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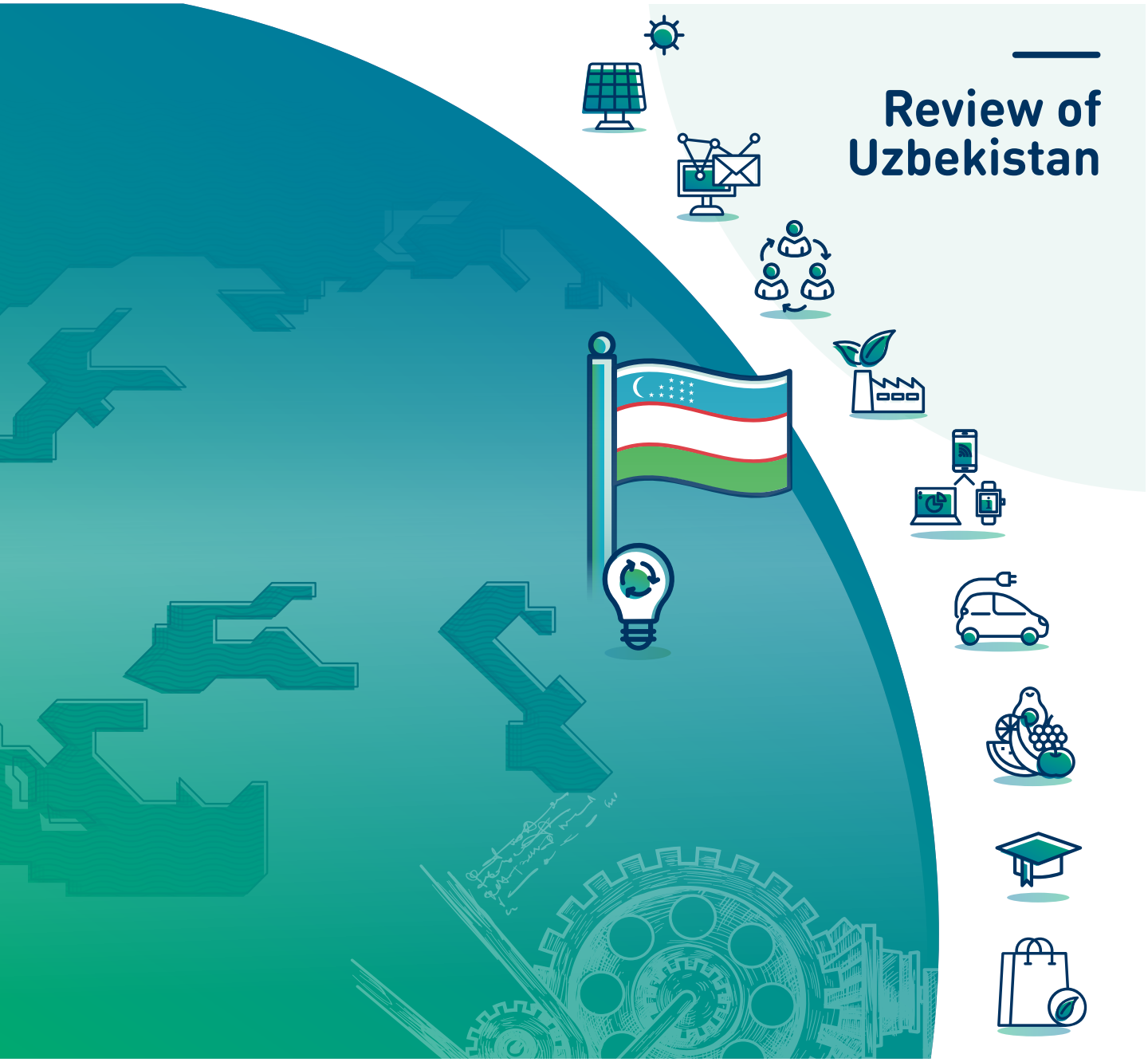
Innovation for Sustainable Development

Review of Uzbekistan



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Review of Uzbekistan

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FOREWORD

Uzbekistan has embarked on an array of reforms in recent years, focusing on spurring private sector development, improving competitiveness and opening up to trade and investment, including negotiations for accession to the World Trade Organization. In this context, the Government has also put innovation, which lies at the heart of the United Nations 2030 Agenda and the Sustainable Development Goals (SDGs), high on the political agenda: it established the Ministry of Innovative Development and introduced new legislation as well as various support mechanisms to promote start-up creation and entrepreneurship. To sustain long-term growth and capitalize on the momentum for innovation-led growth emerging from recent reforms, Uzbekistan needs to foster systematic experimentation with new ideas to diversify and modernize the economy. Current challenges, such as environmental sustainability, inequality and most recently the COVID-19 pandemic, require policies and institutions to effectively support this dynamic.

This review takes an in-depth look at the factors that underpin innovation-led sustainable development in Uzbekistan. These factors include building on a wide range of opportunities to catch up with the most developed economies while avoiding, mitigating or compensating for the risks and challenges posed by structural transformation. The review serves to inform Uzbekistan's new Innovation Strategy 2022–2030 and complements the UNESCO study "Mapping Research and Innovation in the Republic of Uzbekistan".

Uzbekistan can build on several strengths in this endeavour. These include high levels of educational attainment, especially in science and engineering, and a strong legacy of public research with commercial potential. Yet skills shortages and mismatches in the labour market constrain private sector innovation. Stronger coordination as well as regular monitoring and assessment of research, innovation and private sector development policies and mechanisms will be important to ensure the efficacy of policies. At the same time, improving the capacities of the public and private sectors will be essential so as to enable them to absorb new knowledge and technology and put new ideas into practice.

UNECE advisory work in this area draws on its longstanding engagement across Central Asia, including under the overall efforts of the United Nations Special Programme for the Economies of Central Asia (SPECA). In 2019, the SPECA Working Group on Innovation and Technology for Sustainable Development adopted the Innovation Strategy for Sustainable Development, under which UNECE supports members through capacity-building activities and regional initiatives, and facilitates the overall exchange of best practices and experience in reaching the SDG targets.

Olga Algayerova

UNECE
Executive Secretary

PREFACE

Research, analysis and advisory work on innovation and competitiveness policies is part of UNECE work on economic cooperation and integration that aims to harness innovation as a driver of sustainable development. National reviews of innovation policy, carried out upon the request of member States, have developed significantly since their inception more than a decade ago and follow a recently updated methodology and approach that has resulted in the Innovation for Sustainable Development Reviews (I4SDRs). This new approach addresses national priorities under the United Nations 2030 Agenda for Sustainable Development.

The research for the first I4SDR of Uzbekistan began in March 2021 with a virtual consultation with national authorities and other stakeholders to agree on the scope of the review. National priorities for sustainable development were selected for in-depth consideration in two elective chapters on innovation infrastructure and science-industry linkages. The review provides detailed policy recommendations that reflect national specifics and sustainable development priorities.

The I4SDR is the result of in-depth dialogue and consultation among the UNECE Secretariat, leading subject matter experts, Government officials, academia, the private sector and other innovation stakeholders in Uzbekistan. In November 2021, the draft text was submitted for comments to the national authorities and to a group of independent international experts not involved in the review process. The findings and recommendations were endorsed by national stakeholders in November 2021. The final text of the review reflects the outcome of these discussions as well as other comments and suggestions from various stakeholders.

Prepared for publication by the UNECE Secretariat, the I4SDR complements other workstreams undertaken by the UNECE Economic Cooperation and Trade Division to support countries in harnessing the power of trade, infrastructure investment and financing and innovation for sustainable development and economic circularity. These workstreams include the Studies on Regulatory and Procedural Barriers to Trade, agricultural quality standards, trade facilitation standards and recommendations, and normative guidance for public-private partnerships.

This I4SDR of Uzbekistan also incorporates findings and recommendations of the third Environmental Performance Review (EPR) of Uzbekistan in 2020, which examined environmental policy frameworks and compliance assurance mechanisms, including government efforts to green the economy, monitor environmental performance, achieve public participation and improve education.

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The publication was written under the leadership of Elisabeth Tuerk, Director of the UNECE Economic Cooperation and Trade Division, and under the overall supervision and guidance of Anders Jönsson, Chief of the UNECE Innovative Policies Development Section. The project was managed by Jakob Fexer, UNECE Economic Affairs Officer. The authors of the chapters are Immanuela Badde and Anders Jönsson (executive summary, chapter 1); Immanuela Badde (chapter 2); Immanuela Badde and Dmitry Plekhanov (chapter 3); Nadejda Komendantova (chapter 4); and Slavo Radosevic (chapter 5). Immanuela Badde provided coordination support throughout the project. Rauf Salahodjaev, a national consultant, provided essential background research. Ludmila Boichuk provided technical and administrative assistance throughout the project. Lise Lingo copyedited the text, and Thierry Alran designed and laid out the publication.

The continuous engagement of the MoID, the lead national partner for this review, has been essential throughout the process. Special thanks go to Shukrat Otajonov, Head of the Department for the Formation and Monitoring of Programmes of Scientific and Innovation Activities, MoID. The project was coordinated with the valuable support of Askar Mirsaidov, Adviser at the Permanent Mission of Uzbekistan to the United Nations Office and other international organizations in Geneva. The UN Resident Coordinator Office of Uzbekistan and UNDP in Uzbekistan provided useful support at various stages.

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ABBREVIATIONS

ADB	Asian Development Bank
BEEPS	Business and Enterprise Performance Survey
CAWG	Central Asia Working Group
EBRD	European Bank for Reconstruction and Development
ECA	Europe and Central Asia
EDA	Entrepreneurship Development Agency
FEZ	free economic zone
FDI	foreign direct investment
GDP	gross domestic product
GERD	gross expenditure on research and development
GII	Global Innovation Index
GVC	global value chain
HEI	higher education institution
ICT	information and communication technology
IHGE	innovative, high-growth enterprises
IP	intellectual property
LMEs	large and medium enterprises
MoDICT	Ministry of Development of Information and Communication Technologies
MoHSSE	Ministry of Higher and Secondary Specialized Education
MoID	Ministry of Innovative Development
MoPE	Ministry of Public Education
MUNIS	Modernization of Uzbekistan's National Innovation System (World Bank project)
NIS	national innovation system
OECD	Organization for Economic Co-operation and Development
PPP	public-private partnership
PRO	public research organization
R&D	research and development
SDGs	Sustainable Development Goals
SIL	science-industry linkages
SMEs	small and medium-size enterprises
SMFs	small and micro firms
SOE	State-owned enterprise
STI	science, technology and innovation
STP	science and technology park
UNCTAD	United Nations Conference on International Trade and Development
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization

EXECUTIVE SUMMARY

Table 0.1 Overview of main messages

Sustaining reforms and promoting systematic innovation as an essential driver for sustainable development in Uzbekistan

- Uzbekistan stands out among newly independent countries in the region for avoiding significant slumps and retaining a relatively diversified economy in its gradual transition.
- Over the past five years, Uzbekistan has revamped reform efforts by engaging in broad, ambitious economic reforms to open up the economy, boosting growth and investment.
- Existing drivers of growth are reaching the point of diminishing returns, highlighting the need for innovation policy to enable and encourage the economy to diversify and tackle remaining structural challenges.
- Addressing diversification and structural challenges through innovation will require creating a conducive business environment, strengthening market competition and supporting firms in absorbing and adapting ideas, business models and technologies that have proven their viability in other countries or sectors more systematically.
- The country has significant potential for innovation and can build on several strengths, including a qualified workforce, competitive wage levels and public research, as well as opportunities such as services trade and the digital economy.
- Several factors leave significant potential for innovation untapped: low levels of expenditure on research and development (R&D), the weak role of R&D and innovation in the private sector, the skills gap in the labour market, and low levels of absorptive capacity among firms in the private sector.

Improving the effectiveness of policy governance and mechanisms in the national innovation system

- In recent years Uzbekistan has shown strong political commitment to innovation, introducing a wide array of policy institutions, strategies and support mechanisms to nurture the nascent national innovation system (NIS).
- Innovation does not yet happen systematically, as the efficacy of the NIS is constrained by fragmented innovation policy, with relatively scant coordination mechanisms and little inclusion of the private sector; this hinders synergies and alignment with relevant policy areas.
- The coordination of policies is limited and mandates among public institutions unclear. This leads to duplicated functions and fragmented efforts and resources. Institutional capacities to systematically scout needs, constraints and opportunities among innovation stakeholders are underdeveloped.
- Feedback from the private sector is not yet sufficiently reflected when monitoring, assessing and evaluating innovation policy, an essential element in ensuring that policy interventions are effective and address challenges in the policy agenda.
- Targeted innovation policy mechanisms that complement innovation policy governance will defray risks and incentivize experimentation for innovation but are not yet fully effective. Greater coordination is required if such mechanisms are to provide the desired impacts.
- Uzbekistan does not yet systematically and effectively put into practice the principles of evidence-based policymaking to ensure the effectiveness of innovation policy. This is due in part to insufficient monitoring and evaluation processes and in part to the lack of reliable, nuanced, timely and internationally comparable statistics on innovation.

Strengthening the innovation infrastructure to support innovation-led growth

- Uzbekistan has set ambitious targets and made significant policy efforts to develop its innovation infrastructure, including by establishing free economic zones (FEZs) and science and technology parks (STPs), and expanding start-up support, such as innovation centres, incubators and accelerators.
- Although recent efforts indicate significant progress, the infrastructure is at an early stage of development and measures do not yet support innovative activity effectively.
- Challenges of the current infrastructure include weak framework conditions, underdeveloped logistical infrastructure and related critical infrastructure support for FEZs, sparse linkages between initiatives, low levels of participatory governance, a limited regulatory framework for digitalization and regional integration, and a lack of capacity in providing services for start-ups.
- To ensure that mechanisms in the innovation infrastructure effectively support innovative activity, policymakers will need to examine the impact of existing measures, gradually reforming those that are not effective and scaling up those that are successful.

/...

Table 0.1 Overview of main messages (Concluded)

Enhancing science-industry linkages among research, academica, the private sector and foreign technology providers
• Public applied R&D is driven by problem-solving needs related to activities of State-owned enterprises (SOEs), including adapting imported technology to local conditions. • A central feature of the current triple helix model[a] in Uzbekistan is that R&D activity is largely extramural; it is not yet fully driven by market demand and increasingly focuses on basic research and downstream activities, such as science and technology services. • Although the current SIL model stimulates local production and diversification, it is not fully effective as it requires significant investment and largely misses realizing potential in innovation, specialization, economies of scale and export competitiveness. • As the economy liberalizes, privatizes and opens up, policy needs to enable institutional transformation to a more flexible, dynamic model of SIL, one that can build on a range of opportunities such as those afforded by trade and investment openness, requiring significant change in the capabilities of firms and public research organizations (PROs). • The emerging triple helix model would also benefit from a greater role for foreign technology providers and a greater intermediary role of PROs, to increase knowledge and technology transfer for upgrading in the private sector.

Source: UNECE.

[a] The triple helix model refers to relevant interactions between academia, industry and government to foster innovative development.

To sustain growth following recent reforms in Uzbekistan, innovation will be central to tackling structural challenges

After independence, Uzbekistan avoided much of the slump in output and the de-industrialization common among the States emerging out of the Soviet Union. **Since 2015, the country has engaged in large-scale reforms to open up the economy, lifting constraints on foreign exchange, investment and trade at a rapid pace.** Although this has triggered growth and investment, sustaining that growth will be more difficult. The current growth drivers are running out of steam, and Uzbekistan remains reliant on low value added commodity exports with fluctuating prices, large productivity gaps across sectors and a lack of market competition.

Important for sustainable development and the transition to a circular economy is the ambition to diversify and upgrade production, especially in tradable sectors. This, in turn, requires innovation – or trying out new ideas more systematically to discover what works and what does not. Innovation entails the generation and effective transfer of knowledge and technologies, encouraging increased value creation for growth and employment and the overall prosperity of the country. This calls for creating a conducive business environment, improving market competition and strengthening the private sector with solid capacities to absorb innovation. In recognition of these challenges, the Government has demonstrated strong political commitment to economic reform, sustainable development and, more recently, digitalization and innovation policy. Not only has the Government announced a new national development strategy for 2022–2026, but also it has drafted a new national innovation strategy for 2022–2030.

Harnessing the potential of incremental innovation involves a catalytic role for public research, the right skills and stronger absorptive capacities in the private sector

Uzbekistan has several strengths, including high levels of educational attainment, especially in science and engineering; a legacy of public research with commercial potential; and a relatively diversified production structure, including in complex sectors

such as automotive assembly. Challenges to innovation remain, reflected in the low levels of expenditure on R&D (about 0.2 per cent of gross domestic product), the weak role of R&D and innovation in the private sector, and the skills gap in the labour market, leaving significant potential for research and commercialization untapped. **Education does not meet the demand of the labour market – an unexploited opportunity, given the large share of youth in the population.** Low enrolment rates as well as insufficient quality in higher education highlight the need to strengthen support for educational reform. Ensuring that planned increases in R&D investment have a catalytic effect will require that they be accompanied by R&D governance reforms and strengthened linkages with other innovation stakeholders.

For Uzbekistan, a lower-middle-income economy, significant potential benefits lie in incremental innovation: importing, absorbing and adapting knowledge and technology from abroad – products, services and processes that have already successfully worked elsewhere. **Yet absorptive capacity is still underdeveloped, impeding firms, especially innovative high-growth enterprises (IHGEs), from acting as agents for experimentation.** UNECE recently launched a policy handbook that provides recommendations to policymakers on how to shape targeted and strengthened public support for IHGEs for innovation-led growth in Eastern Europe and the South Caucasus and is currently developing one for Central Asian countries.[1]

Nurturing the nascent NIS calls for a holistic approach to innovation governance

Building on the country's innovative potential, Uzbekistan has set up various institutions and introduced a wide array of public support mechanisms to drive innovation in the economy. Most notably, in 2017 the Government established the Ministry of Innovative Development (MoID), the main actor tasked with leading and coordinating innovation policy support. The national innovation system (NIS), however, is still nascent. **Innovation does not yet happen systematically as policies are fragmented, lack positive synergies and coordination, and do not always address challenges for sustainable development, thus inhibiting effective medium- and long-term planning of policy.** Therefore, in light of the new innovation strategy (2022–2030), it will be crucial to review initiatives introduced and examine their impact on innovative activity to see what does not work and to scale up what does. In further support for digitalization, economic circularity and environmentally sustainable development, UNECE has launched the third *Environmental Performance Review of Uzbekistan*,[2] which provides recommendations on how to strengthen environmental management and performance. UNECE is also currently engaging closely with the country on innovation policy at a subregional level through the United Nations Special Programme for the Economies of Central Asia (SPECA) under the Innovation Strategy for Sustainable Development.[3]

Coordinating policy in areas relevant to nurturing innovation and the NIS is central to developing and putting into practice a coherent agenda, ensuring synergies are created, measuring impact and managing overlaps and trade-offs. Limited coordination of policies and unclear mandates among public institutions, however, lead to duplicated functions and fragmented efforts and resources. For example, in 2019 the Government set up the Republican Council of Science and Technology, chaired by the

Prime Minister. Yet the members do not include a wide range of stakeholders relevant to innovation policy. In addition, there is a shortage of public skills for innovation, usually confined to experts who have worked abroad. To improve innovation policy design and administrative implementation capacities, this shortage must be addressed.

