, technologies and services and transfer them to the industry?

- Bioproducts for plant protection.
- Implementation of planting material for various crops.

2.4.8. Internal and external collaboration in relation to bioeconomy

○ Collaboration within own university

Name of partnering unit	Faculties of Agrobiology and Agrobusiness and Logistics
Short description of collaboration	<ul style="list-style-type: none"> • Joint curricula • Joint multidisciplinary study programme (name science directions covered) • Joint research • Sharing of study and research infrastructures
<i>Results, benefits of the collaboration</i>	
A joint curriculum, joint research paper, dissemination materials	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science, providing academic mobility of students and teaching staff.	



○ **Collaboration with other Uzbekistan’s universities and research institutions**

Name of partnering university	Tashkent State Agrarian University
Short description of collaboration	<ul style="list-style-type: none"> • Joint curriculum • Joint multidisciplinary study programme (name science directions covered) • Joint research • Exchange of academic staff ○ Sharing of study and research infrastructures ○ Other (provide information)
<i>Results, benefits of the collaboration</i>	
Integrated achievement of science and industry, preparing competitive staff for the industry.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science, providing academic mobility of students and teaching staffs	

○ **Collaboration with foreign universities and other higher education establishments**

Name of partnering university and country	Latvia University of Life Sciences and Technologies (Latvia)
Short description of collaboration	<ul style="list-style-type: none"> • Joint curriculum • Joint multidisciplinary study programme (name science directions covered) • Foreign university/ies provide guest lecturers (name science directions) • Joint research
<i>Results, benefits of the collaboration</i>	
Integrated achievement of science and industry, preparing competitive staff for the industry.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science, providing academic mobility of students and teaching staff	

Name of partnering university and country	Leibniz Institute of Agricultural Development in Transition Economies (IAMO) (Germany)
Short description of collaboration	<ul style="list-style-type: none"> • Scientific joint projects • Staff exchange • Joint publications
<i>Results, benefits of the collaboration</i>	
Interdisciplinary lab “Agrarian innovation and resources”.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
The lab can be used for teaching master students of bioeconomy.	

Name of partnering university and country	University of Pisa (Italy)
Short description of collaboration	<ul style="list-style-type: none"> • Joint projects in the field of agroeconomics and food safety
<i>Results, benefits of the collaboration</i>	
Integrated achievement of science and industry, preparing competitive staff for the industry.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science, providing academic mobility of students and teaching staff.	

○ **Collaboration with public sector institutions**

Names of partners and their field/sector of activity	Ministry of Agriculture
Short description of collaboration	<ul style="list-style-type: none"> • Involves business sector in definition of degree paper topics, elaboration and defending theses (any level) • Provides lifelong education for specialists working in business sector • Conducts research on demand or for benefit of the business sector entities • Provides carrying out of practices in enterprises • Organises study visits to enterprises
<i>Results, benefits of the collaboration</i>	
The TSAU long-term cooperation with the Ministry of Agriculture	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Knowledge and experience of the ministry can be used for identification of the knowledge gaps and setting aims for the new curricula.	

○ **Collaboration with industries**

Names of partners and their field/sector of activity	JV Agromir group
Short description of collaboration	<ul style="list-style-type: none"> • Involves public sector in definition of degree paper topics, elaboration and defending theses (any level) • Field trips • Conducts research on demand of the public sector
<i>Results, benefits of the collaboration</i>	
Integrated achievement of science and industry, preparing competitive staff for the industry.	
<i>Vision on how this collaboration can be used for the new curricula development and provision</i>	
Applying the novelty of science, providing academic mobility of students and teaching staffs	

<p>The SAMTSAU cooperates with the following establishments:</p> <ol style="list-style-type: none"> 1) Academician Makhmud Mirzaev Scientific-research institute of Horticulture, Viticulture and Wine-making, 2) Kazakh National Agrarian University, KZ 3) University of Hirosaki, Japan 4) University of Porto, PT 5) Practical training program “JD East”, DE 6) Justus –Liebig University of Giessen, DE

2.4.9. Pedagogic approaches and study methods used

<i>Describe, what kind of study methods do students normally use during their studies?</i>
<ul style="list-style-type: none"> • Lecture rooms equipped with modern IT technologies (projectors, WF, etc.), labs and field visits for practical trainings • Interactive study methods such as case study, boomerang, problematic teaching, cluster, assessment technologies, role-play, etc.
<i>Describe, what kind of study materials are used?</i>

<ul style="list-style-type: none"> Paperback books, e-book, e-library, Moodle, YouTube, demonstrative materials, study labs, information technologies, etc.
<i>Which national and international research databases are available for teachers, researchers and students</i>
<ul style="list-style-type: none"> Academic Search (EBSCO), Web of Science, Scopus, Science Direct, Uzbekistan Research Online (uzjournals.edu.uz), Ziyonet.uz
<i>Name and describe teaching methods used currently</i>
<ul style="list-style-type: none"> Lectures (onsite/online), exercises, laboratory work, etc.
<i>What modern/new methodology would need to be introduced as a part of the teacher training?</i>
<ul style="list-style-type: none"> Sensory assessment of the quality
<i>What expectations are related to online teaching/learning methodology and technologies?</i>
<ul style="list-style-type: none"> Unlimited use of the resources of an extensive data base

2.4.10. SWOT analysis of the higher education institution

Strengths (internal factors)	Weaknesses (internal factors)
<ul style="list-style-type: none"> The institution has the capacity of a young and international staff Many employees have an international experience in Erasmus+ or other international projects Strong network of international partners The scientific staff comprises researchers involved in policy making in the sector at the national level 	<ul style="list-style-type: none"> Since the institution is only recently established, it has a smaller staff than other institution The greater part of the scientific staff is overloaded with work unrelated to research; thus, the research capacity is reduced Lack of modern infrastructure for research and education
Opportunities (external factors)	Threats (external factors)
<ul style="list-style-type: none"> Starting to apply ECTS thus simplifying the way to the international level Acceleration of academic mobility ensuring high quality of education and research A new institution with an ambitious strategy of internationalization 	<ul style="list-style-type: none"> A global catastrophe (pandemic, earthquake) Unstable funding of the university increases the dependence on the state central funds State regional policy directed to centralization

2.4.11. Conclusions and recommendations

The state support to internationalization strategy, development of a strategy aimed at integration with business sectors, high scientific potential, etc. ensures the quality at the institution. The young generation demands knowledge. Application of ECTS accelerates the reaching of the international level. An increasing academic mobility of staff and students ensures the quality of education and research. The institution conducts joint research in close cooperation with many research institutions and HEI in Uzbekistan and abroad. There is the demand for implementation of the 'green economy'.

2.4.12. Quality assurance procedures and mechanisms for master level studies and curricula

Quality assurance provider (structural unit/-s)	Quality assurance unit
Quality assurance procedures and their application frequency	A survey is taken among students to understand the quality assurance; on the base of the survey results, the staff is recommended to increase capacity, modify teaching methodology, and/or implement practice-

	oriented classes. However, if there are less points for teacher who provides classes, changes will set in from the next study semester.
Quality assurance criteria	Quality of teaching, capacity of teacher, implementation of modern study technologies into classes, practical oriented, students evaluate classes.

2.5. Other Uzbekistan's higher education institutions providing master and/or doctoral level studies in the fields of science associated to the bioeconomy

General overview on other Uzbekistan's universities providing study programmes in the fields of science to be associated to the bioeconomy, as described below:

Natural sciences:

- Earth and related environmental sciences (1.5)
- Biological sciences classified under the natural sciences (1.6)

Engineering and technology:

- Electrical engineering, electronic engineering, information engineering (2.2)
- Chemical engineering (2.4)
- Materials engineering (2.5)
- Environmental engineering (2.6)
- Environmental biotechnology (2.7)
- Industrial biotechnology (2.8)
- Other engineering and technologies (2.10)

Agricultural sciences:

- Agriculture, forestry, and fisheries (4.1)
- Animal and dairy science (4.2)
- Veterinary science (4.3)
- Agricultural biotechnology (4.4)
- Other agricultural sciences (4.5)

Social sciences:

- Economics and business (5.2)
- Social and economic geography (5.7)

* In the preparation of masters in bioeconomy, the main industry partners will be the sectors of agriculture, forestry, fisheries and biomass processing and their production and management structure (for all universities).

Uzbekistan's universities providing study programmes in the fields of science to be associated to the bioeconomy and holding the most significant competence in the field

	Earth and related environmental sciences	
5140600	Geography	
	National University of Uzbekistan	
	Andijan State University	
	Bukhara State University	
	Karakalpak State University	
	Samarkand State University	
	Urgench State University	
5141000	Soil science	

	Termez State University	
	Urgench State University	
	Karakalpak State University	
5410100	Agro-chemistry and soil science	
	Bukhara State University	
	Gulistan State University	
	Karshi State University	
	Samarkand State University	
	Andijan Institute of Agriculture and Agricultural Technology	
	National University of Uzbekistan	
	Tashkent State Agrarian University	
5630100	Ecology and environmental protection (by industry and field)	
	Fergana State University	
	Urgench State University	
	National University of Uzbekistan	
	Bukhara State University	
	Karakalpak State University	
	Karshi State University	
	Samarkand State University	
	Tashkent Institute of Irrigation and Agricultural Mechanization Engineers	
	Tashkent State Agrarian University	
	Biological sciences classified under the natural sciences	
5140100	Biology (by type)	
	Samarkand State University	
	Gulistan State University	
	Karshi State University	
	National University of Uzbekistan	
	Andijan State University	
	Bukhara State University	
	Namangan State University	
	Karakalpak State University	
	Social and economic geography, economics and business	
5 230 100	Economics (by industry and sector)	48 HEIs
	Tashkent State University of Economics	
	Westminster International university in Tashkent	
	Tashkent institute of finance	
	Veterinary science	
5440100	Veterinary medicine (by activity)	
	Andijan branch of the Tashkent State Agrarian University	
	Termez branch of the Tashkent State Agrarian University	
	Tashkent branch of the Samarkand Institute of Veterinary Medicine	
	Samarkand Institute of Veterinary Medicine	
	Nukus branch of the Tashkent State University	
	Nukus branch of the Samarkand Institute of Veterinary Medicine	
	Agricultural biotechnology	
5320500	Biotechnology (by industry)	

	Samarkand Institute of Veterinary Medicine	
	Tashkent State Agrarian University	
	Animal and dairy science	
5410600	Livestock engineering (by type)	
	Tashkent branch of the Samarkand Institute of Veterinary Medicine	
	Samarkand Institute of Veterinary Medicine	
	Nukus branch of the Tashkent State University	
	Tashkent State Agrarian University	
5411400	Livestock produce processing	
	Samarkand Institute of Veterinary Medicine	
	Agriculture, forestry, and fisheries	
	Other agricultural sciences	
5 410 000	Agricultural sciences	23 HEIs
	Tashkent State Agrarian University	
	Samarkand branch of the Tashkent State Agrarian University	
	Nukus branch of the Tashkent State Agrarian University	
	Gulistan State University	
	Andijan Institute of Agriculture and Technologies	
	Engineering and technology	
5310 000	Energetics	12 HEIs
	Tashkent Institute of Irrigation and Agricultural Mechanization Engineers	
	Tashkent Technical University	
	Tashkent State Transport University	

2.6. Requirements for structure and composition of master level study programmes in Uzbekistan

Structure of master's degree curricula (credits)		
Curricula blocks	Number of credits according to national system / according to ECTS	
	Mandatory disciplines	Optional disciplines
Basic disciplines for the specialization area	8	-
Professional disciplines	31	21
Research and practical work	44	-
Practice	16	-
TOTAL	120	

Structure of lecture	2 academic hours
Duration in minutes	80

Distribution of time per type of activity (for the whole curricula):	1,800 academic hours
Lecture (theory)	340 academic hours
Practical works	440 academic hours
Independent work (self-studies)	1,020 academic hours
Laboratory works	-

2.6. SWOT of bioeconomy related higher education ecosystem, conclusions and recommendations

2.1.1. SWOT analysis

Strengths (internal factors)	Weaknesses (internal factors)
<ul style="list-style-type: none"> ▪ Introduction of a credit system. ▪ Increase in the university science and increase in the publication activity of teachers and scientists. ▪ Improving the legal framework in the field of science and education. ▪ State support to education. ▪ There is scientific potential. ▪ Good location to develop bioeconomy sectors. ▪ Understanding of the importance of growth of R&D sector at the state level. ▪ Availability of research infrastructure. High-quality research personnel. 	<ul style="list-style-type: none"> ▪ Weak integration of science, education and business ▪ There is less academic mobility between universities ▪ Insufficient funding to education and science ▪ Insufficient development of inclusive education ▪ Insufficient educational and research infrastructure ▪ ECTS system is not implemented
Opportunities (external factors)	Threats (external factors)
<ul style="list-style-type: none"> ▪ Expansion of academic freedom of universities ▪ Growth in employment rates of graduates ▪ Improvement of the quality of human capital and the efficiency of the use of labour resources ▪ Improvement of international rankings of the universities, which attracts international students ▪ Emerging of new effective management methods in education and science ▪ Development of academic mobility. Professional development of university teachers through scientific internships at leading international universities ▪ Participation in international projects ▪ Increasing the availability, attractiveness, quality, openness of the education sector ▪ Applying for ECTS, reaching international level ▪ An increasing share of foreign students ▪ Growth of international projects 	<ul style="list-style-type: none"> ▪ Global catastrophe (pandemic, earthquake) with negative impact of quality of education ▪ Limited financial resources for education and research ▪ Insufficient international recognition ▪ A low number of foreign researchers, academic staff and students ▪ Material and technical provision of studies, research and household infrastructure should be improved ▪ Formalism of internal system and processes and slow implementation of the changes needed for the improvement

2.1.2. Conclusions and recommendations regarding bioeconomy-related higher education

All higher education institutions participating in the project cover fields related to several bioeconomy sectors: sustainable production, efficient and integrated use of agricultural, forestry and fishery biological resources, food and wood processing industry, etc. Assessment of the current teaching staff of universities, shows that the basic knowledge and competencies in the areas covered by the new master's programme of the faculty staff involved in the implementation of the project are quite sufficient. In other words, universities can provide academic staff with experience in fields related to the bioeconomy, but the new programme provides for a significantly different approach: (1) interdisciplinarity; (2) the need to acquire new knowledge; (3) the ability to combine knowledge and methods from different fields; (4) development of the research potential; (5) development of the ability to create solutions, products and innovations for a long-term implementation of the new Master's Programme in Bioeconomy in Uzbekistan. Teachers will need to repurpose to teach subjects included in the curriculum. In addition, a need to improve the competence and skills of the teaching staff in the methods of pedagogics and teaching was detected.