When monitoring, assessing and evaluating innovation policy, it will be critical to reflect feedback from the private sector so as to ensure that policy interventions are effective and fully exploit the potential to address challenges and developments in the policy agenda. For this reason, the Government needs to focus on engaging the private sector across stages of policymaking from ad hoc evaluations to interim assessments and ex-post evaluations. Piloting such engagement initiatives in two or three sectors, such as in information and communication technology, or in dedicated socioeconomic challenges would enable policymakers to identify the most effective mechanisms. These could then be scaled up in other sectors and for other challenges to innovation-led sustainable development.

Building and reinforcing the absorptive capacity of firms and promoting entrepreneurship is crucial to innovation-led growth

Complementary to the right governance of innovation policy, the right policy mechanisms need to be introduced. Such mechanisms defray the risks of innovation and incentivize experimentation across the economy, especially among start-ups and small and medium-size enterprises (SMEs). Although such mechanisms are being introduced, obstacles remain.

Essential to innovation is equipping firms with the necessary skills and capacity to identify, absorb and integrate external knowledge and technologies – to try out new ideas. Many SMEs lack the managerial and organizational skills needed to improve productivity and competitiveness, a challenge not yet adequately addressed by policy mechanisms. Efforts need to be put forth through sustainable and targeted programmes as well as through educational reform to address skills gaps, moving towards systematically building such skills and expanding the "missing middle" of enterprises capable of absorbing ideas for innovation. Further supporting the acquisition of knowledge and technology will require Uzbekistan to reinforce ongoing efforts to diversify and facilitate access to early-stage finance for innovation.

Elements such as incubators, accelerators and innovation centres are becoming available within the start-up ecosystem, paving the way for the emergence of a vibrant start-up scene. **As noted by other science, technology and innovation (STI) studies in the country, the flurry of initiatives is largely donor-driven and occurs with little coordination or synergy.** For effective, sustainable policy support, the Government needs to ensure the coordination of donor-funded and national initiatives that support innovation and to establish effective processes to monitor, evaluate and scale up initiatives that prove to have a positive impact on innovation.

Strengthening the collection and use of national statistics on innovation is an essential element in ensuring evidence-based decision-making in the policy cycle

Innovation is inherently unpredictable. This characteristic amplifies the need to introduce the right policy mechanisms to provide a conducive environment for systematic

experimentation – in other words, to enable and encourage innovation stakeholders to try things out on a small scale, to set clear performance criteria and to understand which policy support works well, in order to then scale up that support across the economy.

Fostering a culture of evidence-based policymaking through systematic approaches to monitoring, assessing and evaluating innovation policy initiatives can help ensure that policies create the desired impact. Currently, government authorities do not have the capabilities or expertise to assess and evaluate policy. Available mechanisms mostly target ad hoc assessments for receiving grants; other stages of policy evaluation are weakly developed or not present at all. Following international best practices and the principles of accountability and transparency, Uzbekistan should focus on ensuring consistent access to information on innovation for all stakeholders, streamlining reporting procedures to reduce the administrative burden and enabling public administrations to identify market failures, explore policy options and set clear performance criteria for innovation policy.

To continuously identify and address emerging opportunities and constraints in the NIS, timely, consistent and internationally comparable innovation statistics will be vital. The quality and accessibility of statistical data do not yet effectively support innovation policy. This insufficiency can impede public officials in monitoring and evaluating the impact of policy initiatives, hinder firms in their strategic planning and limit consensus-building in civil society on innovation matters. The Government has recently made efforts to address this challenge, such as working with international partners to harmonize national statistics with international standards as well as establishing the Centre for Scientific and Technical Information. Yet reforms are still in their infancy, so data sets on STI remain inconsistent and incompatible. Additional efforts will require both functional and structural reform of national statistics on STI to enable public and private stakeholders to implement innovation initiatives.

Sustaining, resourcing and enhancing innovation infrastructure are important to promote more systematic innovation across sectors

In line with its ambitions, Uzbekistan has in recent years expanded investments in innovation infrastructure. Although such steps are helpful, there is significant scope for further improvement, especially in measuring and evaluating the catalytic role played by public and donor support. The Government has increased the number of free economic zones (FEZs), expanded start-up support in the regions by establishing science and technology parks (STPs) in support of digitalization, and introduced innovation centres and business incubators to enable early-stage support for new firms. These efforts indicate solid progress, yet their effectiveness is impeded by remaining challenges, such as weak framework conditions, underdeveloped logistical and related critical infrastructure support for FEZs, sparse linkages between initiatives, low levels of participatory governance, a limited regulatory framework for digitalization and regional integration, and the lack of sustainable capacities in service provision for start-ups. In an additional effort to strengthen innovation infrastructure in Uzbekistan and other Central Asia economies, UNECE recently launched *Business Incubators for Sustainable Development in the SPECA Subregion*.[4] This handbook covers the key steps and considerations in setting up, running and evaluating business incubation programmes.

Science-industry linkages will be important to use the potential of public research to enable and promote innovation

Science-industry linkages (SIL) are central to a vibrant NIS. SIL use the potential of public research to trigger and support entrepreneurship and gradual innovation across the economy. **Although SIL exist in Uzbekistan to some extent, they are oriented towards solving production and technology problems of firms, rather than towards innovation and cooperation between R&D organizations and higher education institutions.** This poses challenges to SIL policy. A central feature of the country's triple helix model of interaction between science, industry and government is that R&D activity is largely extramural and not yet fully driven by market demand. To ensure the competitiveness of Uzbek firms in line with ongoing policy developments, such as economic liberalization and privatization, SIL will need to radically transform to meet new requirements for upgrading technology in the emerging triple helix model. This needs to be done by strengthening the capacities of R&D organizations and firms as well as increasing the involvement of foreign technology providers to ensure technology upgrading and knowledge transfer take place in the private sector.

Recommendations

To strengthen innovation-led growth in Uzbekistan, the I4SDR provides concrete policy recommendations, which will feed into the MoID's next innovation strategy, as well as the country's Green Growth Strategic Framework. The findings and recommendations of the I4SDR are intended to support the Government of Uzbekistan in shaping and improving innovation governance and to form the basis for further UNECE assistance.

Table 0.2 Overview of recommendations

Improving the effectiveness of policy governance and mechanisms in the NIS
Recommendation 3.1: Improve innovation policy coordination of initiatives across national and regional government authorities, and strengthen public capacities for effective design and implementation of policy.
Recommendation 3.2: Strengthen the participation of all ministries relevant to innovation, the private sector and civil society in designing, implementing and monitoring innovation policy initiatives.
Recommendation 3.3: Expand existing policy support for enhancing the absorptive capacity of the private sector to equip firms with managerial and organizational skills.
Recommendation 3.4: Promote start-up creation by ensuring sufficient coordination and awareness of innovation policy initiatives to exploit the entrepreneurial capacity of the broader population, including targeted support for female entrepreneurs.
Recommendation 3.5: Enable the functional and structural transformation of the national statistical system to provide policymakers, business and civil society with sufficient data on innovation.
Recommendation 3.6: Foster an evidence-based culture of innovation policymaking through a systematic approach to design and to monitoring, assessment and evaluation.

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Table 0.2 Overview of recommendations (Concluded)

Strengthening the innovation infrastructure to support innovation-led growth
Recommendation 4.1: Create the necessary framework conditions to strengthen the business environment and increase FDI in innovation projects, in order to facilitate innovative development.
Recommendation 4.2: Expand the infrastructure and administrative capacities of FEZs to improve their effective support for attracting FDI and channelling it to innovation projects, as well as facilitating the access of resident firms to GVCs, and strengthen governance processes to engage all relevant stakeholders in the decision-making processes of FEZ development.
Recommendation 4.3: Improve the effectiveness of innovation centres[a] and incubators[b] by clarifying strategic frameworks, providing support in developing sustainable capacities in service provision to start-ups and further facilitating access to finance.
Recommendation 4.4: Enhance the functioning of STPs[c] by improving and expanding regulatory frameworks to benefit from ongoing efforts towards digitalization and IT innovations.
Recommendation 4.5: Adequately equip accelerators with the necessary resources to provide comprehensive and effective support to foster start-up creation.
Enhancing science-industry linkages in Uzbekistan
Recommendation 5.1: R&D route to upgrading technology: Facilitate the development of IHGEs and the commercialization of public research by generating capabilities for innovation-based growth and gradually and actively restructuring the R&D system.
Recommendation 5.2: Local innovation route to upgrading technology: Unleash the latent potential for high-quality SME entrepreneurship by improving the quality of the middle-level skilled labour force and enhancing the production quality and innovation capabilities of firms across all sectors.
Recommendation 5.3: Technology transfer route to upgrading technology: Generate opportunities to use FDI and GVC integration as levers for upgrading technology and as mechanisms for accessing new technologies and learning from foreign partners.

Source: UNECE.

[a] Innovation development centres are seen as the bridges between science, academia and production that facilitate the implementation of scientific and innovative solutions in various economic sectors.

[b] In Uzbekistan there are two kinds of incubators: business incubators and technology incubators. Business incubators are considered to be a promising policy mechanism for supporting entrepreneurship throughout the initial steps of the innovation development life cycle. Technology incubators support the development of new technologies such as digital technologies.

[c] STPs have a broader mission than, example innovation centres. STPs are organizations managed by professionals with the aim to increase wealth of community and promote a culture of innovation and make knowledge-based institutions more competitive.

Synergies and complementarities of the I4SDR of Uzbekistan with other studies

The findings and recommendations of this study complement other UNECE support initiatives for Uzbekistan. UNECE launched the **third Environmental Performance Review of Uzbekistan** in 2020. It examines environmental policy frameworks and compliance assurance mechanisms, including government efforts to green the economy, monitor environmental performance, achieve public participation and improve education. Innovation, especially in environment-related R&D and technologies, will be critical to reducing environmental pollution and improving the efficiency of resource use to achieve sustainable development – notably Sustainable Development Goal (SDG) target 8.4, which calls for improving resource efficiency and decoupling economic growth

from environmental degradation. Synergies are also created with projects conducted by international partner organizations, such as the World Bank project, "Modernizing Uzbekistan's National Innovation System" and the UNESCO project, "Mapping Research and Innovation in Uzbekistan".

As part of the overall objectives of the UNECE Economic Cooperation and Trade Division (ECTD) to support countries in harnessing the power of trade, infrastructure investment and financing and innovation for sustainable development and economic circularity, this I4SDR also complements the following ECTD support to Uzbekistan:

- The **UNECE Agricultural Quality Standards.** ECTD supports the development of internationally agreed standards (including through the Central Asia Working Group) for the commercial quality of agricultural produce, helps with their interpretation and promotes their practical application. The standards are based on existing national standards and on industry and trade practices. In 2019, Uzbekistan elaborated the first-ever international standard for dried melons, which was adopted by the UNECE Working Party on Agricultural Quality Standards. To date, the UNECE Working Party has developed more than 100 voluntary marketing standards for international trade.
- The forthcoming **UNECE study on Regulatory and Procedural Barriers to Trade of Uzbekistan.** To address challenges in customs regulations and in trade, this in-depth analysis of the non-tariff measures governing trade in goods, including those underpinning trade facilitation, technical regulations and quality infrastructure, uses the UNECE survey-based evaluation methodology. The aim is to identify regulatory and procedural trade barriers throughout the country's supply chains and their implications for structural transformation and for achievement of the SDGs.
- The **UNECE Enhancing Traceability and Transparency for Sustainable Value Chains in the Garment and Footwear Sector project** (2019–2022). The project provides a multi-stakeholder policy platform for developing policy recommendations, traceability standards and implementation guidelines, and building capacity in the textile and garments industry. As part of this work, UNECE and UN/CEFACT have launched The Sustainability Pledge, inviting governments, garment and footwear manufacturers, and industry stakeholders to pledge to apply the UNECE toolkit of measures and take a positive step towards improving the environmental and ethical credentials of the industry.

Table 0.3 Selected UNECE tools relevant to issues discussed in this I4SDR

Workstream	Selected UNECE tools
Innovation	*National Innovation for Sustainable Development Review* (I4SDR) – Belarus[a] (2011), Kazakhstan[a] (2012), Ukraine[a] (2013), Armenia[a] (2014), Tajikistan[a] (2015), Belarus (2017), Kyrgyzstan (2019), Georgia[b] (2020), Republic of Moldova (2021), Uzbekistan (2022), Armenia (forthcoming), Ukraine (forthcoming)
	Sub-regional Innovation Policy Outlook (IPO) for Eastern Europe and South Caucasus (2021) Interim Sub-regional Innovation Policy Outlook (IPO) for Eastern Europe (forthcoming) Planned: Sub-regional Innovation Policy Outlook (IPO) for Central Asia and Western Balkans

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Table 0.3 Selected UNECE tools relevant to issues discussed in this I4SDR (Concluded)

Workstream	Selected UNECE tools
Business development, SMEs	*Handbook on Supporting Innovative High-Growth Enterprises in Eastern Europe and South Caucasus* (2021) *Handbook on Supporting Innovative High-Growth Enterprises in the SPECA Sub-region* (forthcoming)
	Handbook on Business Incubators for Sustainable Development in the SPECA Sub-region (2021)
	Findings and recommendations emerging from UNECE COVID-19 impact assessments targeting micro, small, and medium enterprises in selected countries: Armenia, Belarus, Georgia, the Republic of Moldova and Serbia (2021)
	The Impact of COVID-19 on the Trade and Business Development Prospects of Female-owned Enterprises: Armenia (forthcoming), the Republic of Moldova (forthcoming)
Trade, trade facilitation	Promoting sustainable trade and circular economy in SPECA countries: State of play and way forward (2021): regional study as well as country-specific studies, including for Uzbekistan
	Regulatory and Procedural Barriers to Trade: Belarus (2012), Kazakhstan (2014), Tajikistan (2014), Kyrgyzstan (2015), Albania (2016), Republic of Moldova (2017), Georgia (2018), Armenia (2019), Serbia (2021), Uzbekistan (forthcoming)
	More than 50 trade facilitation recommendations and hundreds of e-business standards, technical specifications, and guidance materials on electronic exchange of trade data, developed by UN/CEFACT
	National Trade Facilitation Roadmap for Greece (2012), Tajikistan (2019), Kyrgyzstan (2021)
	Global Survey on Digital and Sustainable Trade Facilitation and *UNECE Regional Report on Digital and Sustainable Trade Facilitation* (2015, 2017, 2019, 2021)
Agricultural trade, including food loss/waste	More than 100 UNECE agricultural quality standards for the commercial quality of agricultural produce including for fresh fruit and vegetables, dry and dried produce, meat, seed potatoes, cut flowers, eggs and egg products
	Simply measuring – quantifying food loss & waste: UNECE food loss and waste measuring methodology for fresh produce supply chains (2020); Code of Good Practice – reducing food loss and ensuring optimum handling of fresh fruit and vegetables along the value chain (2020, 2nd edition in 2022); FeedUp@UN, a blockchain-based solution to identify, quantify and trace food that is lost along supply chains
	Online training course on agricultural quality and food loss (forthcoming)
Textiles, including supply chain transparency and traceability	Sustainability Pledge for measurable and verifiable sustainability in the garment and footwear industry (2021), including UN/CEFACT Recommendation No. 46: Enhancing traceability and transparency of sustainable value chains in the garment and footwear sector; Implementation guidelines; Information exchange standard; Call to action; and blockchain pilots

Source: UNECE.

Note: This list covers selected normative tools (e.g. guidelines, recommendations, standards), analytical papers and studies, and other tools.

[a] UNECE began a programme of Innovation Performance Reviews in 2010. Armenia, Belarus, Kazakhstan, Tajikistan and Ukraine underwent such reviews, released as official United Nations publications. In 2015, the methodology was updated to reflect the SDGs by mainstreaming sustainable development more fully into the reviews and including lessons learned from past reviews to incorporate recent advances in thinking about innovation policy. Along with this methodological update, these reviews have been renamed as UNECE Innovation for Sustainable Development Reviews.

[b] Following a second methodological update in 2020, Georgia became the first country to select elective in-depth chapters addressing national policy priorities for sustainable development.

Notes

1 UNECE (2021). *Supporting Innovative High-Growth Enterprises in Eastern Europe and South Caucasus*. Geneva. https://unece.org/economic-cooperation-and-integration/publications/supporting-innovative-high-growth-enterprises; UNECE (forthcoming). *Supporting Innovative High-Growth Enterprises in the SPECA sub-region*. Geneva.

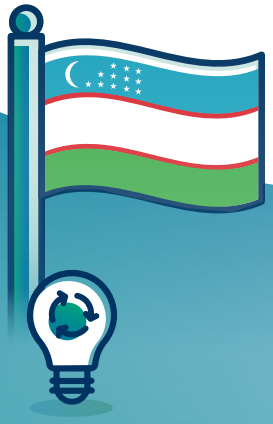
2 UNECE (2020). *Environmental Performance Review of Uzbekistan*. Third Review. Geneva. https://unece.org/environment-policy/publications/3rd-environmental-performance-review-uzbekistan.

3 For more information on SPECA, visit https://unece.org/speca.

4 UNECE (2021). *Business Incubators for Sustainable Development in the SPECA Subregion*. Geneva. https://unece.org/economic-cooperation-and-integration/publications/business-incubators-sustainable-development-speca.

Chapter 1

ECONOMIC OVERVIEW OF UZBEKISTAN



Despite a cautious approach to liberalization in its post-Soviet development, Uzbekistan quickly reached pre-independence growth levels

Uzbekistan is a double-landlocked, lower-middle-income country in Central Asia, neighbouring Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan. It stands out among Commonwealth of Independent States (CIS) countries for having avoided much of the slump in output and rapid structural change that most of them faced in the first decade of independence after the break-up of the Soviet Union. Careful regulation of and barriers to trade and investment as well as direct and indirect subsidies were elements of the country's cautious approach to the transition to a market economy, which maintained a critical mass of productive capacities in the country. Exports of natural resources, such as gas, uranium and gold, as well as of agricultural commodities, in particular cotton, enabled Uzbekistan to attain pre-independence levels of gross domestic product (GDP) in 2001[1] and sustain solid, albeit fluctuating, growth since then. Despite the decrease in GDP growth resulting from the COVID-19 pandemic,[2] the country has exerted a strong public health response and the economy is projected to have grown by almost 7 per cent in 2021.[3] Nevertheless, its cautious approach also produced underlying structural challenges, such as suboptimal capital allocation, that need to be addressed for the country to sustain such growth as well as to facilitate the transition to a circular economy to support greater economic competitiveness and the creation of green and decent jobs.

To create a solid foundation for sustainable development, Uzbekistan has embarked on an ambitious reform path since 2016. In contrast to the gradualist, largely State-led model of the first decades of independence, it has recently demonstrated a commitment to speed up its transition to a market economy with a strong role for innovation and for the private sector by rapidly lifting exchange rate and capital controls as well as restrictions on foreign investment and private sector activity. While these changes open a variety of opportunities for the country in the medium term, they also create unintended, short-term risks stemming from greater competition, structural change and exchange rate fluctuations – compounded by the socioeconomic impact of the pandemic and the fiscal resources needed to mitigate it. Addressing these challenges while enabling and nurturing the innovation needed to create new areas of competitiveness will be important for enabling and sustaining economic growth.

Table 1.1 Basic macroeconomic indicators of Uzbekistan, 2020

Population

Total (millions)	33.9
Capital city: Tashkent (millions)	2.5
Urban (per cent of total)	50.6

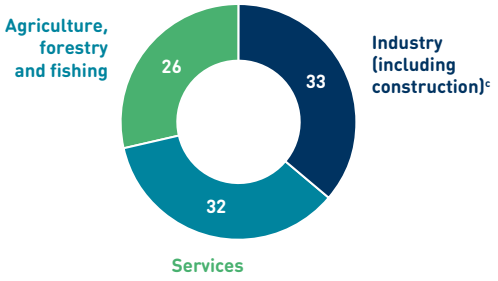
Natural resources[a]

Land area (square kilometres)	440,555
Agricultural land usage (per cent of land area)	58

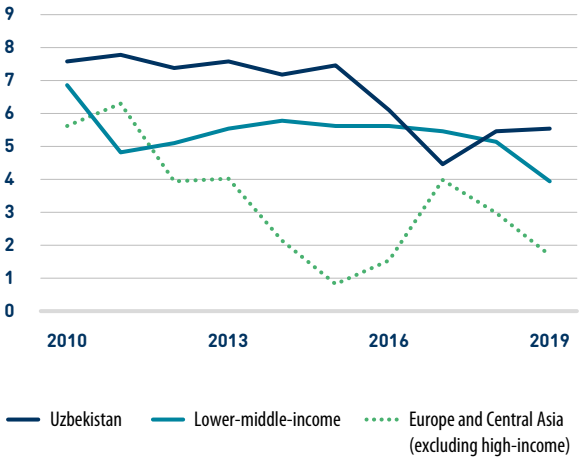
GDP[b]

At current prices ($ billion)	57.9
Per capita, PPP (current international $)	7,308
Average annual growth (2009–2019)	6.8

Value added (per cent of GDP)[b]



GDP growth (annual, %)



Private sector

Private sector[d] SME contribution to GDP (per cent)	53.9
Share of SMEs in export of goods and services (per cent of total exports)	20.5
New business density (new registrations per thousand population ages 15–64)[a]	1.6

Labour market

Employment rate (per cent of total population ages 15+)	55.8
Unemployment rate (per cent of total labour force)[e]	7.0

Trade[b]

Exports and imports ($ billions)	42.2
Exports of goods and services (per cent of GDP)	31.2
Imports of goods and services (per cent of GDP)	41.8
High-tech exports (per cent of manufactured exports)	0.73

Major export markets (per cent of exports)[b]

Switzerland	18.5
United Kingdom	17
Russian Federation	14.5
China	13.6
Kazakhstan	8.6
Turkey	8.2

High-technology exports (per cent of manufactured exports)[b]

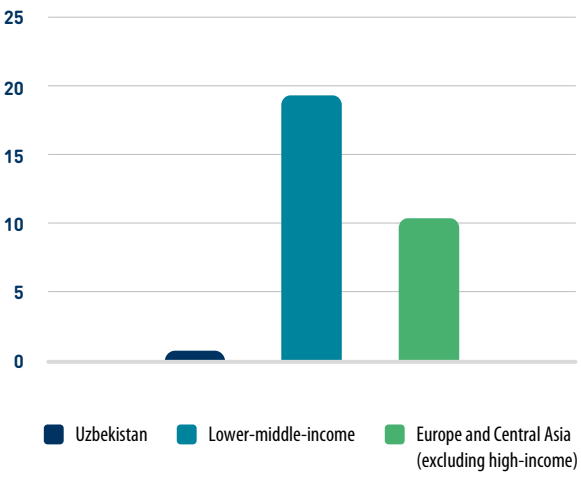


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Table 1.1 Basic macroeconomic indicators of Uzbekistan, 2020 (Concluded)

Macroeconomic environment	
Current account balance (per cent of GDP)[b]	-5.8
Tax revenue (per cent of GDP)[b]	13.1
Inflation (consumer price index, annual per cent)	10.3
FDI net inflows (per cent of GDP)[b]	3.9
Real interest rate (per cent)[b]	3.7
Gross capital formation (per cent of GDP)[b]	40
Remittances (per cent of GDP)[b]	14.8
Public debt ($ billion)	18.2
Public debt (per cent of GDP)	31.3

Source: UNECE, based on data from World Bank (2021a; 2021b), State Statistics Committee of Uzbekistan (2021), OEC (2021), IMF (2021b).
FDI = foreign direct investment, GDP = gross domestic product, PPP = purchasing power parity, SMEs = small and medium-size enterprises.
[a] 2018 data.
[b] 2019 data.
[c] Manufacturing contributes 20 per cent, construction 7 per cent construction and mining and quarrying 6 per cent.
[d] Most firms in Uzbekistan are either fully or partially State-owned. Statistics on the private sector do not indicate at what share a firm is classified as State-owned.
[e] This value represents registered unemployment. The unemployment rate in Uzbekistan in 2020 was about 10.5 per cent, according to national statistics.

Recognising the need for reform to sustain development, Uzbekistan recently embarked on an ambitious path to maintain long-run growth

After gaining independence in 1991, Uzbekistan – in contrast to many other newly independent States – took a cautious approach to economic transition, retaining high degrees of government control of the economy, high levels of State ownership of assets and strong social policies. This path, known as the Uzbek model (Jalilov and Hatasa, 2019), helped the country avoid much of the severe economic slumps and rapid deindustrialization that many of its peers went through as Soviet value chains disintegrated and the economy was exposed to international competition.

Natural resource exports have remained the mainstay of the economy since then, and a range of restrictions have confined the private sector to a limited range of activities. In the medium term, innovation and private sector development will be necessary to boost productivity and diversification, especially of exports.

Recognising this challenge, in 2015 President Mirziyoyev set an ambitious reform agenda, putting private sector development, competitiveness, trade and investment front and centre. In the next years, Uzbekistan reformed swiftly, liberalizing currency exchange, removing price controls, simplifying the tax system, removing a range of restrictions on foreign investment, lowering trade tariffs and reactivating the process of accession to the World Trade Organization. Steps taken to reduce the regulatory burden on the private sector have also borne fruit – on the World Bank Doing Business index, Uzbekistan ranks 8/190 on *Ease of starting a business*. The country's overall ranking still stood at 69/190 in 2020, mostly because of three indicators: *Trading across borders* (152/190), *Dealing with construction permits* (132/190) and *Resolving insolvency* (100/190).

Gross capital formation, which grew from an already high 26 per cent of GDP in 2016 to almost 40 per cent in 2019, has been driven mainly by the rapid, State-led expansion of credit to firms that began in 2017 (EBRD, 2020) and also by a surge in foreign direct investment (FDI). FDI reached 4 per cent of GDP in 2019, attracted by opportunities emerging from these radical reforms.

Continuing on this reform path will require improving governance and institutional capacities

Sustaining this positive momentum requires addressing a range of deeper constraints. Central among them are building governance and institutional capacity with the incentives and skills to design, pilot and roll out effective reforms, especially in areas important to innovation. According to the World Governance Indicators, public governance in Uzbekistan has improved slightly in recent years but remains relatively weak. These indicators cover elements that are essential to defray the risk involved in innovative initiatives, such as control of corruption (–1.05, on a range from –2.5 to 2.5), rule of law (–1.05), and voice and accountability (–1.61) (Kaufmann and Kraay, 2021).[4] Governance reform will be central to improving the business environment and lowering the costs of taking risks and experimenting for innovation.

The Uzbek production structure has retained a strong role for industry

The Uzbek model has helped the country maintain its relatively diversified production structure after the fall of the Soviet Union. Industry, including construction and mining, contributes about a third of GDP, most of it in manufacturing (table 1.1). The growth of the agriculture sector has slowed since 2016, but it still makes up 25 per cent of GDP (box 1.1). The share of the services sector peaked in 2008–2009 at 41 per cent value added of GDP and has since decreased, to 32 per cent in 2019. Total factor productivity has shown modest improvements since 2016 (Conference Board, 2021), and employment patterns have stayed constant over the last decade (figure 1.2). Yet labour productivity, or value added per worker in industry and services, remains the second lowest in Central Asia and below the average for the lower-middle-income group (figure 1.4). According to the 2019 Business Environment and Enterprise Performance Survey (BEEPS), real annual growth in labour productivity in Uzbekistan was –6.7 per cent[5] (–8.6 per cent for small firms) – significantly lower than the 0.1 per cent average in Europe and Central Asia (ECA) (0.4 per cent for small firms) (World Bank, EBRD and EIB, 2019).

Box 1.1 Uzbekistan's agriculture sector

State-led expansion of the strong agriculture sector has contributed significantly to the impressive growth of the economy (Tsereteli, 2018). The country is endowed with large areas of arable land (4,065,000 hectares in 2018) (FAO, 2021) and favourable agricultural conditions. In the first years of transition, the Government spurred agricultural production and the export of cotton, and in 1996 the value of exports reached $1.5 billion (more than 50 per cent of all exports of goods). To strengthen economic self-sufficiency and reduce reliance on imports of grain, the Government further expanded national production of wheat. More recently, it has also diversified horticultural activities, leading the value of fruit and nut exports to double, from $250 million in 2015 to over $500 million in 2018, and reach 50 per cent of the total value of agricultural exports (Growth Lab, 2021).

Current levels of product complexity and concentration do not fully use the substantial potential for diversifying into related commodities or into activities that add value to existing output (World Bank, 2018a). The current production base works on a small scale and is still relatively fragmented. Traditional commodity crops such as cotton and wheat, which occupy approximately 80 per cent of irrigated land (UNECE, 2020a), expose the economy to external price fluctuations and, to some extent, environmentally unsustainable practices, such as soil degradation and inefficient water use.[a] Moving towards exporting a larger range of products will require innovation, such as investment in product standards and certificates (for example, for dried fruit and nuts). It will also require building brands and supply partnerships through cooperatives or other institutions that bring together a critical mass of actual or potential growers.

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Box 1.1 Uzbekistan's agriculture sector (Concluded)

A recent UNCTAD study (2021a) identified strengthening quality along the value chain in Uzbekistan as a key determinant of access to high-priced international markets.

Among the opportunities to diversify and foster exports is participation in UNECE standard-setting activities and subsequent compliance with UNECE agricultural quality standards. UNECE has been supporting Central Asian countries by providing advisory services and delivering capacity-building activities, including through the Central Asia Working Group (CAWG).[b] To address gaps in skills and capacity along the entire value chain, UNECE and partners organized a series of capacity-building activities in Uzbekistan that resulted in greater production, greater sales opportunities, better quality of produce and higher productivity.

As a result of intensified collaboration, Uzbekistan elaborated the first-ever international standard for dried melons,[c] which was adopted by the UNECE Working Party 7 in 2019. In 2021, the Working Party adopted a new standard for sweet apricot kernels (developed by the CAWG and led by Tajikistan). UNECE standards encourage high-quality production, improve profitability and protect consumer interests. To date, the UNECE Working Party on Agricultural Quality Standards has developed more than 100 voluntary marketing standards for international trade. In addition to standards, UNECE develops relevant guidelines and explanatory material.[d]

Innovation in agriculture to expand horticultural activity can increase farmers' income and rural employment as well as strengthen export potential, all significant elements that will drive sustainable growth of the sector. Achieving such innovation entails enabling and encouraging people and companies to try out new ideas to create value – at times through targeted subsidies. Examples include diversifying production, forging partnerships, developing joint marketing and branding initiatives, modernizing sales channels and processing mechanisms, and using and upgrading technology (Yuldashev and others, 2019) to monitor quality and develop, monitor and streamline supply chains. These efforts to support innovative development in agriculture require substantial and long-term investment in systematic innovation across firms and along the supply chain.

Source: UNECE.

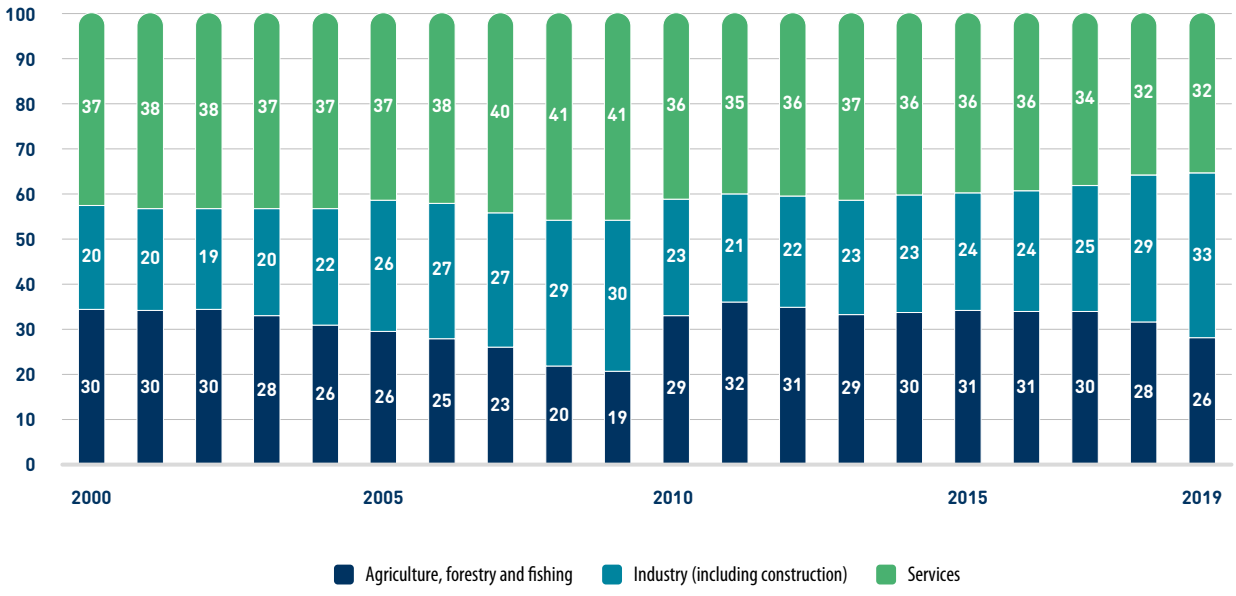
[a] This is also highlighted in the Environmental Performance Review (EPR) of Uzbekistan, in which UNECE experts recommend that "the Ministry of Agriculture and the Ministry of Water Management enhance their efforts to further promote water-saving irrigation techniques" (recommendation 13.2). The study also provides guidance on how the Cabinet of Ministers can "progress with capital infrastructure investments to tackle regional disparities and increase water-use efficiency" (recommendation 9.2).

[b] Established in 2017 and financed by the European Union, the CAWG's goal is to assist local producers in ensuring compliance with Economic Commission for Europe (ECE) Standards. This informal expert group is driven by the business community in the region and is supported by governments.

[c] UNECE, Working Party on Agricultural Quality Standards (WP.7), Dry and Dried Produce – Standards, http://www.unece.org/trade/agr/standard/dry/ddp-standards.html.

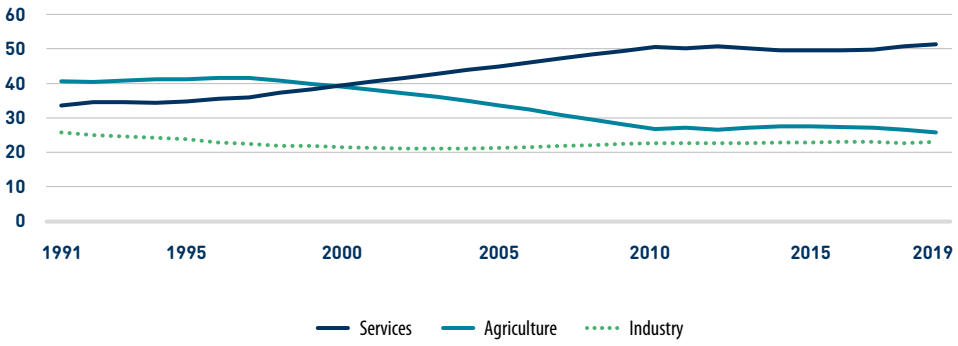
[d] UNECE, Working Party on Agricultural Quality Standards (WP.7), Brochures and Publications, https://unece.org/trade/wp7/brochures-and-publications.

Figure 1.1 · Sectoral decomposition, value added as per cent of GDP, 2000–2019



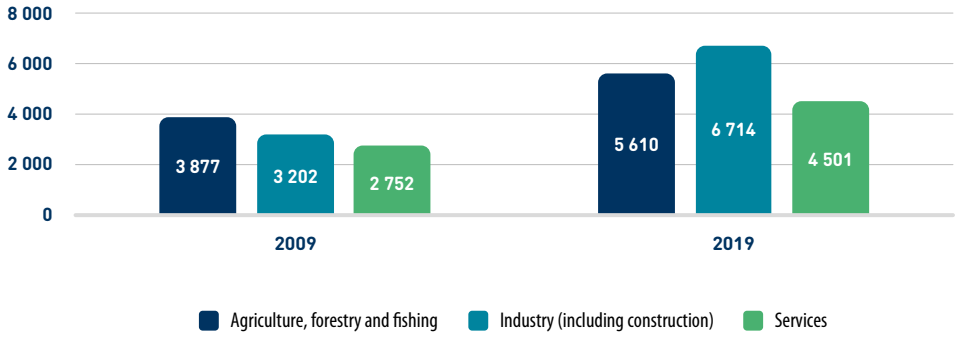
Source: UNECE, based on data from World Bank (2021a).

Figure 1.2 · Employment by sector, 1991–2019
(Per cent of total employment, modeled ILO estimates)



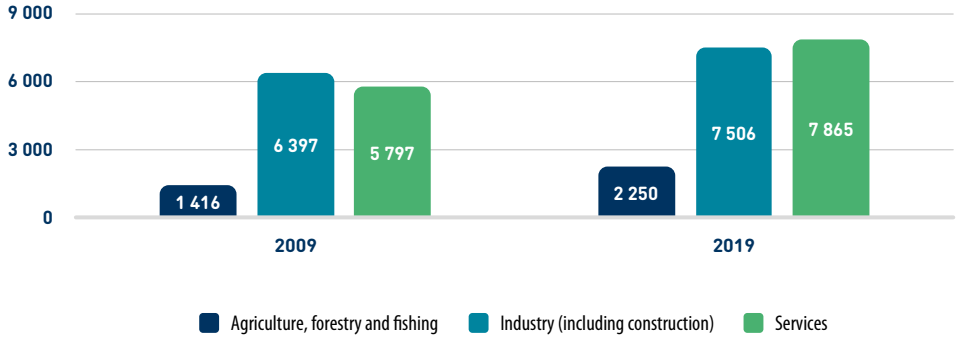
Source: UNECE, based on data from World Bank (2021a).

Figure 1.3 · Value added per worker for Uzbekistan by sector, 2009 and 2019 (Constant 2010 dollars)



Source: UNECE, based on data from World Bank (2021a).

Figure 1.4 · Value added per worker for lower-middle-income group by sector, 2009 and 2019 (Constant 2010 dollars)



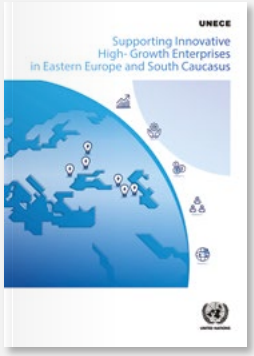
Source: UNECE, based on data from World Bank (2021a).

Productivity growth and diversification require private sector innovation

The drivers of innovation – those that develop, try out and scale up new ideas for creating value and diversifying the economy, in particular through exports – are companies and entrepreneurs, above all a small subset of innovative, high-growth enterprises (IHGEs) (box 1.2). Developing a vibrant private sector with strong absorptive capacities – that is, the ability to put into practice ideas and technology that have proven their worth in other contexts – is the essential starting point in any effort to promote innovation-led, sustainable growth and especially in efforts to make the economy more circular.