Universities have identified the teaching staff, as well as welcomed the participation of young and middle-aged teachers. However, participating universities must find solutions to build a system of knowledge continuity, development of research capacity and participation in internationally recognised research consortia; and to do this, teachers must improve their skills and knowledge of English. It is currently unclear how the new programme will be carried on after the project implementation; so, this issue needs to be addressed by all involved and associate partners. It should be noted that at the moment the new Master's Programme in Bioeconomy has received political support from public sector institutions, and its key point is the involvement of the associate partner - the Ministry of Higher and Secondary Special Education of the Republic of Uzbekistan (MHSSE).

It should also be noted that the partners involved have a good connection with industry ministries; thus, their support to a long-term implementation of the programme in Uzbek universities is essential. These ministries are: the Ministry of Water Resources of the Republic of Uzbekistan, the Ministry of Innovative Development of the Republic of Uzbekistan, and the Ministry of Agriculture Resources of the Republic of Uzbekistan. The involvement of other ministries and governmental agencies is not ruled out.

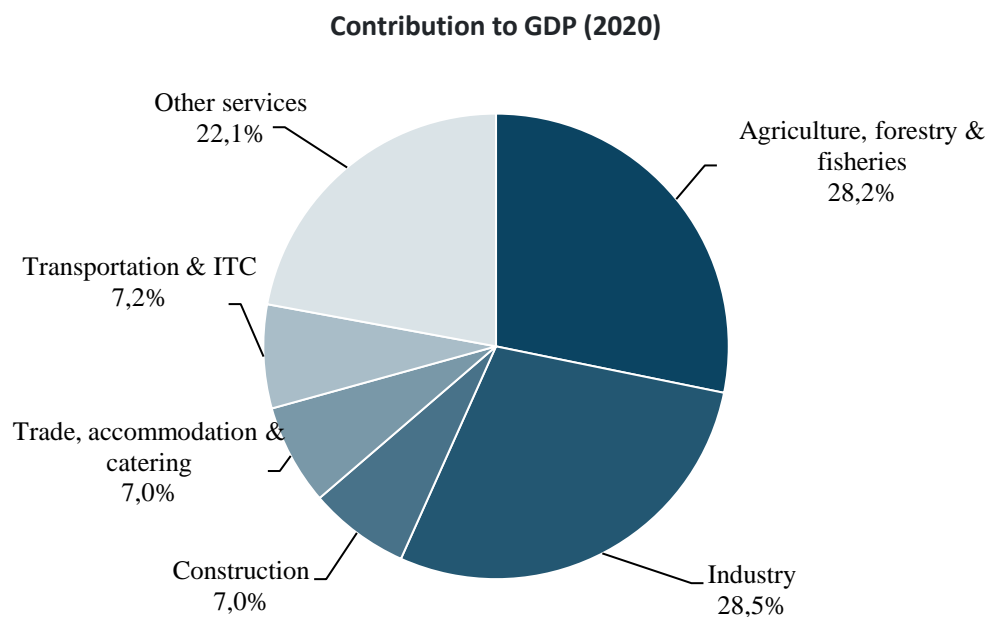
In order for graduates of this programme to be in demand in the labour market, it is necessary to develop an understanding of the bioeconomy and its approaches and support companies in the bioeconomy sectors, thereby stimulating the demand for young professionals in the labour market and thus reaching the main goal at the national level: to increase the competitiveness of education and science, develop human capital for sustainable growth of economic, integrate education, science and business through the development of educational programs in conjunction with leading national and foreign companies, strengthen the scientific potential and status of a scientist, develop a high-quality international system training, and the professional growth of teaching staff.

3. IN-DEPTH ANALYSIS OF BIOECONOMY RELATED INDUSTRIES

3.1. Overview of the bioeconomy related sectors

The data on the main indicators is gathered for the period of last 5 years (2015–2019) according to the tables below.

In 2020, agriculture accounted for 28.2 % of GDP and 26.8 % of employment. Hence, GDP per employee in agriculture is slightly higher than in the rest of the economy. However, over the last 10 years, gross value added per employee has grown more slowly in agriculture than in the entire economy: 2.9 % per year in agriculture and 4.8 % per year in the entire economy.



Source: State Committee on Statistics, 2021

3.1.1. Overall structure of bioeconomy in Uzbekistan

Today, the formation and development of bioeconomy are becoming one of the strategic areas of the state policies for many countries of the world and a special interest for Uzbekistan.

The development of bioeconomy in Uzbekistan offers a comprehensive approach to solving environmental, energy, and food concerns. The formation of bioeconomy through the use of the biotechnology's innovative potential can manifest itself in various areas of human activity, for example, in agriculture: plant and animal protection equipment, bacterial fertilizers; production and enrichment of feed, feed additives; accelerated breeding of elite plants, obtaining virus-free planting material, etc.; in the food industry: nutritional supplements; balance of diet, production of dietary foods and additives (sugar substitutes, amino acids, vitamins, etc.); functional foods, etc.; regarding environmental safety and natural resources: household, agricultural and industrial waste disposal; creation of biodegradable substitutes for traditional environmentally polluting products (biopesticides, plastics, etc.); maintaining biodiversity, preserving rare plant and animal species, restoring populations; resource extraction, including from trash and waste; bioenergetics (biogas, bioethanol, biodiesel, hydrogen, etc.); obtaining chemicals from renewable raw materials for use in a variety of industries, etc.

The development of the bioeconomy in Uzbekistan will help to provide new jobs and maintain competition, reduce dependence on non-renewable natural resources, adapt to ongoing global climate change as well as ensure food security and effective management of natural resources.

Since the development of the bioeconomy is a new direction for our country, finding all the necessary data is a difficult endeavour.

3.1.2. Statistics of primary production sectors

In the statistics of Uzbekistan, agricultural production enterprises are divided into:

- a) **Large-scale enterprises** that engaged into agricultural production: joint-stock companies, cooperatives, agro-clusters, state-owned farms;
- b) **Farms (medium-size)** are private commodity producers with a long-term lease of land from the state (they have different production volumes, which depend on their specialization);
- c) **Dekhkan (household or subsistence) farms** are private farms of the population that produce agricultural products on personal land plots with or without the formation of a legal entity;
- d) **Small-size** – according to the Law on Guarantees of Freedom of Business Activity of the Republic of Kazakhstan (new revision) No 3PY-32 of 02.05.2012, small business entities include:
 - **Microenterprises** with an average annual number of employees involved in the manufacturing industries of no more than twenty people, in the service sector and other non-manufacturing industries – of no more than ten people, and in wholesale, retail and catering – of no more than five people.
 - **Small enterprises** with an average annual number of employees involved in:
 - consumer goods, food and construction materials industries provided by the legislation – no more than two hundred people;
 - metalworking, instrumentation, woodworking and furniture industries, as well as other industrial and manufacturing spheres provided by the legislation – no more than one hundred people;
 - engineering, metallurgy, fuel and energy and chemical industries, production and processing of agricultural products, construction and other industrial and manufacturing spheres provided by legislation – no more than fifty people;
 - science, scientific service, transport, communications, service industry (except for insurance companies), trade and catering and other non-manufacturing sectors – no more than twenty-five people.

Agriculture	2015	2016	2017	2018	2019
Total number of enterprises, units, inter alia	4,626,070	4,669,263	4,707,873	4,736,957	4,692,554
Micro-size (<i>dekhkan</i> farms)	4,525,000	4,535,000	4,560,040	4,585,000	4,600,000
Small-size	x	x	x	x	X
Medium-size (farms)	101,070	134,263	147,833	151,957	92,554
Large-size (organizations engaged in agricultural activities)	17,621	18,319	21,019	24,480	29,379
Total output in agriculture (in billion EUR)	14.5	15.1	13.7	17.7	18.4
Output in crop production (in billion EUR), inter alia	8.0	7.9	7.5	9.1	9.3
Cotton	0.5	0.4	0.5	0.7	1.1
Wheat	1.3	1.4	1.2	1.1	1.4

Vegetables	2.8	2.8	2.7	3.2	3.4
Potato	0.4	0.4	0.7	0.6	0.5
Melons	0.3	0.3	0.2	0.2	0.3
Fruits and berries	1.6	1.5	1.3	1.8	1.6
Grapes	0.9	0.8	0.7	1.2	0.9
Output in livestock production (in billion EUR), inter alia	6.4	7.2	6.1	8.6	9.1
Cattle as main species of livestock (thousand heads)	11,641	12,181	12,471	12,814	12,950
Cows as main species of livestock (thousand heads)	4,174	4,217	4,337	4,626	4,664
Sheep and goats as main species of livestock (thousand heads)	19,119	19,698	20,641	21,581	21,907
Poultry as main species of livestock (thousand heads)	61,349	67,038	74,870	86,375	87,860
Meat (in billion EUR)	4.1	4.7	4.1	5.9	5.9
Milk (in billion EUR)	2.0	2.1	1.7	2.3	2.8
Eggs (in billion EUR)	0.2	0.3	0.2	0.3	0.3
Total import of agricultural produce, in billion EUR	0.4	0.4	0.4	0.5	0.7
Total export of agricultural produce, thousand in EUR	1.5	1.0	0.9	0.8	1.1
Utilized agricultural area (UAA), thousand ha	25,366	25,344	25,280	25,259	25,252
arable land	4,069	4,071	4,073	4,071	4,065
fruit trees	342	344	348	351	357
temporary not used in agriculture	83	83	83	81	80
pastureland	20,872	20,846	20,777	20,756	20,750
Utilized agricultural area (UAA) as % of total country's area	57	57	57	57	57
Number of farms engaged in organic farming, units	2,054	2,713	3,392	4,198	4,628

Data source: <https://stat.uz/en/official-statistics/agriculture>

The **main imported** types of produce:

- Meat and food by-products.
- Dairy products; eggs; natural honey; animal source food not listed or included elsewhere.
- Cereals.
- Flour-and-cereal industry products; malt; starches; inulin; wheat gluten.
- Oilseeds and fruits; other seeds, fruits and grains; medicinal plants and plants for utility purposes; straw and forage.
- Fats and oils of animal or plant origin and products of their splitting; prepared edible fats; waxes of animal or plant origin.

The **main exported** types of produce:

- Cotton
- Vegetables and some edible roots and tubers
- Edible fruits and nuts; peel of citrus fruit or peel of melons

- Oilseeds and fruits; other seeds, fruits and grains; medicinal plants and plants for technical purposes; straw and fodder
- Plant materials for the manufacture of wicker products; other products of plant origin not elsewhere specified or included
- Fats and oils of animal or vegetable origin and products of their cleavage; prepared edible fats; waxes of animal or vegetable origin
- Products of processing of vegetables, fruits, nuts or other parts of plants
- Fertilizers

Exports of fruit and vegetable products in 2019*:

	Amount, thousand tonnes	Million EUR	In % of the previous year
Total	1,408.7	1,006.5	136.4
Vegetables	817.5	458.0	172.4
Fruits and berries,	357.4	339.0	113.7
including dried	52.8	34.0	116.2
Grapes,	190.5	186.4	124.5
including dried	73.5	87.2	106.7
Fresh melons and watermelons	31.3	10.9	200.0
Peanut	11.9	12.0	63.0

*Agriculture of Uzbekistan. Tashkent: 2020 (Stat. abs.), page 64.