Constraints remain on developing the private sector. The prevalence of State-owned assets in the economy, with State-owned enterprises (SOEs) dominating several sectors,[6] hampers overall allocative efficiency, market competition and private sector development (Kotz, 2004). In 2020, enterprises with 100 per cent State ownership generated almost 20 per cent of GDP; in some industries, SOEs even carry out regulatory and supervisory responsibilities (World Bank, 2016; EBRD, 2020; Abdullaev, 2020; OECD, 2021). Their strong role in the domestic market poses a significant challenge to market competition, on which the country scored lowest in the transition assessment of the European Bank for Reconstruction and Development (EBRD, 2020). Furthermore, the national Antimonopoly Committee does not have the power to impose sanctions on legal entities for violating competition regulations. It can impose fines only on private individuals, and the fines are mostly quite modest (approximately $100) and do not deter unfair competition practices. Mitigating and phasing out such constraints, strengthening institutions and safeguarding strong levels of market competition are imperative steps, especially for innovation-intensive growth with a stronger role for the private sector and entrepreneurship (World Bank, 2016).

Box 1.2 UNECE policy handbook: Supporting Innovative High-Growth Enterprises in Eastern Europe and South Caucasus



IHGEs, which make up about 2 to 6 per cent of the private sector, play a disproportionately larger role in spurring innovation in an economy. They act as transformational agents of change that have substantial potential to support the process of systematically experimenting with new ideas in response to emerging challenges and opportunities – a core feature of ensuring innovation-driven growth and sustainable development. In the recovery from the COVID-19 crisis and against the backdrop of ever more rapid technological advancements, it is especially important for Uzbekistan to promote the development of such enterprises through targeted and effective support. This needs to be done by developing a comprehensive understanding of the characteristics, dynamics and needs of such enterprises in the country. UNECE has published the handbook *Supporting Innovative High-Growth Enterprises in Eastern Europe and South Caucasus* (UNECE, 2021a) to support policymakers in designing such effective policies and institutions.

Source: UNECE.

The banking sector is composed largely of State-owned banks: 13 of the 30 banks in the country are State-owned. They control 85 per cent of all banking system assets[7] and in 2021 provided 88 per cent of commercial bank loans (Central Bank of Uzbekistan, 2021a; 2021b). Such a large presence of State-owned banks can lead to the misallocation of credit based on non-commercial objectives. Furthermore, the State-owned banks can require high collateral and interest rates. Owing to the limited resources of small and medium-size enterprises (SMEs) in the country and the high-risk nature of innovation, these requirements may create a barrier to borrowing for innovative activity. Although the private financial sector is still quite small, the Government, together with international financial institutions such as the International Finance Corporation and the International Monetary Fund (IMF), is preparing to privatize the sector (EBRD, 2020; IMF, 2021a).

The ongoing privatization of SOEs[8] as well as State-owned banks is key to enhancing productivity in the economy and encouraging the competitive development of the domestic market (Anderson, Ginting and Taniguchi, 2020).

Equally important for innovation is a strong private sector with the skills, connections, capital and ability to try out new ideas, often by absorbing ideas or technologies that have proven their worth elsewhere. Boosting such absorptive capacity among SMEs is, as a result, high on the agenda in Uzbekistan. The informal sector is estimated to be quite large, reportedly about 40 per cent of employment and more than a third of GDP in 2020, creating a significant impediment to private sector development. According to the BEEPS, in 2019 some 15.2 per cent of firms[9] perceived the informal sector as an obstacle, a higher share than in the ECA region (12.5 per cent) (World Bank, EBRD and EIB, 2019). High levels of informal employment are, in part, a result of the high costs of complying with requirements for formality. Reducing the informal sector is an essential element in building the absorptive capacity of the economy in support of innovative development.

Enhancing data availability and accuracy is a key to providing reliable assessments of the development of the private sector. Although significant progress has been made in recent years, the provision of data and statistics in Uzbekistan is not yet optimal, especially when capturing the size of the informal economy. This constraint creates obstacles to accurately estimating trends and their impact in the economy (chapter 3).

Trade and investment flows have increased but so far do not contribute systematically to diversification

Although trade flows are rising and multifaceted,[10] for export revenue Uzbekistan remains highly reliant on a small range of commodities, including gold (26.3 per cent of total export value in 2018), gas (23.3 per cent) and cotton (9.9 per cent) (OEC, 2021). This concentration creates vulnerability to fluctuating prices, and also – as the Uzbek export product space[11] shows – creates few positive spillover effects for innovation and diversification, because most products rely on productive capacities that cannot easily be applied in other sectors. This low sophistication shows up in the Economic Complexity Index,[12] on which Uzbekistan ranked 80/133 in 2018, lower than Kyrgyzstan (59/133) (Growth Lab, 2021). This situation is partly a result of the country's initial post-independence focus on import substitution rather than export diversification.

A notable exception may be the Uzbek automotive sector (box 1.3). This complex value chain has substantial spillover effects and export potential that is underexploited. Developing this sector further would open a range of opportunities for diversification, such as specializing in specific automotive components for other automotive manufacturing supply chains.

Efficiency-seeking, export-oriented FDI in complex activities holds substantial potential to build the productive capacities that the Uzbek economy needs in order to innovate and diversify into new, potentially competitive economic activities. Uzbekistan has significant unused potential for receiving such FDI. In fact, in recent years the Government has pushed through substantial reforms to liberalize foreign investment. In 2020 Uzbekistan was for the first time included in the FDI Regulatory Restrictiveness Index of the Organisation for Economic Co-operation and Development (OECD), measuring the degree to which FDI faces regulatory, licensing or equity ownership restrictions in different sectors. Uzbekistan ranked 43/83, ahead of Kazakhstan, Tajikistan and Kyrgyzstan.

Box 1.3 Uzbekistan's automotive sector

The automotive sector has great potential to become a pillar of the economy, creating not only jobs and exports directly but also a range of spillover effects that can lead to diversification into other areas of the highly complex automotive supply chain and improve the competitiveness of the sector. A combination of government support and foreign investment has contributed to the dynamic development of the sector (Islamov, 1998; Spechler, 2004). The domestic market for passenger cars is estimated at $2.6 billion, approximately 5 per cent of GDP, yet 95 per cent of passenger cars produced are exported – 3.1 per cent of the total export volume of cars and equipment in 2020 (State Statistics Committee of Uzbekistan, 2021).

Automotive production in Uzbekistan is centrally controlled by State-owned Uzavtosanoat,[a] the main shareholder in the 85 enterprises[b] in the industry. The main manufacturing companies were created through international joint ventures, including UzAuto Motors (Chevrolet and Ravon), SamAvto (Isuzu and MAN Nutzfahrzeuge), Uz Truck and Bus Motors (MAN Nutzfahrzeuge and Sinotruk), UzAuto Motors Powertrain (General Motors), UzAuto Trailer (Kamaz) and Jizzakh Automobile Plant (Volkswagen). Uzavtosanoat has also established a branch at the Turin Polytechnic University to support enhancing the training of specialists in mechanical and automotive engineering. In 2018, the Ministry of Innovative Development signed a preliminary agreement with a Chinese manufacturer to construct an electric car plant in the country (UNECE, 2020a).

The high import tariffs in the sector have resulted in shortages in the domestic market (UNECE, 2020a; Olma, 2020), and State ownership of the sector impedes competition, reducing incentives to improve cost and quality efficiency. The number of passenger cars produced has increased to about 280 per 1,000 people in 2020, higher than in Kazakhstan (65), but lower than in Turkey (855) and the Russian Federation (1,261) (Dstatis, 2021). Since 2017, efforts have been made to liberalize the sector, paving the way for more players to enter the market.

Fostering innovation in the sector will enable Uzbekistan to leverage the potential for greater efficiency of and further demand from the complex automotive supply chain, developing and nurturing capacities in a range of niches that, with time, can cater to automotive supply chains elsewhere and help diversify the economy and exports.

Source: UNECE.

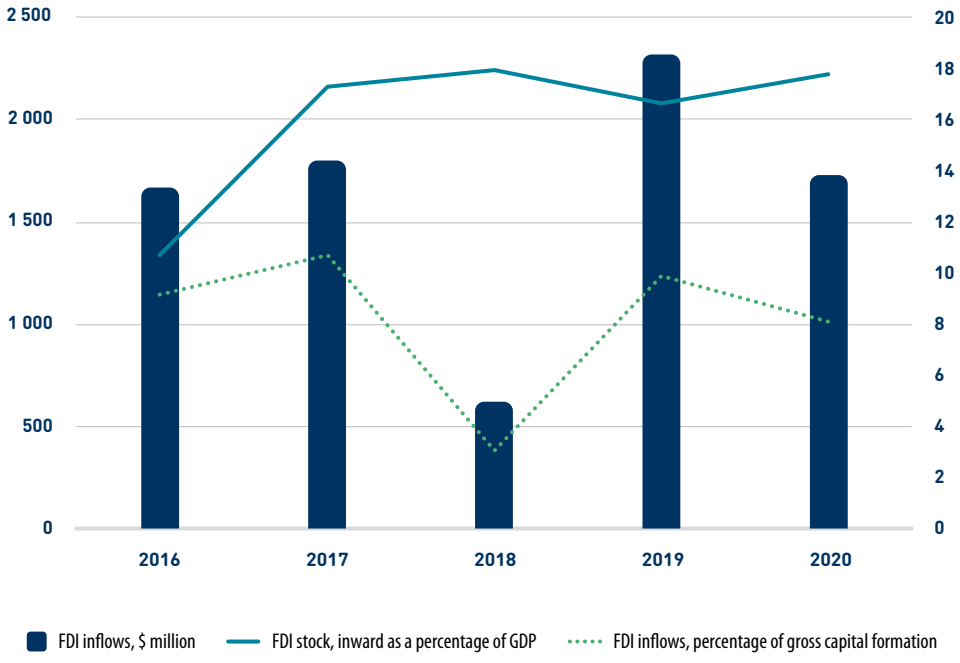
[a] The only shareholder in Uzavtosanoat is the State Assets Management Agency (UzSama).

[b] These include manufacturing enterprises, component enterprises and localization enterprises (for a complete list, see https://uzavtosanoat.uz/company-ru.html).

Nevertheless, although many restrictions have been lifted and business registration made very easy, several factors are likely to hold back FDI into efficiency-seeking, high value added opportunities. They include limited market competition, somewhat insecure property rights, low levels of intellectual property protection, and accounting and corporate governance practices that are not yet up to international standards. Radically improving the cost and speed of cross-border trade, especially for intermediate products in complex supply chains, is essential for many companies active in the fertile areas at the core of the product space, where there is significant potential for upgrading the export basket.

FDI in Uzbekistan tripled in 2019 (figure 1.5), flowing mainly into market- and resource-seeking[13] activities, such as production and building materials (35 per cent), oil and gas (25 per cent), textiles (11 per cent) and construction (9 per cent), while agriculture, health and education received the smallest shares (about 5 per cent each) (UNCTAD, 2021c). The size of the Uzbek market makes the country attractive for foreign investors. Market-seeking investments in manufacturing can be an important force for change, for example, in providing new practices and technology and improving competition in the sector. Yet FDI remains constrained by a lack of resources, including skilled labour and land-tenure rights, as well as remaining administrative bottlenecks. Spurring increased volumes of FDI as well as linking FDI-attracting policies with innovation policy can help to maximize the transformative potential of FDI across sectors (see box 5.6 in chapter 5). In efforts to diversify FDI inflows in upcoming years, the Government aims to continue to actively support greater FDI in electricity, chemicals, information technology, agriculture and construction, among other industries.[14]

Figure 1.5 · FDI in Uzbekistan



Source: UNECE, based on UNCTAD (2021b).

Ensuring sustained growth requires more investment in inclusive skills development, the business environment and environmentally sustainable practices

Innovation will be critical to achieving the country's ambitions to reach the Sustainable Development Goals (SDGs) targets and move towards economic circularity, including efforts to strengthen both skills and environmental sustainability. Uzbekistan has an SDG road map,[15] as well as a Coordination Council and a Parliamentary Commission to oversee progress. It underwent its first Voluntary National Review in 2020[16] (MoEDPR, 2020) and intends to include such reviews as a recurring feature to measure progress and guide reforms (Republic of Uzbekistan, 2020). Out of the 17 SDGs, 16 fall within the five main areas of development addressed in the National Development Strategy. On the SDG dashboard, Uzbekistan ranked 66/193 in 2020 with a score of 71/100,[17] higher than Turkmenistan (63/100) and Tajikistan (69/100) but slightly lower than Kyrgyzstan (73/100) and Kazakhstan (71/100). Achieving targets for reduced inequalities (SDG 10) and industry, innovation and infrastructure (SDG 9) are among the major challenges the country still faces (table 1.2).

Uzbekistan has substantially reduced poverty and gender inequality over the past decades. Poverty fell from 27.5 per cent in 2001 to 11.5 per cent in 2018 (World Bank, 2019), although some of this progress was reversed in 2020 by the effects of the pandemic (OECD, 2020). Uzbek men and women have similar rates of primary and secondary education and literacy (UNESCO, 2021), and women held 32.7 per cent of parliamentary seats in 2021 (UN Women, 2021). In contrast, enrolment in higher education shows a large gender gap: enrolment of women is consistently lower than that of men (figure 1.6), limiting the access of women to high-skilled and high-paid jobs, as well as their potential as innovative entrepreneurs (Elçi, 2020). The labour-force participation rate is substantially lower for women than for men – 66 per cent and 82 per cent respectively in 2018 (ADB, 2021). In 2019, women participated in the ownership of 25.9 per cent of firms, but only 12.4 per cent of firms had a female top manager – lower than the ECA averages, at 33.8 per cent and 18.3 per cent, respectively (World Bank, EBRD and EIB, 2019).[18]

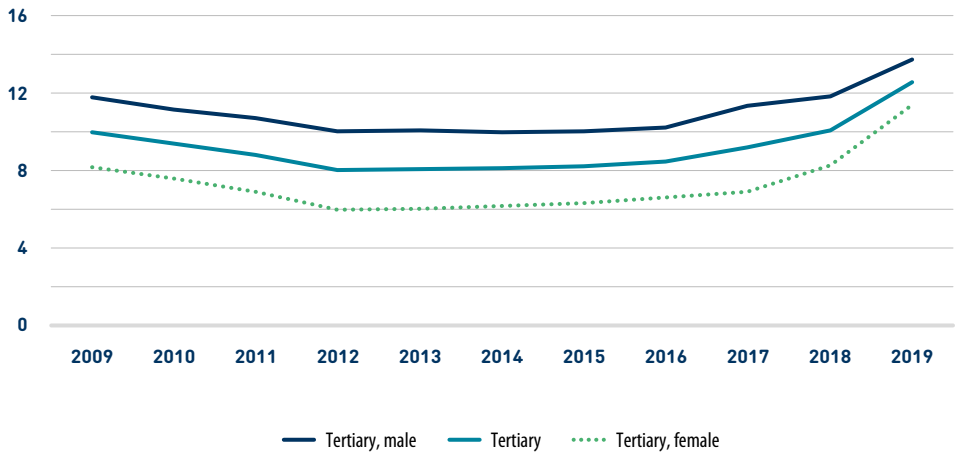
Table 1.2 SDG progress overview

Assessment	SDGs
Major challenges remaining	
Significant challenges remaining	
Challenges remaining	
SDG achieved	n/a

Source: UNECE, based on data from https://dashboards.sdgindex.org/static/countries/profiles/Uzbekistan.pdf.
Note: SDG 14, Life below water, is not included.

Figure 1.6 · Share of tertiary enrolment, 2009–2019

(Per cent of gross enrolment)



Source: UNECE, based on UNCTAD (2021b).

At the subnational level, large disparities prevail between rural and urban regions in terms of both income and the quality of the business environment. For example, in Tashkent, where most SMEs are located, about a third of them use bank credit or leasing services; in some rural regions, only 5–10 per cent do (Tadjibaeva, 2019).

A significant challenge for rural development and environmental sustainability is land degradation (salinization and erosion) and desertification, as well as the near disappearance of the Aral Sea, resulting from decades of damaging agricultural practices such as large canals, wasteful irrigation techniques and inefficient grazing. As this situation affects almost a third of the country's land mass (28 per cent in 2019), it severely limits agricultural potential under current use patterns. Innovation will be essential to boost agricultural productivity – starting by putting to use a range of technologies and good practices adapted to Uzbek circumstances.

The country's energy supply relies on natural gas (85 per cent of the total) (IEA, 2021); however, energy intensity is high, mainly a result of outdated energy infrastructure as well as significant energy subsidies and the lack of incentives for introducing energy-efficient measures[19] (OECD, 2019; UNECE, 2020a). In 2015, Uzbekistan showed the second highest levels of energy intensity[20] in Central Asia (World Bank, 2021a), four times higher than the average in the European Union (IEA, 2021) – although the levels have been declining recently. The most energy-intensive sectors are mining, oil and gas, chemicals, electricity and production of construction materials. Next to inefficient energy consumption and outdated energy production processes,[21] the sizeable subsidies for fossil fuels remain a significant challenge for sustainable development of the energy sector. In 2017 fossil fuel subsidies amounted to 11 per cent of GDP, with gas accounting for 72 per cent of those subsidies (IEA, 2021). Fiscally unsustainable in the long run, subsidies reduce incentives to invest in expanding and upgrading the energy infrastructure, impede the competitiveness of alternate energy sources and remove incentives for innovation towards more efficient production processes (UNECE, 2020a).[22]

Electricity is mainly generated from traditional energy sources – 87 per cent from natural gas in 2018 (IEA, 2021). Inefficient electricity transmission and distribution networks hinder the reliable delivery of power to consumers; transmission system loss is 18 per cent of total output and distribution loss is about 14 per cent (Uzbekenergo, 2021). Ongoing efforts to modernize the electricity and energy infrastructure are critical, as reliable electricity is essential for any remotely innovative or capital-intensive activity to be competitive at scale and for any company aiming to venture into new economic activities with export potential.

Innovation will be a driving force in sustaining the economic development of Uzbekistan

Sustaining growth and ensuring sustainable and inclusive development will require Uzbekistan to capture and further leverage opportunities present in the economy by encouraging innovation, specifically by enabling systematic experimentation across sectors to explore new ways of creating value. Much of the potential will lie in absorbing ideas that work elsewhere into a wider range of contexts in Uzbekistan, through entrepreneurship and foreign investment. This requires a vibrant private sector, with a vanguard of innovative entrepreneurs who can try things out. Sustaining the reform momentum to address more complex issues of governance and market competition, coupled with applying targeted measures to defray the risk of innovation and to build a dynamic innovation system, will be essential to improve lagging productivity, diversify exports and create the foundation for sustainable development overall.

Table 1.3 Summary of the economic performance of Uzbekistan and challenges ahead

Achievements	Challenges ahead
✓ Relatively rapid economic growth and reduction of poverty over the past two decades, with high levels of capital formation	! Sustaining growth in Uzbekistan will require ensuring that capital allocation is more effective, given the high levels of capital formation.
✓ Retention of a substantial portion of the production structure through transition and expansion into complex value chains such as automotive	! The strong reliance on low value added commodities for export revenue creates vulnerability to price fluctuations and shocks and offers little potential for positive spillover effects and diversification.
	! Innovation will be essential to diversify and upgrade the economy while creating good jobs. This requires developing a strong private sector with solid capacities to absorb innovation.
✓ Strong political commitment to economic reform, sustainable development and, recently, innovation policy	! Public governance requires strengthening in order to keep up reform momentum and address the remaining substantial constraints on private sector development overall and innovation in particular.
✓ Rapid reform momentum over the past years to open the economy to the private sector, trade and investment	! The dominance of SOEs holds back market competition and private sector development; further movement to open and facilitate trade is essential to innovation.

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Table 1.3 **Summary of the economic performance of Uzbekistan and challenges ahead (Concluded)**

Achievements	Challenges ahead
✓ Rapidly growing interest among foreign investors following recent reforms, including the removal of many FDI restrictions	! FDI inflows concentrate on resource-seeking (mining and oil and gas) and market-seeking (manufacturing) investment.
	! Obstacles remain, especially to efficiency-seeking investment with potential for both exports and innovation spillovers.
✓ Strong commitment to Agenda 2030; mainstreaming of the SDGs into high-level planning instruments	! Significant divides exist between urban and rural areas as well as between productive and informal parts of the economy.
	! Gender-based differences in labour-market participation and, in particular, in innovative entrepreneurship leave substantial potential untapped.
	! Environmental sustainability requires energy reliability and efficiency – and innovation into more sustainable, productive agricultural practices.

Source: UNECE.

Notes

1 In 1990: $70 billion, in 2001: $71.5 billion (purchasing power parity (PPP), both in constant 2017 international dollars) (World Bank, 2021a).

2 GDP growth dropped to 1.6 per cent in 2020 (World Bank, 2021b).

3 IMF, "IMF staff concludes visit to Uzbekistan", 10 December 2021, https://www.imf.org/en/News/Articles/2021/12/10/pr21369-imf-staff-concludes-visit-to-uzbekistan.

4 The World Governance Indicators measure governance on a scale from –2.5 to 2.5, with higher values signifying better governance.

5 Sectoral decomposition of real annual labour productivity growth in Uzbekistan is as follows: –24.6 per cent in retail, –14.8 per cent in food, –9.4 per cent in rubber and plastics, –7.3 per cent in manufacturing, –6.5 per cent in textiles, –6.4 per cent in textiles, 7.5 per cent in non-metallic mineral products, 9.1 per cent in garments.

6 Sectors with a significant share of SOEs include agriculture; real estate; information and communication; professional, scientific and technical activities; manufacturing; construction; mining; banking; gas; and transport.

7 The ratio of nonperforming loans was at 2.3 per cent in 2020 (Central Bank of Uzbekistan, 2021a). This low number could, in part, be explained by a lack of adequate data or underdeveloped accounting standards.

8 Uzbekistan, On approval of the Strategy for Managing and Reforming of State-Owned Enterprises for 2021–2025, Presidential Decree No. 166 of 29 March 2021, https://lex.uz/docs/-5348948; UzSama, "State-owned enterprises reform strategy approved", 30 March 2021, https://www.davaktiv.uz/en/news/davlat-ishtirokidagi-korxonalarni-isloh-qilish-strategiyasi-tasdiqlandi.

9 This share is highest among small enterprises; 17.2 per cent of small firms surveyed, 10.1 per cent of medium-sized firms and 9.8 per cent of large firms. In comparison, the ECA averages are 13.1 per cent, 12.2 per cent and 8.9 per cent.

10 The product concentration index – also called the Product Herfindahl-Hirschman Index – was 0.301 in 2019, slightly higher than that of Tajikistan (0.294) but lower than that of Kyrgyzstan (0.406), Kazakhstan (0.561) and Turkmenistan (0.788). Index values closer to 1 indicate that a country's exports and imports are highly concentrated on a few products, and values closer to 0 indicate that exports and imports are more homogeneously distributed among a series of products.

[11] The product space of a country is an indication of the potential for economic growth. The proximity between products highlights their commonalities: the closer an economy's products are to one another in the product space, the more easy it is for the economy to diversify to those products. Which products are in the product space shapes the economic growth of an economy, as it is easier to diversify to more related products. Typically, at the core of the product space are metals, chemicals and machinery, and at the periphery are agricultural products (Growth Lab, 2021).

[12] Economic complexity measures the diversity of a country's exports and their ubiquity among other countries. Countries that sustain a diverse range of productive, sophisticated and unique knowledge can produce a diversity of goods, including products that are complex and that only a few other economies can produce (Growth Lab, 2021).

[13] Resource-seeking investment included large projects in the oil and gas sector by Lukoil (Russian Federation) and significant investments in mining by Orano Mining (France) (UNCTAD, 2020).

[14] MoIFT, "Results of investment activity of the Republic of Uzbekistan for 2019", 18 January 2020. https://mift.uz/en/news/results-of-investment-activity-of-the-republic-of-uzbekistan-for-2019.

[15] "On measures for implementing the national Sustainable Development Goals and targets for the period up to 2030." https://lex.uz/ru/docs/4013358.

[16] Ministry of Economic Development and Poverty Reduction, "Uzbekistan presented the first National Report on achieving the SDGs at the UN ECOSOC High-Level Political Forum", 21 September 2020. https://mineconomy.uz/en/news/view/3188.

[17] The value of 100 considers all SDGs to be achieved. The global SDG indicator framework lists 247 SDG indicators; however, 12 are repeated under different targets.

[18] A total of 1,239 firms were surveyed.

[19] Uzbekistan's energy production is not yet fully diversified and relies largely on traditional sources for energy. This challenge is further elaborated in the EPR (UNECE, 2020a).

[20] Per unit of GDP (primary energy).

[21] This refers to outdated technology used in energy transmission and distribution networks, owing to underinvestment in new technologies as well as inefficient energy-saving methods (GlobalCapital, "Uzbekistan's energy sector at the threshold of major reforms", 15 October 2019, https://www.globalcapital.com/article/b1hln8tk842cr2/uzbekistans-energy-sector-at-the-threshold-of-major-reforms). The UNECE EPR (2020) also states that Uzbekistan should "stimulate the implementation of measures for energy efficiency in residential buildings, e.g. by enhancing the attractiveness of energy efficiency measures by guaranteeing a reasonable pay-back period of costs and setting conditions for better technical maintenance of district heating systems" (recommendation 8.4a).

[22] In line with this, the UNECE EPR (2020) recommends that the Cabinet of Ministers "take appropriate steps to meet the targets [SDG 7] of raising the share of renewable energy sources in total power production" (recommendation 12.5) and "continue the planned phasing out of fossil fuel subsidies and the ongoing transition to cost-reflective energy tariffs, while coordinating and synchronizing them with the introduction of effective renewable energy sources support schemes, incentives, such as feed-in tariffs, and competitive bidding auctions for promoting the increased use of renewable energy" (recommendation 3.4). The EPR also recommends that the Cabinet of Ministers "(a) consider the best ways to modulate or reduce fossil fuel subsidies to ensure that higher quality fuels are used in vehicles that have a lower impact on the environment; (b) encourage the move away from the use of lower quality fuels and the take-up of alternative, low-carbon-fuelled vehicles; and (c) encourage the simultaneous deployment of electromobility along with renewable electricity production to help meet the objective of reducing the total amount of vehicle emissions" (recommendation 14.1).

Annex

Table A1.1 Key economic indicators for Uzbekistan, 2010–2020

Indicator	Year										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Output											
GDP growth, % annual	7.6	7.8	7.4	7.6	7.2	7.4	6.1	4.5	5.4	5.6	1.6[a]
GDP per capita, constant 2010 $	1,634	1,714	1,814	1,922	2,025	2,139	2,230	2,290	2,374	2,459	
GDP per capita, PPP, constant 2017 international $	4,652	4,881	5,164	5,470	5,764	6,087	6,346	6,519	6,755	6,999	
Gross capital formation, % GDP	26.5	26.6	25.6	25.5	26.5	26.1	26.4	29.5	37.6	39.8	
Sectoral decomposition, value added as % of GDP											
Agriculture, hunting, forestry, fisheries	28.7	31.6	30.7	29.5	30.3	30.8	30.8	30.1	28	25.5	28.2[a]
Industry, including construction	22.6	21.1	21.7	22.6	23.3	23.7	24.1	24.7	29	33.2	35.5[a]
of which industry	20.2[a]	18.7[a]	19.3[a]	19.7[a]	20.2[a]	20.2[a]	20.6[a]	22.2[a]	26.5[a]	29.3[a]	28.5[a]
of which construction	5.8[a]	5.2[a]	5.3[a]	5.7[a]	5.7[a]	6[a]	6[a]	5.7[a]	6.1[a]	6.6[a]	7[a]
Manufacturing	10.9	11	11.2	12.3	13.4	13.5	14.4	14.5	17	19.6	
Services	35.9	35.3	35.7	36.9	36.1	35.9	35.8	33.7	31.8	32.2	36.3[a]
of which trade, accommodation and food services	9.3[a]	8.9[a]	8.5[a]	8.7[a]	8.7[a]	8.5[a]	8.5[a]	8[a]	7.4[a]	7[a]	7[a]
of which transportation and storage, information and communication	11.3[a]	11.1[a]	11.2[a]	11.4[a]	10.7[a]	10[a]	9.6[a]	9.5[a]	8.5[a]	7.9[a]	7.2[a]
Employment											
Agriculture, % of total employment	27	27	27	27	28	28	27	27	27	26	27[a]
Industry, % of total employment	23	23	23	23	23	23	23	23	23	23	24[a]
Services, % of total employment	50	50	51	50	50	50	50	50	51	51	

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Table A1.1 Key economic indicators for Uzbekistan, 2010–2020 (Concluded)

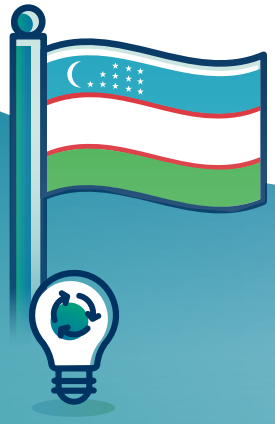
	Year										
Indicator	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Labour-force participation, % of total population	66.3	66.1	65.9	65.7	65.2	65.4	65.2	65.2	65.3	65.3	65.2
of which men, % of total labour force	74.7	74.8	74.9	75	75.1	75.1	75.1	75.2	75.1	75	
of which women, % of total labour force	51.1	50.8	50.5	50.2	50	49.7	49.4	49.3	49.1	48.8	
Unemployment, % of total labour force	5.4	5	5	5	5.1	5.1	5.1	5.8	5.7	5.7	6
Foreign direct investment											
FDI inflow, % of GDP	3.5	2.9	0.9	0.9	1.1	1.3	2	3	1.2	4	
Trade											
Trade, %	47.7	46.6	41.5	41.1	36	30.4	29.7	45.7	66.6	73	
Exports of goods and services, % of GDP	27.9	26.5	21.4	20.8	17.7	15.3	14.9	21.8	28	31.2	
Imports of goods and services, % of GDP	19.7	20.1	20.1	20.2	18.2	15.1	14.9	23.9	38.6	41.8	
Demographics											
Population growth, % annual	2.8	2.7	1.5	1.6	1.7	1.7	1.7	1.7	1.7	1.9	
Education											
School enrolment, tertiary, % of gross	9.4	8.8	8	8.1	8.1	8.2	8.5	9.2	10.1	12.6	
School enrolment, tertiary, male % of gross	11.1	10.7	10	10.1	10	10	10.2	11.4	11.8	13.7	
School enrolment, tertiary, female % of gross	7.6	6.9	6	6	6.2	6.3	6.6	6.9	8.2	11.4	

Source: UNECE, based on data from World Bank (2021a, 2021b).

[a] Data retrieved from State Committee on Statistics (2021).

Chapter 2

INNOVATION PERFORMANCE OVERVIEW



Innovation plays an essential role in diversifying and upgrading the Uzbek economy

Innovation is central to supporting sustainable and inclusive growth of an economy and is a main facilitator of the transition to a circular economy (box 2.1). By generating and effectively transferring knowledge and technologies, innovation can help reduce inequalities and encourage greater value creation for growth and employment and overall prosperity. In the context of supporting sustainable economic growth, innovation reaches beyond the narrow definition of high technology and start-ups. It involves introducing products and services, and production and business processes and methodologies, as well as marketing and organizational methods that may be new to the world or may be new to the country, the industry or even the firm and ultimately contribute to productivity growth, economic competitiveness and sustainable development and support the creation of new ways of producing and consuming to foster economic circularity.

For a lower-middle-income country like Uzbekistan, the largest potential benefits of innovation arise from focusing on importing, absorbing and adapting innovation from abroad – products, services, processes and methods that have already successfully worked elsewhere. Enabling and encouraging innovation is especially crucial for the country to ensure sustainable development by building a competitive economy, and to address challenges such as environmental sustainability and poverty reduction – especially in the wake of the COVID-19 crisis (UNECE, 2020b; 2021b). This means building a vibrant innovation system in which actors systematically try out ideas for creating value to see what works and what does not – discovering, in the process, the activities that will underpin sustainable development and create decent jobs.

Box 2.1 Uzbekistan and the transition to a circular economy

Innovation plays an increasingly important role in facilitating the transition to a circular economy (SDG 12), the inclusive economic model aimed at reducing waste and pollution, extending product life cycles and enabling widespread sharing of physical and natural assets. Regenerative by design, a circular economy preserves and enhances natural capital, optimizes resource yields and mitigates systemic risks by managing stocks and renewable flows. It supports greater economic competitiveness by maximizing the use and value of assets and encouraging the creation of green and decent jobs decoupled from resource depletion.

Fostering economic circularity through innovation requires a systems approach. That entails engagement of as well as collaboration between national and subnational government authorities, the private sector and consumers in finding new ways to provide materials and products in a much more sustainable way across sectors. Numerous examples already exist of new technologies, processes, services and business models that are reshaping product life cycles, from design through production and usage to disposal and recycling.

The transition towards a circular economy plays a particularly important role for overall sustainable and inclusive development in Uzbekistan. At the UNECE 69th session in April 2021, under the theme of "Promoting circular economy and the sustainable use of natural resources", Deputy Minister of Innovative Development Ms. Shahklo Turdikulova spoke about the strategic importance of the private sector as an essential driver of change in this transition. Together with international organizations such as the World Bank, the United Nations Industrial Development Organization, the European Union and the United Nations Development Programme,[a] the Government is putting greater effort

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Box 2.1 Uzbekistan and the transition to a circular economy (Concluded)

into introducing new and sustainable technologies, practices and measures for improving waste treatment[b] and disposal, strengthening pollution control, minimizing water and energy consumption, and enhancing production processes, for example in the textile and garment industries.

Yet, more can be done to maintain the momentum created and strengthen support for efforts to achieve circularity. As highlighted at the UNECE Team of Specialists on Innovation and Competitiveness Policies in November 2021, fully realizing the potential of innovation to aid this transition requires dedicated and sustained policy efforts to create enabling frameworks and incentives for private innovation in fields critical to a circular economy and to encourage consumers to rapidly and broadly adopt innovative and sustainable consumption patterns. This will also require innovative approaches to regulation, to provide incentives and eliminate barriers systematically – trying out which approach works best and then scaling up and diffusing those that are successful across other sectors.[c]

Source: UNECE.

[a] Ministry of Economic Development and Poverty Reduction, "Session 3: Supporting Green, Low Carbon Development of Industry and Economy", 25 September 2019, https://mineconomy.uz/en/news/view/3952; United Nations Industrial Development Organization, "UNIDO and the Republic of Uzbekistan sign Joint Declaration", 22 December 2020, https://www.unido.org/news/unido-and-republic-uzbekistan-sign-joint-declaration; Switch Asia, "Media Advisory: SWITCH-Asia Supports Uzbekistan's Transition to Green Economy through SCP Action Plan and Circular Economy Approach in Textiles Sector", 11 November 2021, https://www.switch-asia.eu/news/media-advisory-switch-asia-supports-uzbekistans-transition-to-green-economy-through-sustainable-consumption-and-production/; Munteanu, D. and B. Avliyokulov, "Nudging Tashkent households to sort their waste", 16 April 2021, https://www.uz.undp.org/content/uzbekistan/en/home/blog/2021/nudging-tashkent-households-to-sort-their-waste.html.

[b] Uzbekistan, On approval of the strategy for solid waste management in the Republic of Uzbekistan for the period 2019–2028, Presidential Resolution No. PP-4291 of 17 April 2019, https://lex.uz/ru/docs/4291733.

[c] Report of the UNECE Team of Specialists on Innovation and Competitiveness Policies on its Thirteenth Session, Geneva (hybrid), 1–2 November 2021 (ECE/CECI/ICP/2021/2).

Recognising this, Uzbekistan has put innovation high on the agenda. Along with sweeping market reforms to open the economy and boost the private sector (chapter 1), the Government set up a dedicated Ministry of Innovative Development in 2017 (Uzbekistan, 2017). The Government has also launched a series of support programmes and organizations to promote private sector innovation, especially start-ups (chapter 3, chapter 4). As this chapter shows, Uzbekistan can build on several strengths, including high levels of educational attainment, especially in science and engineering, and a legacy of public research with commercial potential. At the same time, relatively low levels of investment in research and development (R&D), low enrolment rates in tertiary education, low levels of technological complexity and the lack of systematic commercialization of research results all indicate the room for improvement. The 2021 Global Innovation Index (GII) (box 2.2) ranks Uzbekistan 86/132 countries overall; 4/10 in Central and Southern Asia, between Kazakhstan (79/132) and Kyrgyzstan (98/132); and 10/34 among lower-middle-income economies (WIPO, 2021c).

A salient, recurring issue is the need to translate innovation inputs into outputs. In the GII, Uzbekistan performs significantly better on the former (ranked 75/132) than on the latter (100/132) (WIPO, 2021c). This indicates that the Uzbek innovation system could become better at ensuring that innovation efforts and investment bear fruit. Central to the activities of the Ministry of Innovative Development and future reform efforts will be not so much broadening activities as setting up institutions and processes that enhance the impact of policies and support, acting as catalysts to private sector innovation.

Box 2.2 The Global Innovation Index

For more than 10 years, the Global Innovation Index (GII) report has been published by the World Intellectual Property Organization (WIPO), a specialized agency of the United Nations, in partnership with the Portulans Institute, the Confederation of Indian Industry, the Brazilian National Confederation of Industry, Ecopetrol and the Turkish Exporters Assembly, with support from the GII Advisory Board and Academic Network, including the previous co-publishers, INSEAD (Institut Européen d'Administration des Affaires) and Cornell University. The GII report takes the pulse of the most recent global innovation trends and ranks the innovation ecosystem performance of economies (132 in the 2021 report), highlighting strengths and weaknesses and particular gaps in metrics.

The report has been influential on three fronts. First, as part of their economic policy strategies, policymakers now refer regularly to innovation and their countries' innovation rankings. The GII is officially considered a yardstick for measuring innovation, as noted by the United Nations General Assembly in its resolution on the importance of science, technology and innovation for achieving the SDGs, at its 74th session in 2019. Second, the GII enables policymakers to assess the innovation performance of economies. They invest resources to analyse their GII results in cross-ministerial task forces and use the GII to design appropriate policies on innovation and intellectual property. It assists them in making informed decisions on innovation policy. Third, the GII gives strong impetus for governments to prioritize and collect innovation metrics.