Forestry	2015	2016	2017	2018	2019
Total number of enterprises, thousand units, inter alia	105.3	123.0	125.3	134.7	136.2
Micro-size (<i>dekhkan</i> farms)	X	X	X	X	X
Small-size	129	128	138	134	136
Medium-size (farms)	105,129	122,865	125,158	134,566	136,082
Large-size (organizations engaged in agricultural activities)	X	X	X	X	x
Total output in forestry, in billion EUR	0.4	0.4	0.4	0.5	0.5
Total import of forestry products, in million EUR	304.2	376.8	392.1	540.3	550.6
Total export of forestry products, in million EUR	1.6	1.4	1.4	3.2	5.0
Forest land, ha, inter alia	43,500	44,600	46,900	52,600	55,000
Forest land in total, ha	37,000	38,000	39,000	44,600	40,000
Forest area, in % of total forest land	85	85	83	85	73
Types of forests, total, ha	37,000	38,000	39,000	44,600	40,000
Conifers (mention main species), ha	22,200	22,800	23,400	26,760	24,000
Leaf trees (mention main species), ha	14,800	15,200	15,600	17,840	16,000
Harvests of timber, m ³	x	x	x	x	x

Data source: Committee for Forestry

The main imported types of produce:

In 2020, imports amounted to EUR 17.7 billion (by 12.8 % lower than in 2019). The decline in imports is also due to the impact of the pandemic.

- Uzbekistan mainly buys machinery and equipment including parts and components (37.6 %), industrial goods (16.9 %), chemicals and similar products (13.7 %).
- Compared to 2019, in 2020 the volume of imports of goods decreased by EUR 1.6 billion and amounted to EUR 16.7 billion, and the import of services decreased to EUR 1.0 billion.
- Most of the expenditure was related to the purchase of vehicles and equipment – EUR 8.4 billion. It is followed by chemical products (2.3 billion) and food products (1.3 billion).

The main exported types of produce:

- Export mainly consisted of goods (86.8 %), in particular industrial products (19.2%), food and live animals (8.8 %), chemicals and similar products (5.4 %).
- Gold sale totalled EUR 4.8 billion, energy and petroleum products – EUR 549 million, textiles – EUR 1.6 billion, food products – EUR 1.1 billion. Exports of services amounted to EUR 1.7 billion⁵.

Fisheries and aquaculture	2015	2016	2017	2018	2019
Total number of enterprises, units, inter alia	1,850	2,500	3,526	3,600	4,035
Micro-size (<i>dekhkan</i> farms)	x	x	x	x	x
Small-size	921	1,245	1,756	1,793	2,009
Medium-size (farms)	777	1,050	1,481	1,512	1,695
Large-size (organizations engaged in agricultural activities)	921	1,245	1,756	1,793	2,009
Total output, tons, inter alia	590,852	65,322	83,900	90,984	121,717
Total output, in million EUR	77.3	82.6	77.4	101.4	138.2
Aquaculture (silver carp, common carp, grass carp, bighead carp, African catfish), thousand ton	51.0	53.7	51.1	68.4	95.9
Capture fisheries (silver carp, common carp, roach, crucian carp, bream, snakehead, zander (pike-perch), European wels), thousand ton	26.2	28.9	26.3	33.0	42.3
Total import of fisheries and aquaculture products, in million EUR	7.4	3.7	2.8	5.1	8.5

Data source: <http://uzbekbaliqsanoat.uz/>

The main imported types of produce: no data available.

The main exported types of produce: no data available.

3.1.3. Sectors producing bio-based products

Manufacture of food, beverages	2015	2016	2017	2018	2019
Total number of enterprises, units, inter alia	9,016	11,710	13,306	15,390	19,159
Micro-size (...-...)	x	x	x	x	x
Small-size (...-...)	7,138	9,684	11,004	12,727	15,845
Medium-size (...-...)	1,503	1,621	1,842	2,130	2,652
Large-size (...-...)	376	405	460	533	663
Total output, EUR	3,423,627	3,767,692	2,806,479	3,186,320	3,928,564

⁵ <https://www.spot.uz/ru/2021/01/21/trade/>.

Total import, EUR	1,458,432	1,367,731	1,070,083	1,375,980	1,696,505
Total export, EUR	1,211,090	659,738	735,742	955,079	1,376,938

Data source: *stat.uz*

The main types of produce:

- Ready-made foods from meat, fish or crustaceans, molluscs, and other aquatic invertebrates
- Foods processed from vegetables, fruits, nuts, and other plant parts

Manufacture of bio-based textiles	2015	2016	2017	2018	2019
Total number of enterprises, units, inter alia	6,368	6,986	7,935	8,221	8,972
Micro-size (...-...)	x	x	x	x	x
Small-size (...-...)	6,011	6,604	7,505	7,721	8,353
Medium-size (...-...)	338	365	414	479	597
Large-size (...-...)	19	17	16	20	22
Total output, thousand EUR	3.1	4.3	7.2	10.3	12.3
Total import, thousand EUR	2.1	1.7	5.3	8.3	15.3
Total export, thousand EUR	3.1	4.4	4.5	5.7	6.2

Data source: *www.stat.uz*

The main types of produce:

- Wadding, felt or batt and unwoven materials; special yarn; strings, ropes, cables and cords and products made from them.
- Special fabrics; tufting textiles; lace; tapestries; finishing materials; embroideries.
- Soaked, coated or duplicated textiles; industrial-use textiles.
- Items of clothing and related items, except for machine or hand knitting

Manufacture of wood products and furniture	2015	2016	2017	2018	2019
Total number of enterprises, units, inter alia	104	108	125	142	149
Micro-size (...-...)	x	x	x	x	x
Small-size (...-...)	29	33	43	52	59
Medium-size (...-...)	x	x	x	x	x
Large-size (...-...)	75	75	82	90	90
Total output, EUR	416,793	417,799	478,975	537,851	516,382
Total import, EUR	304,206	376,847	392,107	540,372	550,692
Total export, EUR	1,680	1,413	1,445	3,231	5,047

Data source: <https://stat.uz/en/official-statistics/agriculture>

The main types of produce:

Furniture, doors, window frames

Manufacture of paper	2015	2016	2017	2018	2019
Total number of enterprises, units, inter alia	484	527	604	697	863
Micro-size (...-...)	451	486	552	639	796
Small-size (...-...)	5	8	14	14	18

Medium-size (...-...)	23	28	32	38	42
Large-size (...-...)	5	5	6	6	7
Total output, EUR	15	47	137	380	284
Total import, EUR	142,571	140,108	138,413	180,879	222,498
Total export, EUR	4,618	2,031	4,139	9,761	10,102

Data source: www.stat.uz

The main types of produce:

- Paper and cardboard; paper stock, paper or cardboard products.
- Printed books, newspapers, reproductions and other products of the printing industry; handwritten and typewritten texts and plans.

Manufacture of bio-based chemicals, pharmaceuticals, plastics and rubber (excluding biofuels)	2015	2016	2017	2018	2019
Total number of enterprises, units, inter alia	648	735	796	902	973
Micro-size (...-...)	567	636	681	777	822
Small-size (...-...)	17	21	18	22	38
Medium-size (...-...)	52	63	82	86	92
Large-size (...-...)	12	15	15	17	21
Total output, EUR	585	1,320	485	472	1,117
Total import, EUR	1,940	2,014	1,805	2,199	2,882
Total export, EUR	564	799	742	788	790

Data source: www.stat.uz

The main types of produce:

- Plastics and their products.
- Resin, rubber and their products.

Manufacture of liquid biofuels	2015	2016	2017	2018	2019
Total number of enterprises, units, inter alia	42	49	55	58	66
Micro-size (...-...)	24	28	32	34	36
Small-size (...-...)	x	x	x	x	x
Medium-size (...-...)	12	14	16	16	22
Large-size (...-...)	6	7	7	8	8
Total output, t	131,400	165,200	210,500	268,900	325,600
Total import, t	x	x	x	x	x
Total export, t	x	x	x	x	x

Data source: stat.uz

The main types of produce: no data available.

Production of bioelectricity	2015	2016	2017	2018	2019
Total number of enterprises, units, inter alia	6	6	34	39	47
Micro-size (...-...)	1	1	22	22	22

Small-size (...-...)	5	5	3	8	9
Medium-size (...-...)	-	-	5	5	10
Large-size (...-...)	-	-	4	4	6
Total output, MWh	1,972	1,972	7,383	12,795	23,219
Total import, TWh	-	-	-	-	-
Total export, TWh	-	-	-	-	-

Data source: Grant project “Development of sustainable agriculture and mitigation of the effects of climate change” within the project “Support to agricultural enterprises. Phase II” with the participation of the International Bank for Reconstruction and Development. GEF Grant: TF014400. REPORT. March 2018.

The main types of produce: no data available.

3.1.4. Amount of biomass

Total amount, million tons	2015	2016	2017	2018	2019
Agriculture	51.0	53.5	55.7	57.3	51.0
Forestry*	x	x	x	x	x
Fisheries and aquaculture	0.05	0.06	0.08	0.09	0.1
Waste, inter alias	0.2	0.3	0.3	0.3	0.3
Production waste	0.1	0.1	0.1	0.1	0.1
Household waste	0.1	0.1	0.1	0.1	0.1
Other (please, specify)	x	x	x	x	x

*All forests in Uzbekistan are assigned to group I and commercial felling is prohibited in there.

Data source: Brief Policy Brief. The state and prospects of bioenergy development in Uzbekistan. Association of Enterprises of Alternative Fuels and Energy of the Republic of Uzbekistan, Z. U. Saipov

3.1.5. RTD, innovation and digitalisation

The performance is measured by expenditure for particular type of activities: RTD, innovation, introduction of ICT solutions.

In all bioeconomy sectors, expenditure in EUR	2015	2016	2017	2018	2019
RTD in enterprises	-	-	-	1,033	1,587
Innovation in enterprises	-	-	-	28,872	26,811
ICT usage in enterprises	-	-	-	-	-

Data source: *Узбекистан в цифрах. Ташкент -2020,268с., С.-256.

3.2. Development perspectives and trends from point of view of the bioeconomy sectors

A survey of representatives of the relevant industries – enterprises and associations – was conducted to determine the actual current situation in the manufacturing sectors, as well as to assess the strengths and weaknesses of bioeconomy related industries. In total, six companies, two associations (representing more than 82.0 thousand farms, 47.7 thousand *dekhkan* (family farms) and 4.5 million owners of homesteads) and one government agency representing the bioeconomy sectors were interviewed. All questionnaires were filled in in Russian and kept as working documents.

List of enterprises who participated in the survey

	Enterprise/institution name	Primary manufacturing sector.	
1	AHOLITRANS, LLC	Manufacturing Household waste recycling	Enterprise
2	Bukhara Regional Forestry Administration	Forestry	State owned enterprise
3	Buhoro Balik, LLC	Fishery	Enterprise
4	Horasm Balik, LLC	Fishery	Enterprise
5	Agricultural Information Centre – Uzbekistan's innovations of the Council of Farms, Dekhkans and Owners of Homestead Lands of Uzbekistan.	Agriculture	Enterprise
6	Association of Alternative Fuel and Energy Enterprises of the Republic of Uzbekistan	Agriculture Production of liquid biofuel and bioelectricity	Association of enterprises
7	“AZIZJON” farming	Production of energy resources from biomass (liquid biofuel and bioelectricity).	Enterprise
8	Bukhara Agro Fresh LLC	Agriculture and processing Bio-textile production	Enterprise
9	JV LLC Agromir	Agriculture and crop production Fruit and vegetable processing company	Enterprise

Conclusions of the survey

The survey shows that the enterprises still develop the bioeconomy fields in the traditional way and not many innovative solutions are implemented.

The main factors behind the delayed development of the bioeconomy and the creation of new products in this field are as follow:

- Low level of integration of enterprises with higher education institutions;
- Shortages of personnel in the bioeconomy (economists, sales managers, biotechnologists, biochemists, etc.);
- Lack of innovations and investment projects;
- Low level of decision-making and lack of new knowledge and competencies in the field of bioeconomy.

To prevent the negative impacts of these factors and increase the efficiency of bioproduct production, staff proficient in the field of bioeconomy should be trained on the basis of best practices of foreign universities and cooperation with enterprises. Also, when performing research and development work, the cooperation of research institutions and universities with product manufacturers should be intensified.

3.2.1. Areas/sectors of the bioeconomy in Uzbekistan having the greatest potential

In Uzbekistan, there are great opportunities for the development of biomass processing, biogas, biofuel, hydro-, wind and solar electricity production, and small hydroelectric power plants.