The report shows the positive relationship between economic development (as measured by GDP per capita adjusted for purchasing power parity) and innovation performance (as measured by the GII). It identifies innovation achievers, those countries whose innovation performance exceeds their level of economic development.

The Innovation for Sustainable Development Review of Uzbekistan draws on the 14th edition of the GII, *Tracking Innovation through the COVID-19 Crisis*, which focuses on countries' efforts to build back better after the pandemic, examining how innovation can deepen economic transformation for development that is inclusive and resilient. The global findings of the GII show that during the pandemic many governments and firms increased their investment in innovation, with growth seen in scientific output and R&D expenditures in 2020, specifically in the health, energy production and digital sectors. This growth is not visible across other sectors, as the innovation ecosystems in many emerging economies are fragile – a constraint to adopting new technologies and business models across the economy.

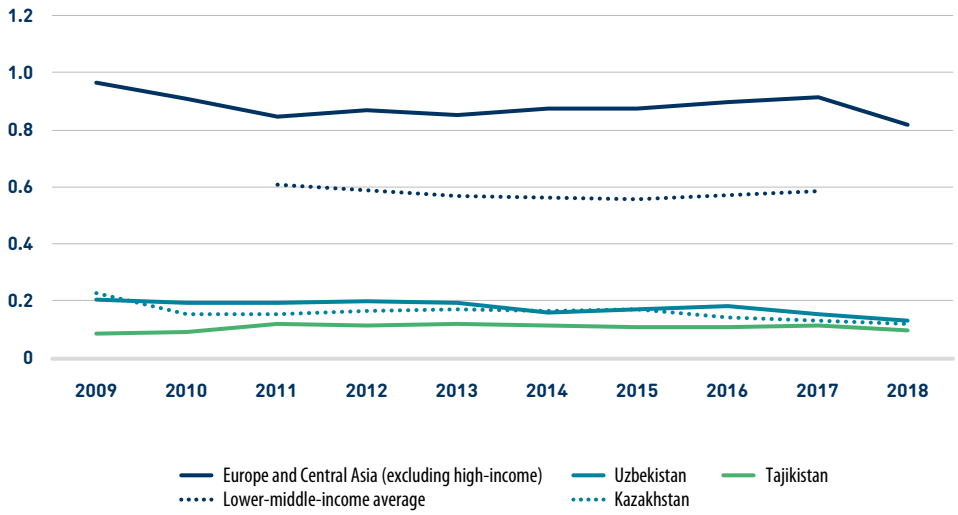
The GII report can be downloaded at https://www.wipo.int/global_innovation_index/en/ and https://globalinnovationindex.org.

Source: WIPO and UNECE.

Uzbekistan needs to invest more in core innovation inputs, such as R&D and human capital, and ensure that such investments catalyse private sector support for innovation

Investment in R&D is one of the main inputs to innovation and is central to raising productivity and creating value within an economy (Vergara, 2019), diversifying products and improving access to international value chains. It can generate high rates of return and encourage long-term growth (Izvorski and others, 2019). Yet, gross expenditure on research and development (GERD) in Uzbekistan is relatively low – equal to or less than 0.2 per cent of GDP since 2012, with a decline to 0.13 per cent in 2018, slightly higher than Tajikistan (0.1 per cent) and Kazakhstan (0.12 per cent) but lower than the income-group average in 2017 (0.58 per cent) (figure 2.1). In recognition of the low levels of investment in R&D, the Strategy of Innovative Development 2019–2021 set out to raise these levels to 0.8 per cent of GDP in 2021 (Uzbekistan, 2018), a goal that was not reached.

Figure 2.1 · R&D expenditure, per cent of GDP, 2009–2018

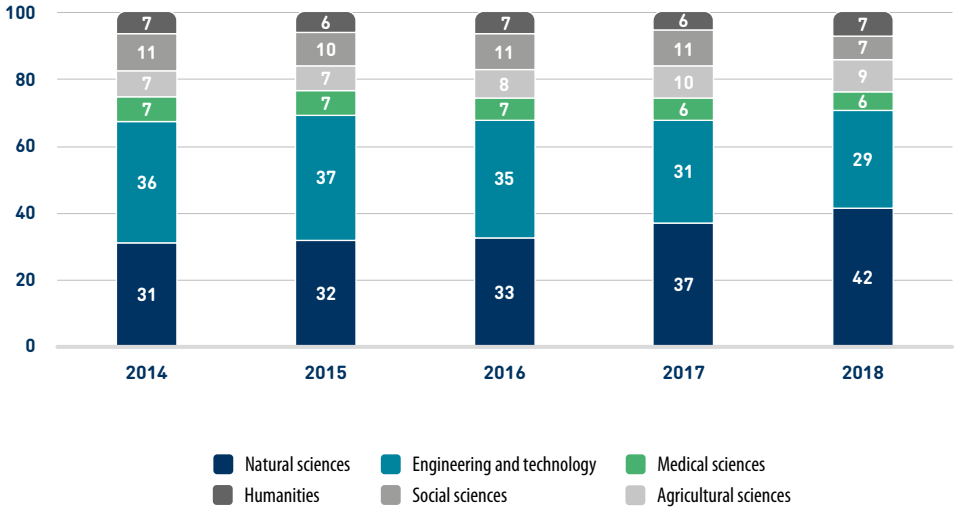


Source: UNECE, based on data from World Bank (2021).
Note: Missing data for lower-middle-income average in 2009, 2010, 2012, 2014, 2016, 2018.

In Uzbekistan, much like in most other post-Soviet countries, public research organizations are the dominant actors in both fundamental and applied research,[1] with the public sector consistently conducting more R&D activity than the private sector. In 2019, for example, 304 firms conducted R&D activity, of which 121 were from the private sector (40 per cent), 118 were State-owned enterprises[2] (39 per cent) – specifically research and scientific institutes, a structure retained from the Soviet heritage – and 65 were higher education institutions (HEIs) (21 per cent). For comparison, 35 per cent of Uzbek firms[3] responding to the 2019 Business Environment and Enterprise Performance Survey invested in R&D, a higher share than both the regional (25.1 per cent) and income-group (17.1 per cent) averages but lower than the shares in Tajikistan (36.7 per cent), the Russian Federation (55 per cent) and Turkey (65 per cent). In addition to boosting levels of R&D investment and supporting R&D activity more effectively, the role of the private sector in R&D and innovation needs to be strengthened. This can be addressed, for example, through establishing effective linkages between science and business (chapter 5) as well as through ensuring that public R&D support has a more catalytic effect in exploiting commercialization potential throughout the economy.

R&D activity can be further diversified across research fields to leverage innovation potential across sectors. In 2018, for example, 29 per cent of GERD was invested in applied research, 21.5 per cent in experimental development and 19.5 per cent in basic research (UNESCO, 2021a).[4] More than 70 per cent of R&D activity was conducted in natural sciences and in engineering and technology, with the share of the former increasing in recent years to 40 per cent. In contrast, research activity in agriculture, medical and social sciences, and humanities each received less than 10 per cent of GERD (figure 2.2). Given the significant growth potential of the agriculture sector, stepping up the currently low levels of GERD in agriculture activities is a promising avenue for supporting sustainable development (see box 1.1 in chapter 1).

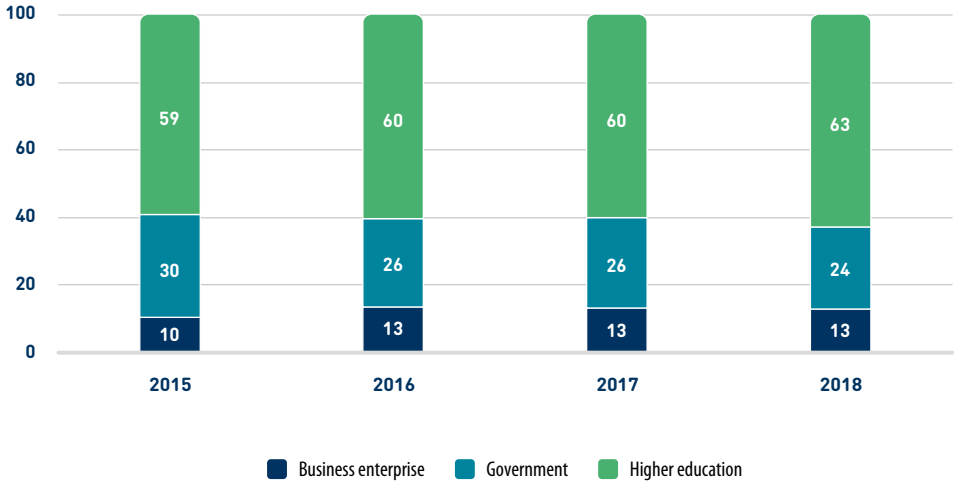
Figure 2.2 · GERD in science, 2014–2018 (Per cent)



Source: UNECE, based on data from UNESCO (2021).

The number of researchers has been relatively stable in recent years. In 2019, of employees engaged in R&D, 85 per cent were researchers and 5 per cent each were technical, support or other staff (State Statistics Committee of Uzbekistan, 2021). More than half of researchers were employed in higher education (figure 2.3). The full-time equivalent number of researchers has remained between 470 and 580 per million inhabitants since 2009, reaching just 476 in 2018, lower than in Kazakhstan (667), Turkey (1,379 in 2017) and the Russian Federation (2,784) (UNESCO, 2021a).

Figure 2.3 · Researchers (Full-time equivalent) by sector, 2015–2018



Source: UNECE, based on UNESCO (2021).

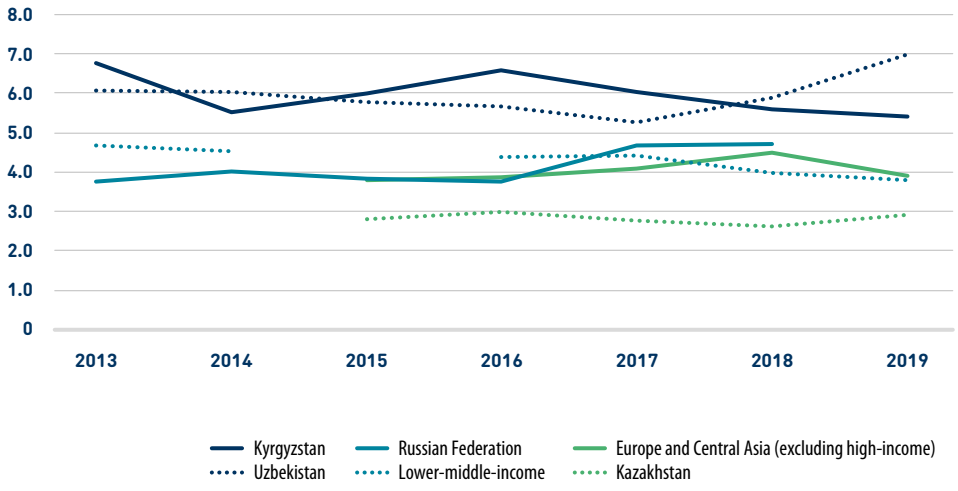
Women constitute approximately 40 per cent[5] of the 31,099 researchers in Uzbekistan – a higher share than in neighbouring Tajikistan (37.5 per cent) but lower than in Kazakhstan (52.8 per cent) (World Bank, 2021a). Over 70 per cent of female researchers work in HEIs, 16 per cent in the public sector and about 10 per cent in the business sector, largely concentrated in Tashkent (50 per cent). The largest share of female researchers is between the ages of 35 and 44 (about 30 per cent), slightly larger than the numbers between ages 25 and 34 (27 per cent), and ages 45 and 54 (22 per cent). Strengthening the presence of female researchers can further leverage unused potential in the country's human capital.

Supporting skills and labour-force development is another important input in expanding innovative capacity and fostering knowledge creation within the economy. Being the most populous and the youngest country in Central Asia – 60 per cent of the population is younger than 30 (UNICEF, 2020) – Uzbekistan has significant untapped potential for developing its human capital. Government expenditure on education is comparatively high, at about 5 per cent of GDP in 2017, lower than only that of Kyrgyzstan (6 per cent) among comparator countries (figure 2.4).

The growing population poses a challenge for the country's educational system, specifically in terms of access to and quality of education. The demand for an increasingly diverse set of skills in the developing labour market is not yet matched by educational reform in the country, and universities do not yet fare well in international comparisons. Standardized quality assessment of education is not yet available; however, in 2021 Uzbekistan did join the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment.

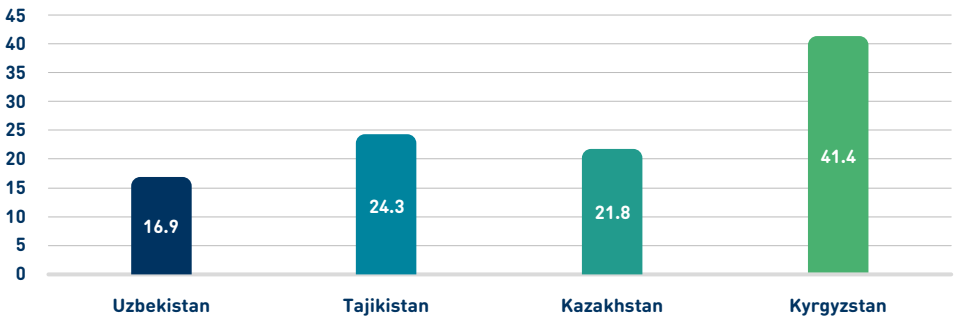
The population has high levels of educational attainment (UNESCO, 2021b) and high rates of enrolment in primary and secondary education – 95 per cent in 2018 and 91 per cent in 2017, respectively. In contrast, enrolment in higher education is low overall –

Figure 2.4 · Government expenditure on education (Per cent of GDP)



Source: UNECE, based on data from World Bank (2021) and UNESCO (2021).
Note: Data missing for Europe and Central Asia (excluding high-income countries): 2013, 2014; Kazakhstan: 2013, 2014; lower-middle-income group: 2015; and the Russian Federation: 2019.

Figure 2.5 · Firms offering formal training for employees in 2021
(Per cent)



Source: UNECE, based on data from WIPO (2021c).

13 per cent in 2019 – and lower still for postgraduate programmes. This creates a lingering skills gap in the labour market, especially in industry, negatively affecting the adoption of technological innovations and limiting the innovative growth of the country (World Bank, 2018b; Holzhacker, 2018; Elçi, 2020; Anderson, Ginting and Taniguchi, 2020). Availability of vocational or on-the-job skills training is low (World Bank, 2019): only 17 per cent of firms in manufacturing offered formal training for employees in 2020 (figure 2.5), less than half of the 2019 averages for the subregion (Central Asia) and the income group. Furthermore, among production workers in the sector, the proportion of skilled workers was 63.6 per cent, lower than the Europe and Central Asia (ECA) average of 77.8 per cent and the world average of 76.7 per cent. The experience of top managers working in the sector averaged about 14 years in 2019, less than the ECA and global averages of 20.4 and 18.3 years respectively (World Bank, EBRD, EIB, 2019).

Uzbekistan invests a significant amount of resources into education; however, these investments are not yet effectively reflected in the capacities of the labour force. Two efforts – supporting tertiary enrolment more widely and ensuring that high-quality education is offered at HEIs – can enlarge the share of skilled workers in the economy, reduce the skills gap to strengthen the labour market, and ultimately improve productivity and capacities for creating and absorbing knowledge – all of which support innovation in the country.

Positive trends in the provision of e-governance as well as in the growing ICT sector need to be further reinforced

Greater use of and access to information and communication technology (ICT) is an important enabler for innovation, productivity growth and competitiveness across sectors in the Uzbek economy.[6] A dynamic ICT sector can also be a source of economic growth and job creation.

The provision of e-governance (chapter 4) as well as digital connectivity has improved significantly, although access to the Internet is not yet equitable across the country. Broadband subscriptions increased from fewer than 1 per 100 people in 2012 to almost 14 per 100 in 2019, the highest in Central Asia – followed closely by Kazakhstan (13 per 100) –

and significantly higher than the lower-middle-income group average (3 per 100) (World Bank, 2021a). Yet, only about half of the Uzbek population (55 per cent) uses the Internet (United Nations, 2020; ITU, 2021; State Statistics Committee of Uzbekistan, 2021).

A small ICT sector has started to form in Uzbekistan in recent years, ranking the country 65/132 on the GII indicator *Information and communication technologies* in 2021, compared with 93/141 in 2015. Room for improvement remains in ICT infrastructure and the IT skills capacity of firms. Despite the establishment of ICT support mechanisms, such as the IT Park in Tashkent (chapter 4) and a sharper focus by universities on ICT research, the sector still contributes little to GDP. Although the value added of the ICT sector has doubled since 2016, it remained less than 2 per cent of GDP in 2020.[7] ICT infrastructure mostly lies in the ownership of monopolies, and such services are mostly available only in urban regions (World Bank, 2016; Holzhacker, 2018). The Telecommunication Infrastructure Index[8] value for Uzbekistan in 2020 was about 0.47, lower than that of Kyrgyzstan (0.59) and Kazakhstan (0.7) (United Nations, 2020). In the GII, the country ranked 87/132 in *ICT service exports* – a significant increase from 129/131 in 2020 – with shares of less than 1 per cent of total trade (Cornell University, INSEAD, WIPO, 2020; WIPO, 2021c) and 4.9 per cent of services exports. Furthermore, in 2019, 77.6 per cent of total exports of IT services occurred in the telecommunication sector while computer software accounted for only 9.4 per cent (State Statistics Committee of Uzbekistan, 2020). This also leaves substantial potential untapped. With its moderate wages, Uzbekistan should be able to follow the path of several Commonwealth of Independent States countries in developing export-oriented ICT-enabled services.

Strengthening the use of digital technologies and reinforcing connectivity has a positive impact on productivity (chapter 1) as well as on voice and accountability[9] by enhancing the ease of use and the transparency of government services (World Bank, 2016). In line with this, the Government has recently announced plans to invest $2.5 billion in digital infrastructure,[10] along with other measures for modernizing the ICT sector, such as smart city technologies (Investment Promotion Agency, 2021).

Low levels of international patent activity indicate unexploited potential to commercialize research; rising intellectual property payments indicate more technology imports

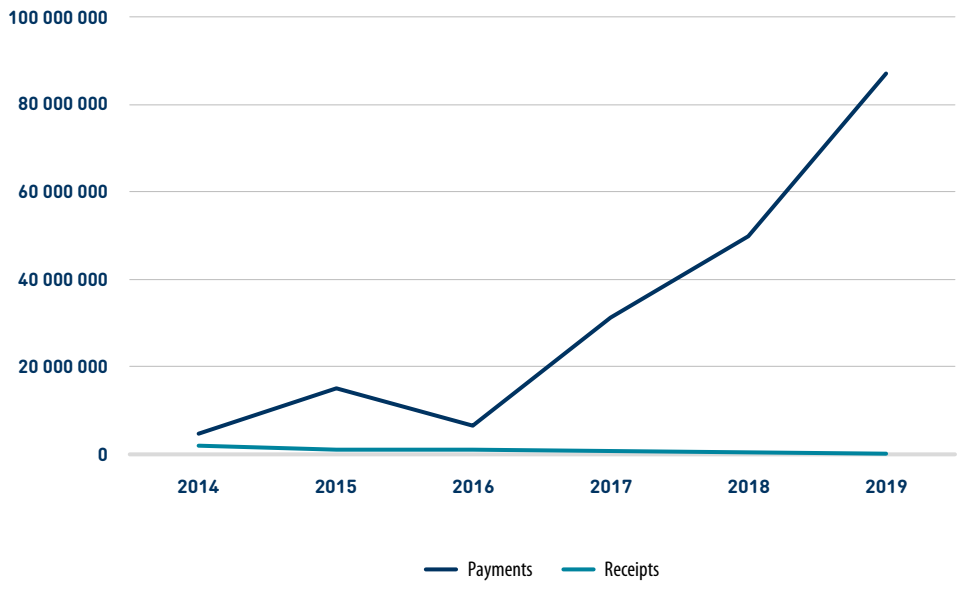
Patent activity, an indication of the potential for research commercialization for innovation, remains comparatively low in Uzbekistan. Overall, trademark filings showed the largest increase in the past decade, from 4,510 in 2011 to 8,494 in 2020, whereas patent filings showed a smaller increase, from 304 in 2011 to 379 in 2020, with a peak of 480 in 2018 (WIPO, 2021a). Specifically, the number of patents filed amounted to 1.5 per billion dollars of purchasing power parity (PPP) GDP in 2021, higher than in Tajikistan but lower than in Kazakhstan and Kyrgyzstan (table 2.1). International patent activity shows little change, with fewer than five Patent Cooperation Treaty applications during 2010–2018 (except in 2014; World Bank, 2020). The country ranked 98/132 in the 2021 GII in treaty patents by origin per billion dollars of PPP GDP (WIPO, 2021c). Receipts for intellectual property have remained low (figure 2.6), amounting to $148,000 in 2019, higher than in Tajikistan ($48,000) but significantly lower than in Kyrgyzstan ($1 million) and Kazakhstan ($2.8 million).

Table 2.1 Number of new patent applications by origin in 2021 versus 2020, per billion dollars of PPP GDP

	Number		Rank	
Country	**2021**	**2020**	**2021**	**2020**
Russian Federation	5.7	6.0	15	17
Turkey	3.4	3.4	24	30
Kyrgyzstan	2.8	6.0	27	16
Kazakhstan	1.9	1.7	39	44
Uzbekistan	1.5	1.7	47	45
Tajikistan	0.4	0.1	83	118

Source: UNECE based on Cornell University, INSEAD and WIPO (2020) and WIPO (2021c).

Figure 2.6 · Foreign payments and receipts for the use of intellectual property, 2014–2019
(Balance of payments, current dollars)



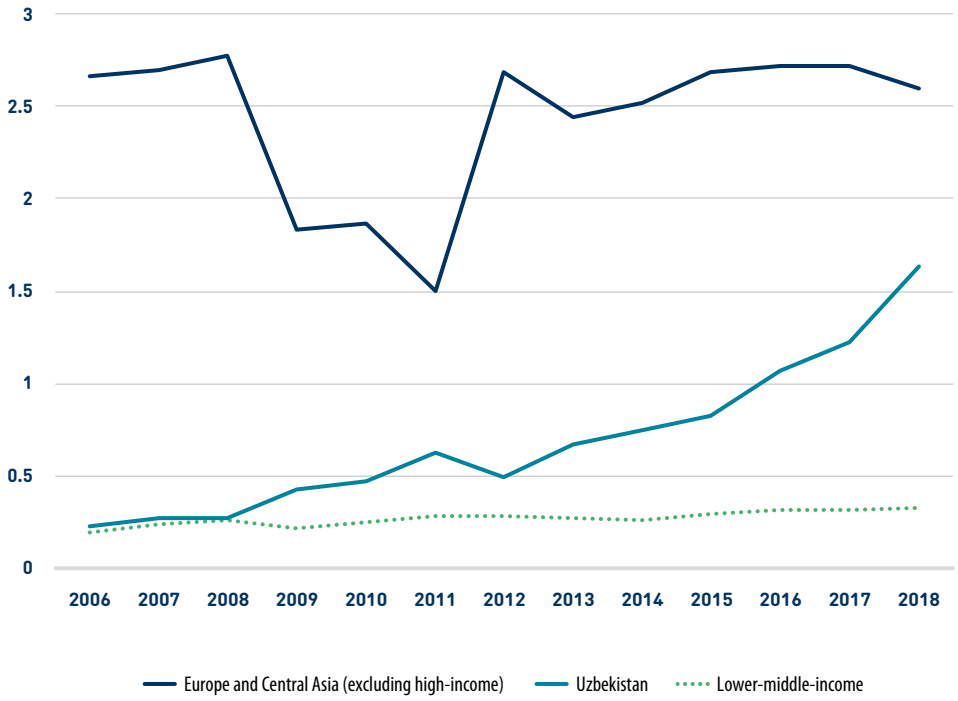
Source: UNECE, based on data from World Bank (2021).

Encouragingly, the country's payments for intellectual property have been increasing rapidly since 2016, albeit from a low base, showing that Uzbekistan is beginning to import advanced technology from abroad to upgrade domestically. Indeed, 19.35 per cent of Uzbek firms have licensed foreign technology, higher than the ECA average (14 per cent) (World Bank, 2020).

With recent reforms, innovation activity in the private sector is on the rise but has further room for improvement

Innovation activity in Uzbekistan has grown significantly in the last decade, with the number of enterprises active in innovation increasing from 304 in 2010 to 1,587 in 2019 and the number of implemented innovations from 683 to 4,869 in the same time frame (State Statistics Committee of Uzbekistan, 2020). Most innovations are conducted in the public sector – more than 43 scientific ideas were commercialized during 2018–2020, mainly by research institutes and HEIs – whereas demand for innovation in the private sector is still quite low and associated with high risks.[11] Despite rising levels of knowledge imported from abroad and increasing density of new business registration (figure 2.7), the low levels of skills and of managerial and technical capacities in the labour force translate into low absorptive capacity in private firms and SMEs. This low absorptive capacity impedes firms from acting as agents for experimentation. Furthermore, innovation in the private sector focuses largely on products rather than processes. Although the private sector in Uzbekistan invests more overall in R&D than is the average in both the region and the income group, in 2019 only 23.2 per cent of firms introduced a new product or service and 14.4 per cent a new process, lower than the regional and income-group averages[12] (World Bank, EIB and EBRD, 2019). Greater investments in R&D and education are also required for upgrading the technological complexity of Uzbek exports to strengthen the overall competitiveness of the economy (Hausmann, Hwang and Rodrik, 2006; Popov and Chowdhury, 2016).

Figure 2.7 · New business density: new registrations per 1,000 people ages 15–64, 2006–2018



Source: UNECE, based on data from World Bank (2021).

Improving how efficiently investment in innovation translates into innovative activity and absorptive capacity in the private sector is key to enabling innovative development

As reflected in recent reforms, Uzbekistan has made significant efforts towards innovative development, including high levels of investment in education, expanded provision of national e-services and greater support for the emerging ICT sector. Nonetheless, additional efforts can be made to facilitate the transition towards an innovation-driven, knowledge-based economy and to fully leverage the country's innovation potential and improve the competitiveness of the economy. Such efforts include supporting the increase in and effective use of investment in R&D, improving access to and ensuring the quality of education, encouraging skills development in the labour force, further expanding ICT infrastructure and skills capacity and strengthening the absorptive capacity of the private sector. The following chapters examine how the national innovation system and governance structure is organized, how the innovation infrastructure can be strengthened and how reinforcing linkages between science and industry can promote innovation and sustainable development.

Table 2.2 Summary of the innovative performance of Uzbekistan and challenges ahead

Achievements	Challenges ahead
✓ Uzbekistan invests substantially in education.	! The potential of research capacity and of commercialization efforts are not fully realized owing to low levels of R&D investment.
✓ The population has high levels of primary and secondary educational attainment.	! Low enrolment rates in tertiary education further widen the skills gap in the labour market.
✓ The ICT sector is growing.	! The low share of the ICT sector's contribution to GDP inhibits further development of productivity in the private sector.
✓ E-governance and digital public services are expanding.	! The low level of technological complexity of exports impedes long-term economic growth.
✓ Imports of knowledge and technology from abroad are increasing.	! The absorptive capacity of the private sector requires enhancement.

Source: UNECE.

Notes

1 Under the Academy of Sciences are 23 research institutes, 3 state museums and 3 research centres. Additional research activity is conducted under HEIs in dedicated research centres and other research institutes established under specific ministries, for example, under the Ministry of Health and the Ministry of Justice.

2 Many firms in what is described as the private sector have State ownership. Data on the exact share of State ownership in firms and at what share a firm is classified as State owned are largely unavailable.

3 The share of firms investing in R&D was higher among larger firms (58.1 per cent) than among small (24.4 per cent) and medium-size (43.1 per cent) firms.

4 The remaining 30 per cent went to activity that was not specified.

5 Based on headcount of all researchers in 2018.

6 Permanent Mission of Uzbekistan to the United Nations, "ICT an important factor of national progress", 12 February 2016. https://www.un.int/uzbekistan/news/ict-important-factor-national-progress.

7 Review.uz, "Development of the digital economy in Uzbekistan", 6 May 2021, https://review.uz/en/post/obzor-centra-ekonomicheskix-issledovaniy-i-reform-razvitie-cifrovoy-ekonomiki-v-uzbekistane-za-chetre-goda. The Government has set the goal of increasing the share of the ICT sector in Uzbekistan to 10 per cent by 2030. Ministry for Development of Information Technologies and Communications, "Investments in ICT", https://mitc.uz/en/pages/inves_tory.

8 The index components are mobile cellular telephone subscriptions per 100 inhabitants, percentage of individuals using the Internet, fixed (wired) broadband subscriptions per 100 inhabitants and active mobile broadband subscriptions per 100 inhabitants (United Nations, 2020).

9 This refers to people's perception of their capacity to participate in the selection of their government, as well as their perception of the freedoms of expression, association and the media (Kaufmann and Kraay, 2021).

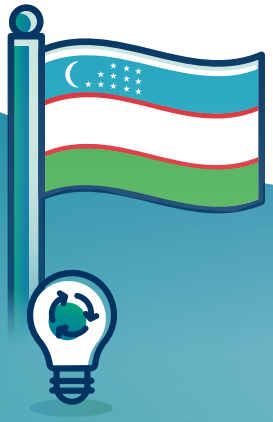
10 *The Tashkent Times*, "US$ 2.5 billion to be drawn for development of digital infrastructure, says Abdulla Aripov", 6 February 2021. https://tashkenttimes.uz/national/6362-us-2-5-billion-to-be-drawn-for-development-of-digital-infrastructure-says-abdulla-aripov.

11 Review.uz, "Инновационные перспективы ГЧП" ("Innovative prospects of PPP"), 20 March 2020, https://review.uz/post/innovacionne-perspektiv-gchp.

12 In 2019, 28.6 per cent of firms in ECA and 36 per cent of firms in the lower-middle-income group introduced a new product or service, and 19.7 per cent of firms in ECA and 35.4 per cent in the lower-middle-income group introduced a new process.

Chapter 3

IMPROVING THE EFFECTIVENESS OF POLICY GOVERNANCE AND MECHANISMS IN THE NIS



Main messages

- Strong political commitment to innovative development in recent years has led to a wide array of strategies and support mechanisms to nurture the nascent national innovation system (NIS) in Uzbekistan.
- The innovation policy landscape nonetheless remains fragmented, with scant coordination mechanisms to ensure synergies and alignment among relevant policy areas and initiatives as well as inclusive and systematic engagement of the private sector.
- Institutional capacities to systematically scout needs, constraints, legislative gaps and opportunities among stakeholders are underdeveloped.
- Existing policies do not fully target a central constraint – underdeveloped absorptive capacities in the private sector – and further efforts need to be made in support of innovative entrepreneurship across all sectors.
- The widely reported skills gap in the labour market shows the need for educational reform towards developing skills based on labour market needs.
- The current low level of public spending on R&D is not only insufficient but fails to be catalytic owing to inefficient allocation of R&D funds.
- A lack of reliable, nuanced, timely and internationally comparable statistics on innovation impedes the effective design, input and assessment of innovation policy interventions.
- Uzbekistan does not yet systematically and effectively put into practice the principles of evidence-based policymaking, in part because it lacks processes for monitoring and evaluation.

Recommendations at a glance: Innovation policy governance and instruments in the NIS

Recommendation 3.1: Improve coordination of innovation policy initiatives across national and regional government authorities, and strengthen public capacities for effective design and implementation of policy.

Actions	Priority	Time frame	Actors
3.1.1. Adopt a holistic approach to innovation policy governance.	①	Medium-term	Cabinet of Ministers
3.1.2. Clarify and streamline the mandates of regional departments of ministries and regional administration (khokimiyat) departments.	②	Medium-term	Cabinet of Ministers
3.1.3. Reinforce skills development in public sector institutions and agencies for innovation.	③	Short-term	Cabinet of Ministers

Recommendation 3.2: Strengthen the participation of all ministries relevant to innovation, the private sector and civil society in designing, implementing and monitoring innovation policy initiatives.

Actions	Priority	Time frame	Actors
3.2.1. Expand representation of the private sector and relevant ministries in the Republican Council of Science and Technology.	①	Short-term	Republican Council of Science and Technology
3.2.2. Introduce consultations with the private sector and civil society at the main stages of the policymaking cycle.	②	Medium-term	Cabinet of Ministers
UNECE Environmental Performance Review (2020) recommendation on public-private partnerships			
3.7. Strengthen efforts to establish an effective and transparent PPP framework that meets advanced international standards.			Cabinet of Ministers

Recommendation 3.3: Expand policy support for enhancing the absorptive capacity of the private sector to equip firms with managerial and organizational skills.

Actions	Priority	Time frame	Actors
3.3.1. Invest in and reinforce skills development programmes to systematically build organizational, managerial and technological capacities.	①	Medium-term	Cabinet of Ministers, MoHSSE, MoPE
3.3.2. Align higher education curricula and vocational education systems to better respond to the skills gap in the labour market.	②	Medium-term	Cabinet of Ministers, MoHSSE, MoPE
3.3.3. Implement effective marketing and outreach campaigns to increase awareness of and participation in skills development programmes.	③	Medium-term	EDA, with relevant ministries and industry associations

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Recommendation 3.4: Promote start-up creation by ensuring sufficient coordination and awareness of innovation policy initiatives to exploit the entrepreneurial capacity of the broader population, including targeted support for female entrepreneurs.			
Actions	**Priority**	**Time frame**	**Actors**
3.4.1. Strengthen the entrepreneurial culture and enhance start-up support by incentivizing coordination between support initiatives.	①	Short-term	MoID
UNECE EPR (2020) recommendation on greening the industry			
15.1. Create economic and financial incentives and foster the creation of SMEs and start-ups for green technology and for industrial enterprises to move towards green technology.			Cabinet of Ministers
Recommendation 3.5: Enable the functional and structural transformation of the national statistical system to provide policymakers, business and civil society with sufficient data on innovation.			
Actions	**Priority**	**Time frame**	**Actors**
3.5.1. Provide statistical data in a digital format.	①	Short-term	State Statistics Committee, Centre for Scientific and Technical Information
3.5.2. Harmonize national statistical data with international statistical standards.	②	Medium-term	State Statistics Committee, Centre for Scientific and Technical Information
3.5.3. Increase the coverage and offers of statistical indicators on STI.	③	Long-term	State Statistics Committee, Centre for Scientific and Technical Information
3.5.4. Offer capacity-building opportunities for users of STI statistics.	③	Long-term	State Statistics Committee, Centre for Scientific and Technical Information
Recommendation 3.6: Foster an evidence-based culture of innovation policymaking through a systematic approach to design and to monitoring, assessment and evaluation.			
Actions	**Priority**	**Time frame**	**Actors**
3.6.1. Introduce ad hoc evaluations, interim assessments and ex-post evaluations.	①	Medium-term	Cabinet of Ministers
3.6.2. Ensure evidence-based design of innovation policy.	②	Long-term	Cabinet of Ministers
3.6.3. Establish a policy mechanism to monitor the realization of different programmes.	②	Medium-term	Cabinet of Ministers, MoID
UNECE EPR (2020) recommendation on environmental monitoring, biodiversity monitoring and research, and scientific and technical innovation in the field of pollution prevention and control			
4.1. Automate data collection, quality control and transfer in general towards the establishment of a continuous monitoring and real-time pollution data-collection system, particularly with regard to the atmospheric air pollution monitoring network.			Cabinet of Ministers, State Committee on Ecology and Environmental Protection
11.1. Adopt and ensure the implementation of a long-term state biodiversity monitoring and research programme as part of the integrated system of State environmental monitoring. Ensure the establishment and operation of an efficient biodiversity information system, utilizing contemporary techniques for digitalized data acquisition, storage, retrieval, processing and data set harmonization.			Cabinet of Ministers, Academy of Sciences, PROs
4.7. Ensure that a sectoral assessment of priority areas for research and innovation in line with the road map of the Strategy for Innovative Development for the period 2019–2021 is carried out, and identify resources needed for promoting applied research and technology development in the field of pollution prevention and control technologies.			Cabinet of Ministers

Source: UNECE.

EDA = Entrepreneurship Development Agency, EPR = Environmental Performance Review, MoHSSE = Ministry of Higher and Secondary Specialized Education, MoID = Ministry of Innovative Development, MoPE = Ministry of Public Education, PPP = public-private partnership, PRO = public research organization, SMEs = small and medium-size enterprises, STI = science, technology and innovation.

Strong political commitment has led to development of a range of strategies and support mechanisms for innovation, but the NIS is still nascent

In recent years, the Government has recognized the importance of innovation for sustainable development, as demonstrated by various newly established institutions and ambitious reforms focused on prioritizing innovation and science. These include creating the Ministry of Innovative Development (MoID), developing the Strategy for Innovative Development 2019–2021[1] and increasing investment in various support mechanisms for innovation, such as incubators, accelerators, science and technology parks (STPs) and start-up competitions.

Innovation policy reforms in Uzbekistan need to ensure experimentation happens systematically.

Reviewing these initiatives is especially important in the run-up to the medium-term Innovation Strategy for 2022–2030. As chapter 2 notes, to make use of Uzbekistan's potential, substantial work remains to be done to ensure that innovation, or experimentation with ideas to see what works and what does not, becomes more systematic across the economy, the public sector and society at large. This requires a systems perspective: stakeholders, regulations and processes in the emerging NIS (box 3.1) must systematically enable and incentivize interaction, collaboration and knowledge sharing.

As outlined in the following sections, the nascent NIS does not yet fully support the broad and systematic experimentation with new ideas required to realize the significant potential for innovation identified in previous chapters. Although Uzbekistan has introduced a variety of innovation reforms and with them new institutions, agencies and policy instruments, policy measures need to be adapted further to the structural changes of the economy that are under way, in line with national strategic priorities.

Box 3.1 National Innovation Systems

The notion of a national innovation system (NIS) has evolved as a way of understanding the many aspects and dynamics that drive the process of trying out new ideas. The subsystems of an NIS include the following:

- International and national markets for innovative products and services
- International and national firms and entrepreneurs, developing and commercializing innovative products and services
- Knowledge-generating institutions, such as universities, public research organizations (PROs), and R&D institutions
- Innovation intermediaries providing support services
- Framework conditions that shape incentives and create a conducive environment for innovation

For an NIS to effectively enable creation and experimentation with new ideas, it requires systematic and vibrant links among all its participants. These complex interactions lie at the core of the NIS as they affect the generation, diffusion and application of innovation across the economy and improve the efficiency of the innovation process.[a] Weak linkages between public and private stakeholders are a common shortcoming in the NISs of transition economies that impede countries in fully realizing their potential for innovation-led growth.