The analysis carried out in the country shows the presence of interconnected problems and needs in ensuring an efficient, resource-saving and environmentally friendly economy in the face of climate change. Therefore, a strategy has been adopted to pay attention to the following issues:

- reducing the specific emission factor for greenhouse gases per unit of gross domestic product by 10 % of the level achieved in 2010;
- doubling energy efficiency and reducing the carbon intensity of gross domestic product;
- further development of renewable energy sources, bringing their share to more than 25 % of total generated electricity;
- ensuring access to modern, affordable and reliable energy supply for up to 100 % of the population and sectors of the economy;
- upgrading the infrastructure of industrial enterprises ensuring their sustainability by improving energy efficiency by at least 20 % and increasing the use of clean and environmentally friendly technology and industrial processes;
- expanding the production and use of motor fuels and vehicles with improved energy efficiency and environmental performance, as well as the development of electric transport;
- significant improvements in water use efficiency in all sectors of the economy, the introduction of drip irrigation technology on up to 1 million hectares and increase in yields of up to 20–40 % of the crops cultivated there;
- achieving a neutral balance of land degradation;
- increasing the average productivity of basic food agricultural products up to 20–25 %⁶.

3.2.2. Needs of the bioeconomy sectors for research, technological development and innovation; main challenges

The main problem is the lack of personnel in the field of the bioeconomy and innovative developments, as well as the poorly developed cooperation of research institutions with production facilities and the low level of biomass processing.

Another problematic issue is the lack of the modern knowledge and modern high-yielding intensive technology with a very low level of teaching in the country's universities. It is necessary to intensify the work in terms of education, training and development of industry workers by attracting competent scientists. Regulatory requirements for the quality of fish are virtually non-existent or very poorly observed/controlled.

3.2.3. Needs related to digitalization of production processes, management, trade, logistics

The introduction of digital solutions in the country is slowing down due to the following: the lack of modern managers, programmers, biotechnologists, and biochemists, backward infrastructure, and a low level of innovation and investment activities.

A monitoring service is required consisting of specialists proficient in modern computer technology to keep records of the energy performance of biogas plants and prepare production reports throughout the year by enterprises, regions and the country in general.

IT specialists are required to introduce digital solutions for product management and sale to local and foreign markets.

⁶ Постановление Президента Республики Узбекистан об утверждении Стратегии по переходу Республики Узбекистан на «зеленую» экономику на период 2019 — 2030 годов. №ПП-4477 04.10.2019 <https://lex.uz/docs/4539506>

3.3. Knowledge, skills, and competence needs of the associated sectors of the bioeconomy

3.3.1. Industry/sector/company needs of specialists/professionals: required knowledge, skills, competencies

Companies involved in the bioeconomy need to introduce innovative solutions to improve the quality of manufactured products at a minimal cost of the bioproduct output. The main task for the companies is to expand the range of products while minimising the risk of goods adversely affecting both the human body and environment. Achieving a certain goal and solving the set task require deepening of innovative research in the field of the bioeconomy and training highly qualified staff proficient in technology and industry management.

The development of the industry requires the training of bioenergetics specialists with the knowledge and skills of effective design, construction and operation of biogas plants, as well as the use of bioenergy waste as fuel and fertilizers for agricultural production. In addition, IT specialists highly skilled in the field of process automation, processing and storage of bioproducts are required.

3.3.2. Industry/sector knowledge/skills/competence needs related to technological development and innovation

The main problem is the lack of highly qualified personnel in all areas of the company's activities in the field of the bioeconomy: economists/managers, biochemists and biotechnologists with a world-class level of knowledge and skills. Thus, to expand the range of products and improve the efficiency of management and production solutions, as well as to introduce new world-leading solutions in science and technology for the enterprises involved in sectors of the bioeconomy, the staff should have all the appropriate qualifications and knowledge in this area.

Specialists with the following competencies are required:

- determining and analysing the potential of agricultural biological resources for the specific region;
- electrical engineers for stable use of biogas for electric generators, considering the needs of farms.

3.3.3. Industry/sector knowledge/skills/competence needs related to sustainable management

The current trend of fierce competition both in the world and domestic market leads to the increasing demand for human resources, which flexibly respond to the changing market factors and will be able to ensure the financial and economic sustainability of the growth of enterprises operating in the bioeconomy sectors.

The development of the manager service is required, who would be responsible for the conclusion of contracts with farms and supply of modern efficient biogas equipment into the country.

3.3.4. Industry/sector knowledge/skills/competence needs to introduce and maintain digital solutions

Further development of enterprises on the basis of the introduction of innovative digital solutions for the higher level of automation requires a long-term high competence of personnel in the field of information and digital technology. In response to this trend, there will be a growing demand for personnel proficient in digital solutions and e-management in the field of the bioeconomy.

IT specialists are required to introduce digital solutions for product management and sale to local and foreign markets. Monitoring service consisting of specialists proficient in modern computer technology to is required

keep records of the energy performance of biogas plants and prepare production reports throughout the year by enterprises, regions and the country in general.

3.3.5. Trends to be observed while developing higher education content

In the future, in training staff in the field of the bioeconomy, the best practices of foreign universities should be considered, in particular, the scientific and innovation experience and staff training system existing in Finland and other countries related to biomass production and waste recycling and management. The university's bonds with manufacturing plants (i.e. with consumers of personnel) should also be strengthened.

Training courses, appropriate equipment for laboratory work, the use of modern video and media as means of displaying educational material should be introduced into higher agricultural education institutions.

3.4. Overview of university-research and industry-university relation

3.4.1. Cooperation between universities and research institutions

Cooperation between universities and research institutes is unstable.

The Tashkent State Agricultural University, the Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, and the Bukhara State University are the main universities in their respective specialisations. Together with related universities, they develop state educational standards, state educational requirements, curricula and programmes for all related higher education institutions in the country. In turn, other universities of Uzbekistan are the main universities in some science fields in these institutions. For example, for the Bukhara State University in Economics and Business, the main university is the Tashkent State Economic University (Tashkent). Thus, the universities of Uzbekistan cooperate with each other in the preparation of educational documentation and arrangement of the educational process.

Another important aspect of inter-university cooperation is teaching staff mobility, i.e. leading teachers of university teach classes at other universities when invited by the parties. All universities in Uzbekistan develop scientific projects together with farms and training farms. In addition, the industry cooperates with universities when updating bachelor's and master's curricula. Once a year, universities conduct a survey in industrial enterprises (organisations) and find out the right skills for today's technology and trends.

Another important aspect of cooperation between universities is the joint development and implementation of national and international research and educational projects (which is spontaneous).

3.4.2. Efficiency of higher education: relevance to business needs and development trends

Universities train specialists in accordance with the demand of enterprises and other employers. But, graduates sometimes cannot find jobs according to their qualification, and sometimes graduates do not agree to work for low wages at the initial stage of their professional life.

Unfortunately, universities provide more graduates than the industry needs. The industry fails to create jobs for university graduates fast enough.

3.5. Overview of the bioeconomy sectors in Central Asia countries

3.5.1. Structure and specific weight of the bioeconomy sectors per Central Asia country

Indicator	Uzbekistan	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan
Population 2020 (mln. persons)	34.23	18.73	6.52	9.12	5.94
Data in 2018 (World Food and Agriculture Statistical YearBook 2020// www.fao.org/faostat/en)					
Total output of agriculture products, mill. USA \$	27,119.9	9,807	1,014	2,009.4	38,58.7
Total capture fisheries and aquaculture production, thousand tones	91	33.8	2.6	1.6	15.1
Aquaculture production, thousand tones	57.4	1.6	2.6	0.5	0.1
Production of roundwood, thousand tones	34	27,432	46	3,674	0
All food exports, mill. USA \$	1,054	2,751	182	37	23
All food imports, mill. USA \$	1,457	3,263	497	548	437
Share of organic agricultural area, %	0	0.1	0.2	0.2	-
Total amount of renewable energy produced, TWh	6.5 bln kW	11,097.1		19,169	1.14231593

The main exported types of produce from Uzbekistan:

Uzbekistan mainly exports: lint cotton, food products, textiles, chemicals and their products.

The main imported types of produce to Uzbekistan:

Uzbekistan imports: food products (fish and seafood, various canned food, kiwi, bananas, tangerines, oranges and other foodstuffs), energy resources and oil, machinery and equipment, chemicals and their products, services.

(Detailed description in paragraph 3.1.2 “Statistics of primary production sectors”.)

3.6. SWOT of the bioeconomy related industries, conclusions and recommendations

3.6.1. SWOT analysis

Strengths (internal factors)	Weaknesses (internal factors)
<ul style="list-style-type: none"> • The diversity of the country's bioclimatic potential allows having even two harvests a year and producing many agricultural products. • The level of introduction of new solutions into the agricultural sectors is relatively high. • There is enough manpower in rural areas. 	<ul style="list-style-type: none"> • Low level of production mechanisation and intensification. • Lack of knowledge and own financial assets to develop and implement innovative solutions. • Weak (poorly developed or not yet built) road infrastructure, electricity, drinking water, gas. • Insurance in the agricultural and fishery sectors is undeveloped.

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| <ul style="list-style-type: none"> • The country has hydro-ecological and biological conditions, such as rivers, lakes, irrigation and drainage networks that enable sustainable development of fisheries and aquafarming. • There is a sufficient market share and consumers to sell grown fish. The average annual consumption of fish in the country is only 3–4 kg per capita, and the demand per year is 2–3 times higher. • Extensive experience and territory in forestry development – forestry is a rich source of biomass production with a variety of plants and animals. • Accumulated experience in the introduction of biogas plants at agro-industrial factories and farms. Developed crop and livestock production as a source of raw materials for the production of biogas. • Household waste recycling is widely supported by the state, environmental and other public institutions in order to preserve clean environment and a wide range of products. • There are large reserves of raw materials for the development of household waste processing (about ¼ of the household waste is processed). | <ul style="list-style-type: none"> • Relatively low productivity and low crop yields; large losses of fruit and vegetable products at all stages of their production. • Due to a poorly developed feed base, the level of animal productivity is low and production unit costs of such goods are high. • Research institutes are very limited in funding research in the agriculture and fish industry. • Lack of training equipment for demonstration of efficient use of water. • Distinct fragmentation of the manufacturing of many types of products, a huge number of <i>dekhkan</i> farms (micro-size/family farms). • Low level of sustainable forest management, environmental protection, low level of forest product processing. • The level of cooperation between agricultural and forestry companies with higher education institutions in research and staff training is low. • Lack of personnel competent in progressive growth trends and the basics of modern bioeconomy, training of highly skilled personnel utilising training programmes of foreign countries and their support leads to the inability to overcome the staff shortage. • Lack of personnel for the design and operation of modern biogas equipment. • Lack of organisational structure on bioenergy. • Low levels of agricultural waste collection and processing. • Low levels of processing agricultural products and by-products of the industry and production waste. • Lack of knowledge and own financial means and experience for the accelerated development of the industry. • Low level of the industry competitiveness due to the underdeveloped infrastructure. • Food production quality standards (certification). • Aspects of good management: labour safety, means of protection, hygiene. • Unstable price for agricultural products on international markets. • Due to the abundance of the produced goods, prices on some agricultural goods are being lowered during the season. • High transport costs for exports and imports of goods. |
|---|--|

Opportunities (external factors)	Threats (external factors)
<ul style="list-style-type: none"> • Great potential for exporting agricultural goods in the country. • Development of joint entrepreneurship in the process of production and processing of agricultural goods. • State support for attracting foreign investment and staff training in the production and processing of agri-food and manufactured food goods. • Introduction of new and advanced production technology for agro-industrial sector and development of international cooperation in the industry. • Production of new goods and creation of new jobs with attracting overseas investment. • Increase in the demand for Uzbekistan's food products in the global market. • The possibility of a sharp increase in fish production through the introduction of intensive high-yielding solutions, water resources of Collector and Drainage Water (RDW) and reservoirs. • High potential of fish productivity in natural reservoirs (up to 20–75 kg/ha) compared to 5–7 kg/ha today. • Increase of employment by creating more jobs. • Strong state support for forestry development. • Opportunities for foreign investment for the development of the bioeconomy in forestry. • Attention of foreign grant institutions to the development of bioenergy in the country. • A system of bank microcredits for purchasing biogas plants to support farms. • Attraction of foreign investment for the development of the bioenergy sector. • International cooperation in the development of innovative solutions and research work on household waste processing. • National areas of development of the bioeconomy and biotechnology sectors. • The government's focus on innovation – the Ministry of Innovation is created. • Use of solar energy in production processes. • Increase of wind power generation. • Concessional loans to businesses during the pandemic. 	<ul style="list-style-type: none"> • Water scarcity and unfavourable weather in the spring. • A great production dependence on foreign suppliers of seed and planting materials of high-yielding varieties of individual agro-food crops and high-yielding breeds of animals and manufacturers of machinery for the agro-industrial sector. • Threat of infection of the country's agri-food sector with diseases and viruses in the aftermath of the import of seed and planting materials and animals. • Very frequent droughts and water salinisation in low-water years, sometimes leading to the complete drainage of many lakes and reservoirs, especially in the lower rivers, and the mass loss of fish. • Inland reservoirs (which include the country's reservoirs) are not productive throughout the year, and in winter they are covered in ice, so during the cold period of the year fish stop growing. Sometimes, in very cold years, winter fish kill occurs. • Reduced water quality due to salination and chemical contamination of water. • The presence of invasive species that enter aquatic ecosystems and cause significant environmental damage to biodiversity. • Fisheries management is largely dependent on irrigation and crop production and requires the protection of rights of fisheries as of an equal user of water and land resources. • High level of governmental intervention in forestry development. • State monopoly in the electricity production and networks. • Shortage of highly qualified personnel. • Natural disasters: droughts, earthquakes, insect invasions. • The amount of import duty on potential export markets. • Low and weak state of services in the sector at the national and local levels.

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| <ul style="list-style-type: none">• High growth in biomass production and processing. High biomass production capability can meet the needs of the market. | |
|--|--|

3.6.2. Conclusions and recommendations regarding the bioeconomy related sectors of national economics

In Uzbekistan, bioeconomy development is at the stage of formation and evolution. The country is particularly slow in developing the deep processing of biomass and use of renewable resources, and there is currently no single methodology and tools available to assess the biomass potential, as well as forecast its current and future demand. When using biomass, the bioeconomy approach can give society significant benefits in terms of food and energy production. The increased introduction of the bioeconomy into agriculture will enable performance and productivity growth in the sector. It should be noted that the analysis showed great opportunities to introduce innovative “green” solutions in bioprocessing, such as the use of solar and wind energy, which are not yet widely applied.

The country has adopted legislation to transform the economy in the direction of the green economy according to the country's development priorities and the trend of global development of the bioeconomy; so, it is necessary to conduct international joint research and staff training programmes in the country. This contributes to filling the gap in the bioeconomy currently existing in the national economy.

4. IN-DEPTH ANALYSIS OF POLICY FRAMEWORK and PUBLIC SECTOR BODIES ASSOCIATED with the BIOECONOMY

4.1. Description of the bioeconomy related fields/areas and their knowledge needs

4.1.1. Development of the sectors of economics

Uzbekistan has developed agricultural production. By the end of 2019, agriculture, forestry and fisheries showed a positive growth rate of 2.5 %. The contribution of this industry to GDP growth was 0.7 p.p. Positive dynamics in agriculture, forestry and fisheries is associated with an increase in crop production by 3.7 % and livestock production by 1.7 %.

It should be noted that in 2019, in the structure of industrial products, the share of food, beverages and tobacco products reached 13.8 %, textiles, clothing, leather goods and related products – 13.4 %, rubber, plastics and other non-metallic mineral products – 9.7 %, chemical products – 7.3 %, vehicles, trailers, semi-trailers and other transport equipment – 6.2 %, electrical equipment – 3.2 %, coke and refining products – 2.5 %, and other products of manufacturing industry – 7.6 %. (Analytical materials of the State Statistics Committee of the Republic of Uzbekistan).

Knowledge needs:

In Uzbekistan, the bioeconomy is at the stage of development. The main reason hindering an accelerated growth of the bioeconomy sector at both the state and micro levels is the lack of highly qualified specialists in this field. Due to the insufficiency of personnel in the field of bioeconomy, scientific, innovative and investment activities are developing spontaneously. Our observations and research results for the development of the bioeconomy sectors in Uzbekistan show that special attention should be paid to staff training in the following areas:

- Biotechnology,
- Bioenergy and biofuel production,
- Production and processing of biomass and waste,
- Biochemistry and bioanalysis,
- Fish farming and aquafarming,
- Economics and bioeconomy sector management.

4.1.2. Environment, nature and biodiversity

The structure of the earth's surface in Uzbekistan is non-recurring, that is why its nature and resources are diverse. Convenient natural conditions are an important natural factor for the productivity of production. Environmental conditions are particularly evident in agriculture, mining and transport communications. Mountainous terrain, salt marshes, steppes, takyrs (salt flats) and ravines complicate the economic development of the territory. In dry years, the flow of water in rivers decreases and it becomes difficult to water crops and develop fish farming.

Natural resources are directly related to production, i.e. they make up its raw material and electric power base. One of the most important natural resources is underground resources (minerals and fuel). They are widely used in industry and for domestic needs in large quantities.

Uzbekistan has large ground resources, but the country's economy needs in raw materials and fuels are growing indefinitely. Almost half of the natural resources are currently used. Nevertheless, it is necessary to use natural resources sparingly, as land-based resources are finite and unrecoverable (<http://geografiya.uz/socialno-ekonomicheskaya-geografiya-uzbekistana/10170-prirodnye-usloviya-i-prirodnye-resursy-uzbekistana.html>).

Intensive mineral extraction is accompanied by the accumulation of large volumes of dumps, ash, slag, and other substances that occupy the land suitable for agriculture and contaminate soil, surface and groundwater (<https://www.uzbektravel.com/rus/nature1.htm>). The real threat is the intense contamination of soils by various types of industrial and household waste. Although bioeconomy does not include non-renewable resources, this approach can be used to address the above problems.

Uzbekistan has undergone legislative reform improving existing ecology and environmental protection legislation that meets world standards. An important step in improving the organisational structure of the environmental activity is the **Law on Environmental Control of the Republic of Uzbekistan**, which provides a legal basis for active participation of all civil society institutions in the environmental protection system and the process of solving environmental problems. (<https://www.uz.undp.org/content/uzbekistan/ru>)

The country has also developed and adopted the **Concept for the Protection of the Environment of the Republic of Uzbekistan until 2030** providing for measures to:

- ensure the quality of environmental sites and preserve them from human impacts and other adverse factors;
- priority use of materials, products, manufacturing and other facilities that pose the lowest environmental hazard;
- expand protected natural areas;
- ensure the environmentally safe use of toxic chemicals and radioactive substances;
- improve an environmentally friendly waste management system;
- create an environmental population culture, increase the transparency of government affairs in environment protection and strengthen the role of civil society.

<https://uza.uz/ru/posts/ob-utverzhdenii-kontseptsii-okhrany-okruzhayushchey-sredy-re-31-10-2019>

Knowledge needs:

To solve the urgent environmental problems, the level of environmental literacy of the population and all economic entities of the country should be ensured in the first place. To manage the country's natural resources, it is necessary to train personnel capable of developing and applying modern innovative environmentally friendly and waste-free solutions in production. And there should be an improvement in the specialist training programmes for economics and environmental protection considering the best world experience of teaching students in this field.

4.1.3. Food safety and security

Food sustainability in Uzbekistan

Over the past 14 years, the number of people suffering from malnutrition in Uzbekistan has decreased from 3.6 million to 1.7 million. According to the data, about 16 million tons of fruit and vegetable products are produced in Uzbekistan every year. In addition, the country has formed substantial stocks of grain and food essentials – meat, vegetable oil, sugar and rice.

In 2018, the Ministry of Agriculture and Water Economy was divided into two separate ministries. Now the Ministry of Agriculture organises food stocks to provide the population with food at stable prices year-round. Also, the Inspectorate of Control over the Agro-Industrial Sector and Food Security has been established under the Prosecutor General's Office of Uzbekistan.

A draft Law on Food Security has been developed in the country. According to the draft law, Uzbekistan plans to introduce a threshold of food independence of at least 80 % of the availability of basic foodstuffs per year. (<https://ictsd.iisd.org/bridges-news/>).

One of the priorities of the Strategy for Further Development of the Republic of Uzbekistan is the modernisation and intensive development of agriculture. In 2019, the Agriculture Development Strategy of the Republic of Uzbekistan for 2020–2030 was approved, which covered nine strategic priorities, the first of which was to ensure the food security of the population.

The last three years can be described as a period of unprecedented comprehensive reforms in the agricultural sector, including the introduction of market mechanisms and advanced solutions and the transition to a cluster production system. Measures were taken to expand the acreage, prioritise region specialisation in fruit and vegetable production and combine producers in fruit and vegetable clusters and cooperative societies.

The high export potential of Uzbek food products is evidenced by the fact that even under the most severe quarantine restrictions associated with the pandemic, Uzbekistan has managed to significantly increase their exports. In January–August 2020, the supply of Uzbek fruits and vegetables to the Russian Federation market increased by 57.7 % compared to the same period of 2019 and reached 169.1 million dollars. At the same time, there was a significant increase in fruit and vegetable exports to countries such as the United States by 47.1 % and Georgia by 19.2 % (<https://review.uz/>).

The main reserves of food supply growth for the population in Uzbekistan are:

- applying progressive, intensive and innovative agricultural production solutions to ensure the growth of agricultural product competitiveness in both domestic and global markets;
- deepening cooperation, integration of the production and processing of agricultural products and their production waste;
- improving the management of the agricultural sector and implementing effective mechanisms for the organisation of production and quality management in agriculture;
- developing rural and agricultural infrastructure, as well as improving staff training systems for agricultural sector entities.

Knowledge needs:

In order to achieve a qualitative change in food security and the economic security of the population, the skills of all agricultural workers and staff training programmes based on best practices of the world's leading countries should be improved. As the application of modern agricultural production and processing solutions requires new knowledge and skills, the agricultural sector of the country particularly experiences a severe shortage of personnel deeply aware of modern methods of effective management, agriculture economics, biotechnology, biochemistry, agro-chemistry, biomass production and processing, and agricultural waste management.

4.1.4. Employment and jobs

According to the analytical data of the State Committee of the Republic of Uzbekistan, as of April 1, 2019, the permanent population of the country amounted to 33,375.8 thousand people and has increased by 120.3 thousand people or by 0.4 % since the beginning of the year. At the same time, the urban population amounted to 16,865.1 thousand people (50.5 % of the total population) and the rural population amounted to 16,510.7 thousand people (49.5 %).

Territories	Labour force, thousands of people	Economically active population, thousands of people	Employed in the economy, thousands of people
Republic of Uzbekistan	18,949	14,876	13,541
Republic of Karakalpakstan	1,063	782	711
Regions:			
Andijan	1,741.7	1,413.9	1,284.5
Bukhara	1,081.0	875.4	797.1
Jizzakh	764.1	590.3	536.2
Kashkadarya	1,813.8	1,345.3	1,220.0
Navoiy	555.8	450.9	412.7
Namangan	1,573.9	1,214.7	1,104.6
Samarkand	2,117.1	1,604.2	1,455.8
Surkhandarya	1,456.9	1,128.8	1,024.2
Sirdarya	484.5	385.9	350.1
Tashkent	1,607.3	1,353.5	1,232.9
Fergana	2,052.1	1,644.8	1,492.6
Khorezm	1,029.6	810.0	736.5

Although many new jobs are created in the country every year, the country's problem of unemployment is completely insurmountable. To alleviate this problem, it is necessary to improve the qualifications and skills of workers in the country.

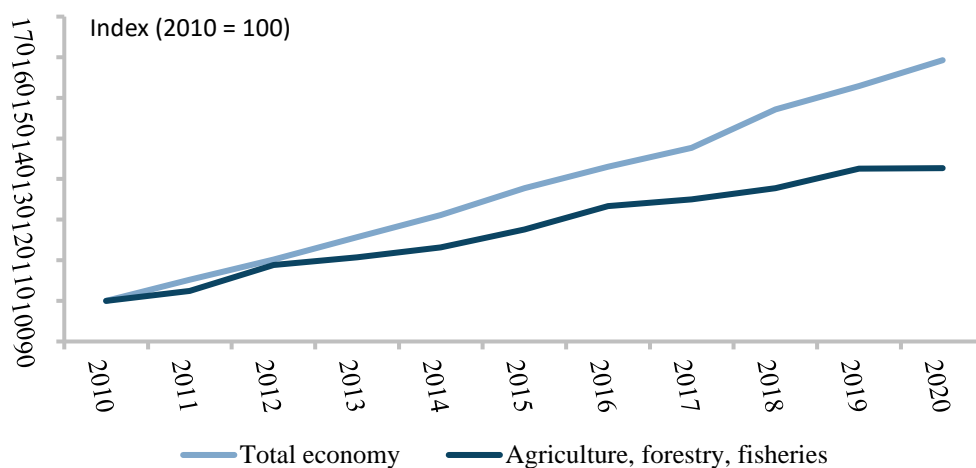
Knowledge needs:

Creating knowledge-based well-paid jobs by increasing the production of export-oriented (and import-competitive) goods and services. Staff training in science-driven and labour-intensive areas of the economy should be improved and intensive training and retraining courses for workers should be organised.

4.1.5. Balanced territorial development: regional and rural development

Between 1995 and 2018, all regions of Uzbekistan had positive economic growth, which in turn ensured the growth of the country's economy. In this period, the national economy grew by 4.1 times.

Changes in gross value added per employee since 2010



In 2020, agriculture accounted for 28.2 % of GDP and 26.8 % of employment. Hence, GDP per employee in agriculture is slightly higher than in the rest of the economy. However, over the last 10 years, gross value added per employee has grown more slowly in agriculture than in the entire economy 2.9 % per year in agriculture and 4.8 % per year in the entire economy. Thus, growth of productivity per worker in agriculture lags the rest of the economy.

Knowledge needs:

Knowledge of the growth trend of global agricultural production, strategies and innovations in the global agricultural sector. This knowledge should be developed and passed down at the national level:

- national and international higher education institutions,
- various organizations that train specialists in specific curricula (funds, private and non-governmental institutions).

4.2. Strategies, policies, development programmes

Agriculture is one of the dominating sectors of the Uzbekistan's economy and developing intensively. One of the priority directions of the Strategy of Actions for the Further Development of the Republic of Uzbekistan adopted at the beginning of 2017 is the modernisation and intensive development of agriculture. On October 23, 2019 the Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020–2030 was approved. Priority directions for the implementation of the Strategy are fulfilment of the state policy on food security, providing for food safety and improvement of the consumer intake, production of food products in the required quantity; creation of a favourable agribusiness climate and value added chain, production of agro-food products with high added value competitive on target international markets; introduction of mechanisms to reduce the role of the state and increase the investment attractiveness of the industry.

The government of Uzbekistan has developed the Strategy for innovative development of the agricultural education system until 2030. According to the Strategy, joint educational programs with 30 foreign universities are going to be organised. It is expected that the new degrees will be developed applying Bologna process principles. Furthermore, measures will be taken to include universities in the system of agricultural education in the list of 1,000 prestigious universities in the world (QS rating system). From academic year 2020/2021, in all areas of training bachelors and masters in this field, a credit-modular education system will

be gradually introduced. In order to widen the autonomy of higher education institutions and increase accessibility to higher education, it is planned to transform Nukus, Termez and Samarkand branches of the Tashkent State Agrarian University into independent institutes.

In accordance with the resolution, “Smart agriculture” and information technologies are being introduced in agriculture.

In the development of strategies and policies (laws and regulations) for the growth of a particular industry (e.g. agriculture, food industry, etc.), the relevant government departments (the Presidential Executive Office, the Cabinet of Ministers, ministries, committees, etc.) set up working groups for these areas with the involvement of experts and academics from specialized universities. At the request or instruction of the authorized state and political bodies, they may also develop various types of documents (effective at the industry, national or regional level).

4.2.1. National strategies, policies, development programmes already adopted and under implementation:

Uzbekistan's Development Strategy 2017–2021

Short description of relation to the bioeconomy:

Modernisation and intensive development of agriculture:

- Expansion of structural reforms and dynamic development of agricultural production, further improvement of the country's food security, expansion of the production of environmentally friendly products, significant improvement of the agricultural sector's export potential;
- Further optimisation of the acreage, aimed at reducing the acreage for cotton and cereals and planting potatoes, vegetables, fodder crops and oilseeds on the freed lands, as well as new intensive gardens and vineyards;
- Promotion and creation of favourable conditions for the development of farms, especially multi-purpose farms engaged in both agricultural production and processing, harvesting, storage, sale, construction and services;
- Implementation of investment projects for the construction of new and reconstruction and modernisation of existing processing plants equipped with the most modern high-tech equipment for deeper processing of agricultural products, production of semi-finished products and finished food products, as well as packaging products;
- Further expansion of agricultural product storage, transportation and sale infrastructure and provision of agrochemical, financial and other modern market services;
- Further improvement of the reclamation condition of irrigated land, the development of a network of reclamation and irrigation facilities, the widespread introduction of intensive methods into agricultural production, especially modern water- and resource-saving agricultural solutions, the use of high-performance agricultural machinery;
- Expansion of research to create and introduce new breeding varieties of crops and animals with high productivity and resistance to diseases and pests adapted to local soil, climatic and environmental conditions;
- Systemic measures to mitigate the negative impact of global climate change and the drying-up of the Aral Sea on the development of agriculture and population's life activities (<https://www.lex.uz/ru/docs/3107042> Decree No 4947 adopted by the President of the Republic of Uzbekistan on 07.02.2017).

Authority responsible for implementation: the strategy is being implemented by the established *National Commission for the Implementation of the Performance Strategy* in five priority areas of development of the Republic of Uzbekistan in 2017–2021 under the direction of the President of the Republic of Uzbekistan.

Goals: based on the introduction of advanced and innovative solutions, the development of staff training and research, the improvement of the facilities and resources of the agricultural sector for ensuring food and environmental security, the abundance of food production and the promotion of production growth, as well as the efficiency of agricultural production in Uzbekistan.

Uzbekistan's Agri-food Development Strategy 2020–2030

Short description of the relation to the bioeconomy:

Strategic priorities for the development of agriculture in Uzbekistan for 2020–2030:

- ensuring food security for the population;
- creating a favourable agribusiness climate and value chains;
- reducing the role of the state in the management of the sector and increasing investment attractiveness;
- ensuring rational management of natural resources and environmental protection;
- phased diversification of public spending in support of the sector;
- development of science, education, information and advisory service systems in agriculture;
- rural development;
- development of a transparent system for industry statistics.

Authority responsible for implementation: the Coordinating Council for the implementation of the Agricultural Development Strategy of the Republic of Uzbekistan for 2020–2030 under the direction of the Prime Minister of the Republic of Uzbekistan and the relevant ministries and agencies that are part of the Coordinating Council.

Strategy aim: to diversify production, improve land and water relations, create a favourable agribusiness climate and high-value chain, support the development of cooperative relations, broad implementation of market mechanisms and information and communication solutions into the industry, as well as effective use of scientific advances and increase human resources in the agricultural sector.

Main goal of the strategy: to achieve job growth, food security and security of the country's population, increase farm incomes and ensure sustainable use of natural resources.

Strategy for the treatment of Solid Household Waste in the Republic of Uzbekistan for 2019–2028

Short description of relation to the bioeconomy:

It is expected that its implementation will allow to create an effective system of processing Solid Household Waste (SHW) with the necessary infrastructure, improve pricing and optimise tariffs in the field of sanitary treatment, reduce the amount of garbage sent for landfill and use waste as an alternative fuel.

The strategy will be implemented in two stages.

The first stage (2019–2021) is to improve the legislative framework and mechanisms of economic regulation in the field of SHW treatment, develop the facilities and resources and infrastructure of sanitary treatment in order to ensure the effective organisation of services for the SHW collection and removal, strengthen the payment discipline, create methodological and informational support for the development of environmental education in the field of the SHW treatment.

The second stage (2022–2028) is the development of investments aimed at developing infrastructure for separate collection of SHW, optimisation of landfills, construction of reloading stations and waste processing facilities, improvement of cluster activities on integrated waste management and development of their capacity for SHW processing.

As a result of the second stage, Uzbekistan intends to increase the coverage of the population with solid waste collection and removal services to 100 % and ensure the processing of at least 60 % of the resulting Solid Household Waste. <https://uz.sputniknews.ru>

Goals: the goal is to create an effective system for collecting, transporting, disposing, recycling and dumping Solid Household Waste, preventing its harmful effects on public health and the environment.

The main **objectives** of the Strategy are as follow:

- development of sanitation infrastructure aimed at ensuring that the population is fully covered by the collection and disposal of Solid Household Waste;
- creation of an efficient and modern Solid Household Waste recycling system and its use in alternative energy sources;
- reduction of the amount of Solid Household Waste sent to landfills, creation of modern landfills for Solid Household Waste that meet the requirements of sanitary and environmental standards, as well as taking actions to close and rehabilitate existing landfills. <https://lex.uz/docs/4291733>

Innovative Development Strategy for the agricultural education system up to 2030

The Strategy includes the implementation of the following priorities:

- modernisation of the agricultural sector, improvement of the quality of training of highly qualified professionals for sustainable socio-economic development and development of human capital in accordance with the labour market's requirements;
- introduction of resource-saving “Smart Agriculture” and information technology to agriculture;
- development of agricultural production through start-up projects;
- improvement of the education, science and production integration mechanism to ensure the ubiquitous introduction of research results, R&D and process work, etc.

According to the Strategy, up to 2030:

- joint training programmes with 30 foreign universities will be arranged;
- the number of interactive services rendered in agriculture will reach 20;
- measures will be taken to include universities in the agricultural education system in the list of 1,000 prestigious higher education institutions of the world (QS rating system).
- measures will be taken to introduce solutions and modern agriculture digitalisation methods into the educational process.

(https://www.norma.uz/novoe_v_zakonodatelstve/reformiruetsya_sistema_agrarnogo_obrazovaniya?utm_source=yxnews&utm_medium=desktop)

Regarding the measures to radically update the state policy in the economic development and poverty reduction 2020–2030. The Decree of the President of the Republic of Uzbekistan

Short description of relation to the bioeconomy:

The task of reducing poverty can only be solved through the parallel development of all areas of human life, including meeting minimum needs for food, drink, housing and human empowerment through increased access to education, health care and professional and creative development.

In Uzbekistan, the strategically important and consistently solvable task is to improve the well-being of the population. However, in recent years the fight against poverty has been consistently implemented in the state economic policy and is included in the national goal, which is taken into account in the development and implementation of Uzbekistan's strategic programmes and development plans. (<https://review.uz/post/uzbekistan-na-puti-sokrasheniya-bednosti-opt-kitaya>)

Authority responsible for implementation: the Prime Minister of the Republic of Uzbekistan and the Advisor to the President of the Republic of Uzbekistan.

Task:

- Determining the key indicators of the level of industry development widely used in international practice, developing and executing methods of implementing the basic principles and methods of the “green economy” and energy efficiency, as well as monitoring methodology.
- Management of urban agglomerations through the introduction of advanced, energy-efficient, environmentally friendly solutions and materials while taking into account the creation of satellite cities with social, engineering and transport infrastructure. <https://lex.uz/ru/>

The concept of science development up to 2030

Short description of relation to the bioeconomy:

The concept includes the introduction of a national rating system aimed at assessing the effectiveness of scientific and innovation activities of scientific organisations, improving the social partnership between the state and scientific organisations through the development of the system of self-government in science, as well as the implementation of projects within it. In the area of improving the funding system for science and science activities, as well as diversifying sources of funding: an increase by 6 times by 2025 and by 10 times by 2030 of the share of all funds allocated to science in relation to the gross domestic product.

In the direction of creating a modern infrastructure for the development of science, the following is planned:

- increase by 3.5 times by 2025 and increase by 9 times by 2030 of the share of organisations' spending on process innovation, implemented by their own efforts in the total expenditure on process innovation in the field of research and development;
- bringing the number of residents of the innovative Yashnabad Technology Park to 60 by 2021, on this basis expanding the range and increasing the volume of innovative products while creating more than 720 new jobs;
- creation of 7 state-of-the-art laboratory facilities equipped according to GLP and GMP global standards.

Authority, responsible for implementation: the Prime Minister of the Republic of Uzbekistan and the Advisor to the President of the Republic of Uzbekistan. (<https://kun.uz/ru/news/2020/10/30/prezident-uzbekistana-utverdil-konsepsiyu-razvitiya-nauki-do-2030-goda>)

Goal: to accelerate the development of industries and social spheres, make extensive use of scientific and innovation potential with full mobilisation of scientific, intellectual and financial resources, identify priorities for continuous reform of science for the future, train strong-minded highly-qualified personnel with modern knowledge, and raise the work on modernisation of scientific infrastructure to a whole new level.

4.2.2. National strategies, policies and development programmes under development:

The project of the State Programme “Year of Youth Support and Public Health Promotion”, 2021 and beyond.

In the field of the bioeconomy, the following key measures and events are planned:

- Designing the programme for the **development** and reproduction of the **mineral and raw material base** of the country;
- Acceleration of the integration of science and practice with the introduction of fundamental, scientific, practical and innovative research, as well as modern international standards based on a scientific cluster established at the University of Geological Sciences;
- **Improvement of crop yields and efficiency** in agriculture;
- Improvement of crop breeding, **seed and seedlings farming system**, introducing a mechanism to provide buyers with guaranteed seeds and seedlings;
- **Modernisation and digitalisation of agriculture**, land fertility improvement, the introduction of modern agricultural solutions;
- **Increase of the harvest of meat, dairy, fish and eggs** to ensure the population's food security;

- **Arrangement of cluster activities of subsistence farming** in 32 districts of the country specialised in the cultivation of fruit and vegetable products to arrange a comprehensive service of subsistence farms of the population (<https://2021.strategy.uz/ru>).

Goal: improving labour productivity, product competitiveness, resource management, food security and safety of the country's population, and ultimately achieving stable growth in the country's macroeconomic performance.

4.3. International treaties, agreements, memorandums, and other understandings having impact on Uzbekistan initiatives associated to areas/fields of the bioeconomy

Uzbekistan in the system of international relations

Uzbekistan has more than a dozen United Nations (UN) programmes, foundations and agencies, including specialised agencies such as the United Nations Development Programme (UNDP), the Population Fund (UNFPA), the Children's Emergency Fund (UNICEF), the World Health Organization (WHO), the Educational, Scientific and Cultural Organisation (UNESCO), the United Nations Economic Commission for Europe, the Organization for Industrial Development, the Environmental Protection Programme and the European Economic Commission, the Office for Drugs and Crime, the Joint Programme for HIV/AIDS, the Department for Gender Equality and Women's Empowerment, the Regional Centre for Preventive Diplomacy for Central Asia, the International Labour Organisation (ILO), and the United Nations Food and Agriculture Organisation.

To promote new initiatives and joint projects, Uzbekistan is implementing a road map to further develop mutual cooperation with the UN. <http://uza.uz/posts/179877>

Delegation of the European Union (EU) in the Republic of Uzbekistan:

- Promotes bilateral relations in the political, economic and trade cooperation, as well as cooperation in the field of financial and technical assistance, in particular, to implement the provisions of the Partnership and Cooperation Agreement, as well as the European Union's Strategy for Central Asia;
- Introduces and protects the values and interests of the EU;
- Promotes cooperation with the EU at the state and regional level in Central Asia;
- Supports and raises awareness of the EU's activities and understanding of its goals and tasks. <https://old.jahonnews.uz/ru/cooperation/international>

Food and Agriculture Organisation (FAO)

FAO provides support in three priority areas agreed with the Government of Uzbekistan:

- Institutional and strategic support for the Ministry of Agriculture and other government agencies;
- Development of agriculture and the food and supply chain and market access;
- Sustainable management of natural resources, climate change and biodiversity.

The institution responsible for communication and implementation of joint actions: the Ministry of Agriculture, the Ministry of Water Economy, and others. <http://www.fao.org/home/en>

Separate projects and agreements between Uzbekistan and the FAO.

The implementation of the FAO projects together with Uzbek partners is aimed at improving the sustainability and efficiency of agriculture and improving the standard of living of the rural population. In particular, the signed agreements provide for the introduction of the latest solutions into the greenhouse industry, strengthening pest control, and adaptation to new realities during the pandemic.

1. “Smart farming for the next generation”. The overall goal is to initiate and promote smart and sustainable production, post-harvest processing and marketing of crops produced in greenhouses. The project will enable industry specialists and small landowners to master advanced production technology and learn high-quality and safe marketing of agricultural products. The introduction of new solutions in greenhouse horticulture will increase yields and profits.

2. The project aims to improve the locust control in six Central Asian countries, including Afghanistan. The result will be an improved locust control at the national and regional levels in Central Asia through sustainable regional cooperation and an effective pest control preventive strategy, as well as improved knowledge and best practices in the field. <https://www.uzdaily.uz/ru/post/54838>; <https://www.gazeta.uz/ru/2020/09/04/fao/>

Uzbekistan's participation in the **Food Systems Summit** opens up a number of new opportunities for Uzbekistan:

- increased cooperation with international organisations on implementing joint measures in the reorganisation of food systems;
- participation at and contribution to proposals on transforming food systems on a regional and global scale;
- opportunity to inform the world community about the country's food security policy and share its experience and achievements in successful reform of the agricultural industry;
- opportunity to further strengthen the cooperation and initiatives of the state in exchanging information with Kazakhstan.

Reporting systems for sustainable forest management in the Caucasus and Central Asia

A project aimed at strengthening national capacity has been approved for funding by the United Nations Development Account (UNDA) under the 10th tranche. The project's time frame is from 2016 to 2020. The aim of this project is to strengthen national capacity in five target countries (Armenia, Georgia, Kazakhstan, Kyrgyzstan and Uzbekistan) to develop national criteria and indicators (CI) and reporting or reporting systems for sustainable forest management (SFM).

The project is expected to encourage more active participation by target countries in international processes related to forests and promote sustainable development of the sector in the context of the green economy. National criteria and indicators for SFM will serve as a tool to spread information on the importance of forests that relate to the environment, as well as the social and economic situation at national, regional and international levels.

<https://unece.org/ru/node10/sistemy-otchetnosti-dlya-ustoychivogo-upravleniya-lesami-na-kavkaze-i-v-centralnoy-azii>

4.4. Other public sector stakeholders involved in strategic and policy planning and implementation or monitoring

No	Title of the institution	Higher education , science and research	Food-related agriculture	Food processing	Agriculture for other industries (textile, etc.)	Forestry	Aquatics	Environmental issues	Biobased engineering and production	Digital issues	Innovation and technological development	Role of an institution in the bioeconomy ecosystem, possible contribution into development and further provision of new curricula
1	Ministry of Agriculture	+	+	+	+	+	+	+	+	+	+	Implements a unified government policy on agriculture and food security; develops comprehensive targeted, industry and territorial programs; ensures the close integration of education, science and agricultural industry
2	State Veterinary Service	+	+	+	-	-	-	+	+	-	+	Participates in the development of strategies and policies, makes suggestions and recommendations; carries out state veterinary supervision
3	State Forest Service	+	-	-	-	+	-	+	-	-	+	Develops and implements policies and strategies for the forestry development program in the country.
4	Ministry of Water Economy	+	-	-	-	-	+	+	-	-	+	Develops and implements policies and strategies for water management, irrigation and land reclamation
5	Ministry of Innovation Development	+	-	-	-	-	-	-	-	+	+	Identifies the main paths and priorities of the development of science, technology, and innovation and supports scientific and innovation activities in the country through grants, start-up projects and tenders



6	Ecology and Environmental Protection Committee	+	-	-	-	-	-	+	-	-	-	Develops and implements environmental management and protection policies and strategies and oversees the use of natural resources
7	Ecological Party							+				Is involved in the development of strategies and policies in the said area; gives recommendations and suggestions
8	State Inspectorate of Quality Assurance of Education	+										Monitors the quality of education, determines the rating of higher education institutions, conducts certification and accreditation of the country's higher education institutions
9	"Uzstandard" Agency	+		+								Sets standards and regulations, monitors compliance with standard regulations, approves and registers state standards

4.5. SWOT analysis of policy framework and public sector stakeholders, conclusions and recommendations

The bioeconomy sector is growing in Uzbekistan, the government is paying attention to diversify agricultural and bioresources production in the country. The government issued a several legislative acts to support bioeconomy sectors and education, e.g. the agricultural strategy of development until 2030, a strategy of transforming of 'green economy of Uzbekistan' until 2030, or agrarian education development strategy until 2030, etc. Science driven and practical oriented strategy is being implemented in education.

4.5.5. SWOT analysis of the bioeconomy related policy framework and stakeholders

Strengths	Weaknesses
▪ Adopted national strategy transforming 'green economy'	▪ No statistical data to analyse current condition of bioproducts
Opportunities	Threats
▪ Increasing biomass forcing use and processing of biowastes	▪ The adopted legislative acts do not work because of the growth of economy

4.5.6. Conclusions and recommendations regarding the bioeconomy related policy framework and public sector stakeholders

Uzbekistan has developed the conceptual basis for the strategic development of certain areas of bioeconomy, but they are of an industrial nature and focus. Therefore, Uzbekistan should develop a common strategy for the development of bioeconomy over the long-term on the basis of an integrated approach, covering the entire field of bioeconomy and related industries including staff training in this area. Government mechanisms should also be developed to support and regulate the development of the bioeconomy in Uzbekistan.

The main areas of the bioeconomy development in Uzbekistan are as follow:

- crop, livestock, fish farming and aquafarming development based on: introduction of new machinery and solutions, development of breeding and seed farming, and increase of soil fertility and livestock productivity;
- ensuring the growth of biomass production and processing, as well as the development of household and other waste recycling;
- expanding the use of hydro, wind and solar energy for accelerated growth in the agricultural sector in order to achieve food security and security of the country's population by increasing the energy security of this sector of the economy;
- expanding exports of high-value-added agricultural products;
- ensuring the environmental safety of agricultural production and the rational management of land, water and other resources including waste;
- ensuring faster growth of new production capacities and increasing employment by creating new capacities;
- strengthening the development of the bioeconomy sectors through staff training and retraining based on the best practices of foreign universities and cooperation of universities with manufacturing enterprises in the implementation of training programmes.

5. SUMMARY, MAIN CONCLUSIONS and RECOMMENDATIONS

Uzbekistan has the strategies and policies related to the bioeconomy development. They are both similar to and different from the EU bioeconomy strategy and policy, and national strategies and policies of the EU countries as well. Curricula of the programme should include a broader context of the strategies and policies related to the bioeconomy development.

The universities are experienced in having joint curricula and that gives a fruitful platform for joint bioeconomy curricula of four universities. The UZ universities are ready to adapt circular bioeconomy principles in curricula. Policies and other topics should be localized to have the UZ perspective and more international perspective.

In business development perspective, more UZ expertise is needed to get understanding of how to encourage the students towards entrepreneurship and to introduce local tools and initiative to promote new businesses.

Geographical differences of each country require specific knowledge in sustainable crop and livestock production and consumption, sustainable forestry, sustainable fisheries and aquaculture, etc. So, teaching of study courses will require the competencies of Uzbekistan and EU partners' teachers.

In UZ, more attention could be paid to the waste reduction in the processes of the bioeconomy and in social perspective in general. UZ emphasizes bioenergy but has a low interest in stream utilization and circular

economy in general. Expanding the use of hydro, wind and solar energy should not be included in curricula of the programme because these sectors are not bioeconomy sectors.

Number of small farms is remarkable, and the quality of the products can be approved and give additional value. EU partners can give fruitful view on the EU markets. Forestry in UZ is quite different from European forestry and the EU partners are likely not able to give additional value to forest management practices except in theory. Fishery in UZ is unique and the additional expertise offered by the EU partners should be discussed. Focus should be made on waste recycling, environmental management and protection.

6. ANNEXES

No 1 – EXPLANATION of ABBREVIATIONS and TERMS USED in the DOCUMENT

<i>Abiotic resources</i>	Resources available in the nature but not derived from living organisms, for example, soil
<i>Biorefinery</i>	Using biomass instead of oil for producing energy and chemicals
<i>Bioresources</i>	Non-fossil biogenic resources which can be used by humans for multiple purposes: to produce food, substantial products, and/or energy carriers
<i>Biotic resources</i>	Resources related to or resulting from living organisms, for example, plants, animals
<i>B2B</i>	Business-to-business
<i>B2C</i>	Business-to-customer
<i>Farm</i>	A farm or an agricultural holding, or holding is a single unit, both technically and economically, operating under a single management and undertaking agricultural activities within the economic territory of the European Union, either as its primary or secondary activity. Non-agricultural products and services may also be provided by the holding https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Agricultural_holding
<i>Farmer</i>	An individual (or group of individuals e.g. partnerships, companies, and other legal structures through which a business is conducted) whose holding is situated within the territory of the European Union and who exercises an agricultural activity https://ec.europa.eu/agriculture/glossary_en#glossary-f
<i>Innovation</i>	Innovation is a process in which new scientific, technical, social, cultural or other ideas, developments and technologies are implemented in a marketable and competitive product or service
<i>Innovation ecosystem</i>	Innovation ecosystem is the term used to describe the large number and diverse nature of participants and resources that are necessary for innovation. These include “entrepreneurs, investors, researchers, university faculty, venture capitalists as well as business development and other technical service providers such as accountants, designers, contract manufacturers and providers of skills training and professional development http://www.know-hub.eu/knowledge-base/videos/innovation-ecosystems-as-drivers-of-regional-innovation-validating-the-ecosystem.html
<i>Institutional memory</i>	The collective knowledge and learned experiences of a group. As turnover occurs among group members, these concepts must be transitioned. Knowledge management tools aim to capture and preserve these memories
<i>Knowledge-driven</i>	Knowledge-driven is one in which the generation and use of knowledge will come to play a major part in the creation of growth of the economy of the region, and wealth of its society today and in the future
<i>RDI</i>	Research, development and innovation
<i>RTD</i>	Research and technological development
<i>SMEs</i>	Small and medium enterprises according to the EU definition
<i>Start-up</i>	A company or project undertaken by an existing or potential entrepreneur to seek, develop, and validate a scalable economic model, product or technology
<i>SWOT</i>	Strengths, weaknesses, opportunities and threats

**No 2 – CVs of academic staff (template)**

1. <i>Name and surname:</i>																					
2. <i>University:</i>																					
3. <i>Year of birth:</i>																					
4. <i>Education, field of science:</i>																					
5. <i>Experience in university:</i>																					
6. <i>Other work experience (if there is any relevant besides work at HEI):</i>																					
7. <i>Core academic and research areas:</i>																					
8. <i>Research activities and main achievements:</i>																					
9. <i>The most significant and relevant publications during last 5 years period:</i>																					
10. <i>International academic experience:</i>																					
11. <i>International research experience:</i>																					
12. <i>Languages and their knowledge level:</i>	<p>Indicate knowledge on a scale of 1 to 5 (1 - excellent; 5 - basic)</p> <table border="1"> <thead> <tr> <th>Language</th> <th>Reading</th> <th>Speaking</th> <th>Writing</th> </tr> </thead> <tbody> <tr> <td>Uzbek</td> <td colspan="3">Mother tongue</td> </tr> <tr> <td>English</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Russian</td> <td></td> <td></td> <td></td> </tr> <tr> <td>...</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Language	Reading	Speaking	Writing	Uzbek	Mother tongue			English				Russian				...			
Language	Reading	Speaking	Writing																		
Uzbek	Mother tongue																				
English																					
Russian																					
...																					
13. <i>Digital skills:</i>	<p>Indicate skills: proficient – average – basic level</p> <ul style="list-style-type: none"> • Information processing - ... • Use of online-based communication tools - ... • Content creation, using computer – ... • Storage and downloading materials in Internet document storages – ... • Safety, problem solving – ... 																				

No 3 – Questionnaire: bioeconomy sectors and their knowledge needs from the point of view of bioeconomy-associated industries/sectors (refers to business, universities have to organise data gathering and development of the summary in section 3.2–3.4).

Area/sector
PRIMARY PRODUCTION SECTOR
Agriculture
Forestry
Fisheries and aquaculture

Area/sector
SECTORS, PRODUCING BIO-BASED PRODUCTS
Manufacture of food, beverages
Manufacture of bio-based textiles
Manufacture of wood products and furniture
Manufacture of paper
Manufacture of bio-based chemicals, pharmaceuticals, plastics and rubber (excluding biofuels)
Manufacture of liquid biofuels
Production of bioelectricity

Area/sector
SERVICES
Natural resources-based tourism
Natural resources-based health treatment
Services for environmental management and protection
Freshwater abstraction and supply services

Information about an enterprise /organisation

Name of company/organisation	
Year of establishment	
Number of employees (for enterprise)	
Number of member organisations	

1. Bioeconomy development perspectives and trends from perspective of related economic sectors

Which areas/sectors of the bioeconomy in Uzbekistan do you think have the greatest potential? Why? What are the arguments and considerations behind your opinion? *For example, raw material potential, demand in the regional/world market, etc.*

What are the main challenges of sectors having the highest development potential? Why? What are the arguments and considerations behind your opinion? *For example, lack of knowledge, lack of knowledgeable staff, too strict regulatory requirements, etc.*

2. Knowledge needs of the associated sectors of the bioeconomy considering sectors' development perspectives and trends

What kind of specialists/professionals your industry/sector/company needs? What kind of professional (product and/or technology related) knowledge, skills, competencies must they have?

What are the industry/sector/company knowledge/skills/competence needs related to technological development and innovation?

What are the industry/sector/company knowledge/skills/competence needs related to a sustainable management of the companies and their departments?

What are the industry/sector/company knowledge/skills/competence needs to introduce and maintain digital solutions?

What trends should be observed while developing higher education content in order to strengthen the industry/sector/company?

3. What are your suggestions?

What improvements would you suggest in order to develop and strengthen cooperation among industries/sectors and universities?

What improvements would you suggest in order to improve relevance of higher education to needs of your sector?

Thank you for your participation!

If you would like to take part in the further activities, please provide your contact information:

Name and surname:

E-mail:

Telephone:

**No 4 – List of other Uzbekistan’s universities providing study programmes
in the fields of science to be associated to the bioeconomy (in Russian)**

	Earth and related environmental sciences	
5140600	География	
	Национальный Университет Узбекистана	
	Андижанский Государственный Университет	
	Бухарский Государственный Университет	
	Каракалпакский Государственный Университет	
	Наманганский Государственный Университет	
	Самаркандский Государственный Университет	
	Термезский Государственный Университет	
	Ферганский Государственный Университет	
	Ургенчский Государственный Университет	
5141000	Почвоведение	
	Термезский Государственный Университет	
	Ферганский Государственный Университет	
	Ургенчский Государственный Университет	
	Каракалпакский Государственный Университет	
5410100	Агрохимия и агропочвоведение	
	Ташкентский Государственный Аграрный Университет Термезский филиал	
	Бухарский Государственный Университет	
	Гулистанский Государственный Университет	
	Каршинский Государственный Университет	
	Самаркандский Государственный Университет	
	Ташкентский Аграрный Государственный Университет Андижанский филиал	
	Ташкентский Государственный Аграрный Университет Нукусский филиал	
	Национальный Университет Узбекистана	
	Ташкентский Государственный Аграрный Университет	
5630100	Экология и охрана окружающей среды (по отраслям и сферам)	
	Ташкентский Государственный Технический Университет Термезский филиал	
	Андижанский Государственный Университет	
	Гулистанский Государственный Университет	
	Джизакский политехнический институт	
	Наманганский Государственный Университет	
	Наманганский инженерно-строительный институт	
	Ферганский Государственный Университет	
	Ургенчский Государственный Университет	
	Национальный Университет Узбекистана	
	Ташкентский Технический Университет	
	Ташкентский химико-технологический институт	
	Бухарский Государственный Университет	
	Каракалпакский Государственный Университет	
	Каршинский Государственный Университет	
	Каршинский инженерно-экономический институт	
	Самаркандский Государственный Университет	
	Ташкентский Государственный Транспортный Университет	

	Ташкентский архитектурно-строительный институт	
	Ташкентский институт инженеров ирригации и механизации сельского хозяйства Бухарский филиал	
	Ташкентский институт инженеров ирригации и механизации сельского хозяйства Каршинский филиал	
	Ташкентский институт инженеров ирригации и механизации сельского хозяйства	
	Ташкентский Государственный Аграрный Университет	
	Biological sciences classified under the natural sciences	
5140100	Биология (по видам)	
	Институт предпринимательства и педагогики Денау	
	Самаркандский Государственный Университет	
	Гулистанский Государственный Университет	
	Каршинский Государственный Университет	
	Термезский Государственный Университет	
	Ферганский Государственный Университет	
	Ургенчский Государственный Университет	
	Национальный Университет Узбекистана	
	Андижанский Государственный Университет	
	Бухарский Государственный Университет	
	Наманганский Государственный Университет	
	Каракалпакский Государственный Университет	
	Social and economic geography	
5140600	География	
	Национальный Университет Узбекистана	
	Андижанский Государственный Университет	
	Бухарский Государственный Университет	
	Каракалпакский Государственный Университет	
	Наманганский Государственный Университет	
	Самаркандский Государственный Университет	
	Термезский Государственный Университет	
	Ферганский Государственный Университет	
	Ургенчский Государственный Университет	
	Economics and business	
5230100	Экономика (по отраслям и сферам)	48 ВУЗы
5230200	Менеджмент (по отраслям и сферам)	
5230300	Управление бизнеса (по отраслям)	
5230400	Маркетинг (по отраслям и сферам)	
5230600	Финансы и финансовые технологии	
5230700	Банковское дело и аудит	
5230800	Налоги и налогообложение	
5230900	Бухгалтерский учет и аудит (по отраслям)	
5231000	Экономика зарубежных стран и страноведение	
5231100	Мировая экономика и международные экономические отношения (по регионам и видам деятельности)	
5231200	Страховое дело	
5231300	Бюджетный контроль и казначейство	

5231400	Статистика (по отраслям и сферам)	
5231500	Оценочное дело	
5231600	Управление человеческими ресурсами	
5231700	Биржа труда	
5231800	Бизнес-анализ	
5231900	Корпоративное управление	
5232200	Эконометрика	
5232300	Региональная экономика	
5232400	Экономическая безопасность	
5232500	Логистика (по направлениям)	
5232700	Обслуживание и финансирование инвестиционных проектов	
5232800	Электронная коммерция	
5233000	Организация и управление водными ресурсами	
5233300	Агробизнес и инвестиционная деятельность	
5233500	Международная экономика и менеджмент (по регионам и направлениям деятельности)	
5233600	Торговый бизнес (по видам)	
5234100	Цифровая экономика (по отраслям и сферам)	
5234400	Международные валютно-кредитные отношения	
	• Veterinary science	
5440100	Медицинская ветеринария (по видам деятельности)	
	Ташкентский Государственный Аграрный Университет Андижанский филиал	
	Ташкентский Государственный Аграрный Университет Термезский филиал	
	Самаркандский институт ветеринарной медицины Ташкентский филиал	
	Самаркандский институт ветеринарной медицины	
	Ташкентский Государственный Университет Нукусский филиал	
	Самаркандский институт ветеринарной медицины Нукусский филиал	
5440200	Ветеринарные препараты	
	Самаркандский институт ветеринарной медицины	
5440300	Ветеринарная диагностика и лабораторные работы	
	Самаркандский институт ветеринарной медицины Ташкентский филиал	
	Самаркандский институт ветеринарной медицины Нукусский филиал	
	Самаркандский институт ветеринарной медицины	
5440400	Ветеринарно-санитарная экспертиза	
	Самаркандский институт ветеринарной медицины Ташкентский филиал	
	Самаркандский институт ветеринарной медицины	
	Agricultural biotechnology	
5320500	Биотехнология (по отраслям)	
	Самаркандский институт ветеринарной медицины	
	Ташкентский Государственный Аграрный Университет	
	Animal and dairy science	
5410600	Зооинженерия (по видам)	
	Ташкентский Государственный Университет Андижанский филиал	
	Ташкентский Государственный Университет Термезский филиал	
	Самаркандский институт ветеринарной медицины Ташкентский филиал	
	Самарканд ветеринария медицинаси институти	
	Наманганский Государственный Университет	

	Ташкентский Государственный Университет Андижанский филиал	
	Ташкентский Государственный Университет Нукусский филиал	
	Ташкентский Государственный Аграрный Университет	
	Самаркандский институт ветеринарной медицины Нукусский филиал	
	Ферганский Государственный Университет	
	Ташкентский Государственный Аграрный Университет	
	Ташкентский Государственный Аграрный Университет Андижанский филиал	
	Самаркандский институт ветеринарной медицины Нукусский филиал	
	Ташкентский Государственный Аграрный Университет Нукусский филиал	
	Ташкентский Государственный Университет Нукусский филиал	
	Самаркандский институт ветеринарной медицины Нукусский филиал	
5411400	Технология переработки продуктов животноводства	
	Самаркандский институт ветеринарной медицины	
	Agriculture, forestry, and fisheries	
	Other agricultural sciences	
5410100	Агрохимия и агропочвоведение	23 ВУЗы
5410200	Агрономия (по видам сельхоз продукциям)	
5410300	Защита растений (по типу культуры)	
5410400	Селекция семеноводство сельскохозяйственных культур (по видам культур)	
5410500	Технология хранения и первичной обработки сельхозпродукции (по видам продукции)	
5410700	Земельный кадастр и землепользование	
5410800	Лесное хозяйство	
5410900	Тутовый шелкопряд	
5410601	Зооинженерия: Рыболовство	
5410900	Тутовый шелкопряд	
5411000	Садоводство и виноградарство	
5411100	Технология выращивания и обработки лекарственных растений	
5411200	Декоративное садоводство и садоводство	
5411300	Растениеводство (растениеводственное чуйское пастбище)	
5411400	Технология по переработке продуктов животноводства	
5411500	Карантин растений и сельхозпродукции	
5411600	Овощеводство, садоводство и картофель	
5411700	Организация и управление теплицами	
5430100	Механизация сельского хозяйства	
5430300	Техническая служба в сельском хозяйстве и водном хозяйстве	
5450200	Водное хозяйство и мелиорация	
5450300	Механизация водного хозяйства и мелиорации земель	
5450400	Использование гидротехнических сооружений и насосных станций	
5450500	Мелиоративная гидрогеология	
5450600	Гидроэнергетические объекты в ирригационных системах	
5450700	Инженерные системы водоснабжения	
5450800	Инновационные технологии и их использование в управлении водными ресурсами	
	Engineering and technology:	
5310100	Энергетика (по отраслям)	

5310200	Электроэнергия (по отраслям и направлениям)	
5311100	Гидроэнергетика	
5311200	Инновационные технологии дистанционного зондирования земли	
5311800	Гидрогеология и инженерная геология	
5311900	Нефтегазовый бизнес (по деятельности)	
5312100	Энергосбережение и энергоаудит	
5312400	Альтернативные источники энергии (по видам)	
5312500	Энергетика (по отраслям)	
5313000	Биомедицинская инженерия	
5320400	Химическая технология (по видам производства)	
5320500	Биотехнология (по отраслям)	
5321000	Пищевая технология (по видам продукции)	
5321200	Технология первичной обработки наткральных волокон (сырьем и технологическим трудом)	
5321300	Технология переработки нефти и газа	
5321400	Технологии нефти-газовой отрасли	
5321500	Технологии и оборудование легкой промышленности (по видам продукции)	
5321700	Информационно-коммуникационные системы для управления технологическими процессами	
5322200	Технология глубокой переработки газа	
5322400	Технология масел, эфирных масел и парфюмерной косметики	
5322500	Технология виноделия, пивоваренной продукции и безалкогольных напитков	
5322700	Консервная технология	
5322800	Функциональное питание и технология детского питания	