Source: UNECE, based on OECD and Eurostat (2018), OECD (2015).
[a] Based on the definitions and explanations in the OECD Oslo and Frascati Manuals.

The NIS remains fragmented and lacks synergies, and medium- and long-term policy planning is not well developed. Procedures for formulating and designing innovation policy do not sufficiently involve the private sector and civil society, thus undermining the effectiveness of policy interventions and potentially missing out on accounting for urgent challenges and developments in the policy agenda. Policy mechanisms do not yet fully address the low absorptive capacity in the private sector – an impediment to innovative activity, as it leaves firms without the tools and capacities necessary to effectively absorb new knowledge and technologies and try out new ideas. Low enrolment rates as well as insufficient quality in higher education highlight the need to strengthen support for educational reform, as skills developed do not meet the demands of the labour market – an unexploited opportunity for a country with such a large share of youth in the population. Furthermore, to ensure the catalytic effect of growth in R&D, the planned increases in R&D funding need to be accompanied by reforms of R&D governance and strengthened linkages with other innovation stakeholders. Last, but not least, for all stakeholders to adequately assess and implement innovation policy, Uzbekistan needs to structurally and functionally reform its system for collecting national statistics on science, technology and innovation (STI), as well as foster a culture of evidence-based policymaking by developing systematic approaches to monitoring, assessment and evaluation to ensure that innovation policies create the desired impact.

This chapter examines the current trends and context of innovation policy governance, including the legislative and institutional framework as well as policy coordination and alignment, then presents an analysis of the availability and effectiveness of policy instruments supporting innovation. It discusses the main strengths and weaknesses, based on which it presents concrete recommendations to support further improvements in these areas.

Innovation policy is fragmented, misses opportunities for synergies and does not always align with challenges and needs for sustainable development

Innovation policy governance is being reformed through top-down innovation policy initiatives aimed at supporting innovation-led growth of the economy

Innovation policy governance refers to the capacity of government administrations to spur innovation through coherent, cross-sectoral policy interventions. It encompasses overarching institutional and legal frameworks and strategic documents that set the direction for designing, formulating and implementing innovation policy initiatives. Innovation policy needs to manage tensions and conflicts between different parts of the NIS to create the conditions necessary for long-term sustainable development.

A significant milestone has been the establishment of the MoID, which drives and coordinates innovative development across public actors.

In recent years, the growth of innovation activities has been driven mainly by a top-down approach, with the Government introducing various support institutions and elements within the NIS, as depicted in figure 3.1. The Cabinet of Ministers of Uzbekistan has the highest powers in shaping the development trajectory of the NIS, as it ratifies milestone policy initiatives that set the stage for research and innovation activities. Given its cross-cutting nature, innovation and science policy is formulated by multiple ministries: the MoID, the Ministry of Economic Development and Poverty Reduction, the Ministry for Development of Information and Communication Technology (MoDICT), the Ministry of Specialized Secondary and Higher Education and the Ministry of Public Education, as well as the Supreme Attestation Commission under the Cabinet of Ministers.

The MoID was established to formulate and implement national STI policy and conduct regular assessments and evaluations of STI policy initiatives. The Ministry is the main actor responsible for coordinating innovation policy across government authorities. To support digital transformation of the private sector and government, the President of Uzbekistan issued the decree to form the MoDICT in February 2015. The Government restructured institutions to adapt their roles to ongoing widespread economic reforms. For instance, in 2020, transformation of the Ministry of Economic Development and Poverty Reduction put policy priorities for economic growth and poverty reduction at the highest political level for the first time. Also in 2020, the Ministry established the Entrepreneurship Development Agency (EDA) as the main agency responsible for supporting entrepreneurial activity.

To ensure the effectiveness of newly introduced institutions and agencies and to create complementarities and synergies between various initiatives, public authorities and institutions need to interact constantly with the other NIS participants: the private sector and civil society. Owing to structural limitations of the NIS, however, participation in policy design by non-governmental stakeholders, such as the private sector, is low, which leads to negative consequences for research commercialization, education quality and the proper functioning of innovation policy initiatives in general.

Recent reforms in Uzbekistan have integrated various strategic objectives in line with Agenda 2030 into national policy documents

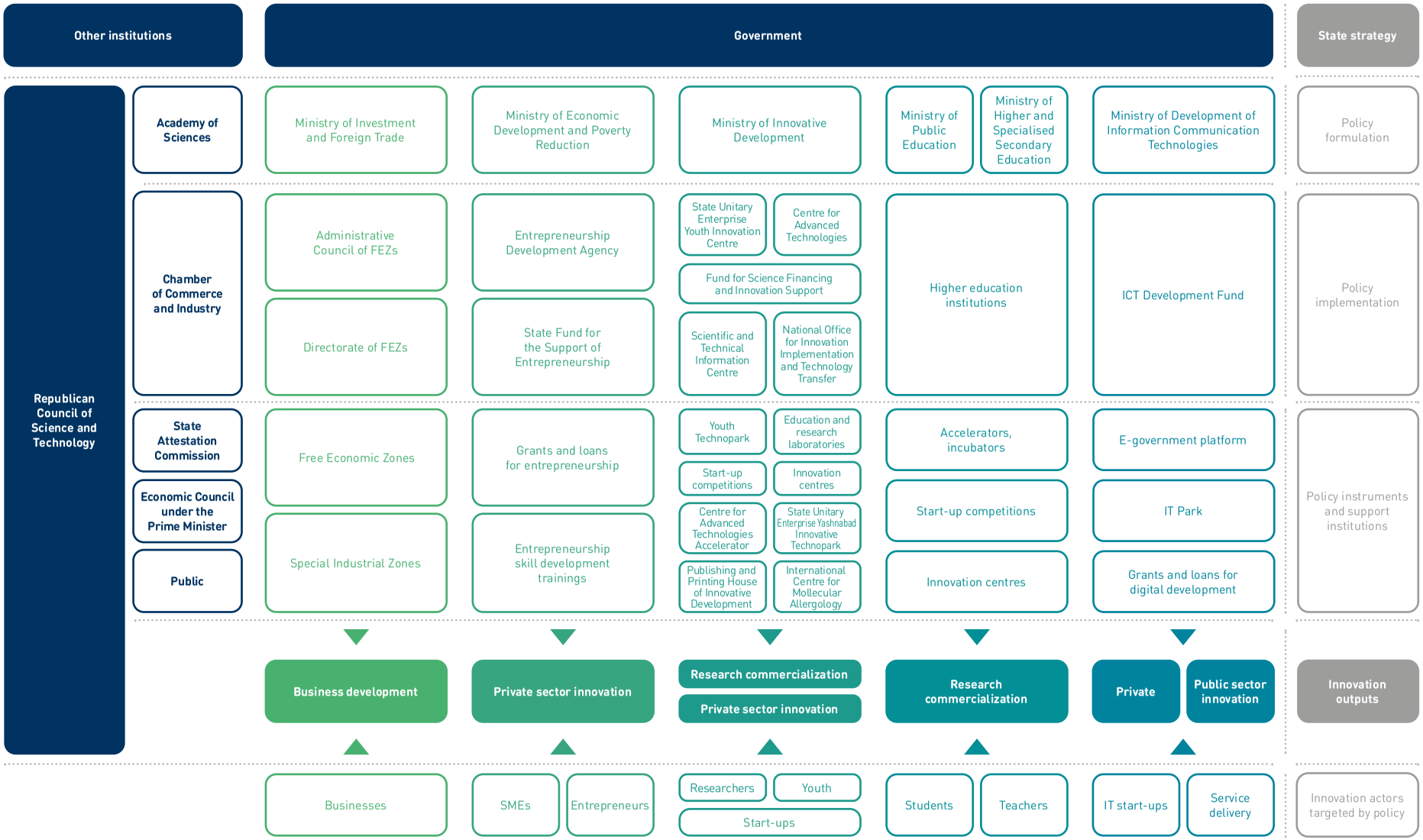
Uzbekistan shows strong political and social commitment in its ambitions to work towards sustainable and inclusive development and reach the UN Sustainable Development Goals (SDGs), as outlined in the Action Strategy on Five Priority Areas of Development of the Republic of Uzbekistan in 2017–2021[2] (chapter 1) and the Development Strategy 2035. After the President's re-election, he announced a new development strategy for 2022–2026 called "New Uzbekistan", which covers seven priority areas (table 3.1).

Table 3.1 The seven priority areas of the New Uzbekistan 2022–2026 national development strategy

Area	Policy Priority
1	Building a state that cares about dignity, ensuring citizens' legitimate interests and well-being, based on the further development of a free civil society
2	Strengthening justice and the rule of law, ensuring respect for human honour and dignity
3	Developing the national economy
4	Implementing a fair social policy and developing human capital
5	Implementing reforms in the spiritual and educational spheres
6	Elaborating solutions to global problems at the national and regional levels
7	Ensuring peace and security, further developing international cooperation

Source: UNECE.

Figure 3.1 · Mapping of innovation governance in Uzbekistan



Source: UNECE, based on author's analysis.

Furthermore, the country's Voluntary National Review (UN DESA, 2021) shows that Uzbekistan is working to boost its market economy by undertaking structural changes, such as currency and tax reforms, as well as implementing a variety of measures to improve the business climate, support productivity growth, promote entrepreneurship and formal employment – particularly among youth and women, attract investment and facilitate innovation. Accordingly, the country has implemented several State programmes, such as the Year of Support for Active Entrepreneurship, Support of Innovative Ideas and Technologies (2018) and the Year of Science, Enlightenment and Digital Economy (2020), as well as other efforts, such as the Digital Uzbekistan 2030 Strategy, to strengthen innovation-driven growth.

Uzbekistan is engaging with international organizations to support green growth in the economy.

The Strategy for the Transition to a Green Economy for the Period 2019–2030[3] outlines measures for encouraging the development of sustainable technological solutions and organizational practices in the oil and gas industry, introduces an inventory of regulations for energy efficiency and adopts "green" public procurement processes. Uzbekistan is also actively working with international partners on regional initiatives, such as the United Nations Special Programme for the Economies of Central Asia (SPECA) (box 3.2), to support sustainable development.

Box 3.2 SPECA – regional cooperation on innovation for sustainable development

The United Nations Special Programme for the Economies of Central Asia (SPECA), established in 1998, fosters subregional cooperation in Central Asia and integration into the global economy, providing a framework for progress towards attaining the SDGs. The economies include Azerbaijan, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. The programme includes capacity-building activities and regional initiatives, and facilitates the overall exchange of best practices and experience in reaching the SDG targets. UNECE, together with the United Nations Economic and Social Commission for Asia and the Pacific, provides support to the activities under this programme.

In 2019, at the 14th session of the SPECA Governing Council in Ashgabat, Turkmenistan, the SPECA Innovation Strategy for Sustainable Development was adopted. It is the main document guiding the activities of the SPECA Working Group on Innovation and Technology for Sustainable Development. At its session on 21 October 2021, the Working Group discussed and endorsed the action plan to support the implementation of the strategy, which was adopted by the SPECA Governing Council on 19 November 2021. A United Nations Development Account project running from 2020 until 2023 supports the implementation of this strategy, including through a substantive capacity-building component.

Outputs from SPECA activities include the following:

- Policy Handbook: *Business Incubators for Sustainable Development in the SPECA Subregion*, launched during the Working Group in 2021 (see box 4.6 in chapter 4).
- Analytical papers: "Science, technology and innovation gap assessment of the SPECA countries" (Dobrinsky, 2020); "Prospects for SPECA regional cooperation on innovation for sustainable development" (Tautiyeva, 2020); "Towards industrial policies to support technology upgrading for sustainable development in SPECA subregion" (Radosevic, 2021); and "Towards technological transformation of the SPECA countries: The innovation imperative for sustainable development" (Dobrinsky, 2021).
- Capacity-building: supporting the development of the innovation ecosystem in Kyrgyzstan, including two meetings of the task force and the draft road map for developing the innovation ecosystem.
- A series of other activities to help SPECA policymakers implement recommendations provided under these and upcoming outputs.

The last session of the Working Group was chaired by Kyrgyzstan.

Source: UNECE.

To support the implementation of national strategic documents on sustainable development and a green economy, the Government is also working on mobilizing private and public financial and technical assistance, both domestically and internationally, to accelerate progress towards achieving the SDGs. To support the country's environmental performance and management, an especially important topic as Uzbekistan deals with the repercussions of the Aral Sea crisis (box 3.3), UNECE recently launched the third Environmental Performance Review (EPR) of Uzbekistan (box 3.4).

Box 3.3 Environmental sustainability in the Aral Sea

Uzbekistan recognizes the need for innovation in addressing environmental challenges. In addition to its efforts to attain overall sustainable development and green growth in the economy, it is strengthening efforts to combat the desiccation of the Aral Sea, a consequence of unsustainable agricultural practices and one of the most significant environmental crises in Central Asia (chapter 1). As a policy priority, the Government has set out to develop ways to ensure a stable water supply, fostering the creation of innovative water management systems.[a] On the initiative of the MoID and the State Committee on Forestry, in January 2019 Uzbekistan established the International Innovation Centre for the Aral Sea Region.[b] The centre is tasked with cooperating with international organizations and donors to implement innovative solutions in fields such as afforestation, bioenergy, crop cultivation, livestock and pasture management, and adaptation to climate change. In this vein, the centre initiated the agro- and eco-tourism project "My Garden in the Aral Sea" for tourists and local residents to contribute to the greening of the region through a landscaping project and a crowdfunding platform for planting trees.[c]

On the initiative of the President of Uzbekistan, the United Nations General Assembly adopted a resolution on 18 May 2021 declaring the Aral Sea region a zone of ecological innovation and technology. The resolution encourages stakeholders to conduct multidisciplinary research and to develop and implement environmentally sound technologies, thereby contributing to improving productivity and competitiveness and ultimately supporting sustainable development. The Presidential resolution, adopted on 29 July 2021, contains measures to introduce modern, resource-saving and highly effective technologies in the Aral Sea region, to conduct scientific research and to introduce scientific and innovative developments into practice. Measures to implement the resolution of the General Assembly are also included under priority action 6 of the national development strategy New Uzbekistan 2022–2026 (table 3.1).

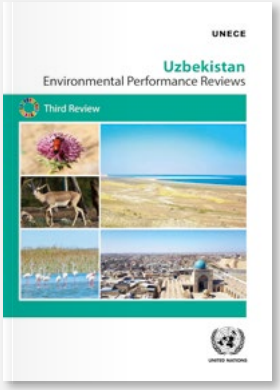
Source: UNECE.

[a] "Concept Aral Sea Region – ecological innovations and technologies zone", developed by the Interagency Working Group under the MoID (2019).

[b] Uzbekistan, On the formation of the Aral Sea International Innovation Centre under the President of the Republic of Uzbekistan, Presidential Resolution No. PP-3975 of 16 October 2018, https://lex.uz/docs/3994105; https://iic-aralsea.org/.

[c] International Innovation Centre for the Aral Sea Region, Мой сад в Аральском море ("My garden in the Aral Sea"), https://iic-aralsea.org/my-garden-in-the-aral-sea/.

Box 3.4 UNECE EPR for Uzbekistan



The Environmental Performance Review (EPR) Programme is a UNECE flagship programme that assists and supports Member States in improving their environmental management and performance. Conducted at the request of national governments, the EPR assesses the progress of countries in reconciling environmental and economic targets and strategies to meet international environmental commitments in line with the 2030 Agenda. The findings and recommendations help countries integrate environmental policies into economic sectors, promote greater accountability to the public and contribute to the achievement and monitoring of relevant SDGs. The research process promotes exchange among countries of information on policies and experiences as well as strengthening cooperation of countries with the international community.

In 2020, UNECE conducted the third EPR of Uzbekistan, reviewing developments in environmental policy and the implementation of the recommendations of the second EPR, conducted in 2010.

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Box 3.4 UNECE EPR for Uzbekistan (Concluded)

The EPR examines environmental policy frameworks and compliance assurance mechanisms, including government efforts to green the economy, monitor environmental performance, achieve public participation and improve education. It addresses issues of specific importance to Uzbekistan related to air protection, biodiversity and protected areas, as well as water, waste and chemicals management. The EPR provides guidance on integrating environmental considerations into policies on energy, agriculture, transport, industry and health, with the topic of the Aral Sea crisis (see box 3.3) and its consequences for the environment incorporated throughout.

Innovation, especially in environment-related R&D and technologies, will be critical to reducing environmental pollution and improving the efficiency of resource use to achieve sustainable development – notably SDG target 8, which calls for improving resource efficiency and decoupling economic growth from environmental degradation. Recommendations of the third EPR of Uzbekistan that are related and complementary to innovation policy are included alongside the recommendations of this I4SDR publication. More information on the third EPR of Uzbekistan is available here: https://unece.org/environment-policy/publications/3rd-environmental-performance-review-uzbekistan.

Source: UNECE.

Recognizing the importance of innovation for sustainable development, the country has put innovation high on the political agenda

Innovation policy is located at the intersection of multiple policy domains ranging from education to industrial development. For effective innovation policy, it is crucial to ensure that national strategies covering innovation support have detailed action plans and sufficient funds to realize their vision. As part of overarching policy efforts, Uzbekistan has developed national strategies that set priorities and strategic objectives and outline policy mechanisms for the transition towards a knowledge-based economy.

Strategic documents for innovation, science and education, lay out the path to building a solid foundation for developing the NIS.

One of the guiding documents is the country's first Strategy of Innovative Development 2017–2021,[4] which focuses on developing human capital, improving educational quality, enhancing the business environment and creating equal and fair conditions for doing business.[5] In addition to other quantitative targets, the strategy sets forth an ambitious goal of Uzbekistan ranking among the 50 most innovative economies in the Global Innovation Index (GII) (see box 2.2 in chapter 2). It also emphasizes the need to stimulate participation by the private sector in funding R&D activities and expanding its role in co-developing innovation policy initiatives.

In 2020, the MoID adopted the Concept for the Development of Science until 2030,[6] to increase the share of public R&D spending in gross domestic product (GDP), create favourable working conditions for young scientists and improve the quality of the research infrastructure. The concept introduces a national ranking system to assess the effectiveness of scientific and innovation activities of higher education institutions (HEIs) and public research organizations (PROs) and outlines governance reforms necessary for research organizations to develop capabilities for self-governance. The concept gives special attention to diversifying as well as augmenting available R&D funding by establishing venture capital funds, increasing public spending and creating favourable conditions for firms to invest in R&D. Furthermore, the Government has recently adopted a Presidential decree outlining efforts to develop an artificial intelligence ecosystem along with regulatory and legal steps for its development.[7]

The Government has drafted the Innovation Strategy for 2022–2030, which aims to comprehensively support and develop scientific and innovation activities in Uzbekistan,

with the main objective being to develop a continuous (cyclic) innovation ecosystem ("innovation–capital–innovation"). This includes further developing human capital for innovation, ensuring the rapid socioeconomic growth of regions of the country, developing the infrastructure to support start-up initiatives, organizing large-scale efficient production (capital creation), encouraging demand for innovation, forming a system for redirecting the created capital to "radically renewable" innovations and increasing the share of innovatively active enterprises. The Government is also preparing the Investment Strategy 2025 and the Industrial Development Strategy, which will create frameworks for attracting foreign investment in technology-intensive industrial sectors and for improving knowledge capital.

To maintain momentum, the Government is developing more strategies to strengthen industrial and innovative growth.

Recognizing the potential of the country's ample human resources (chapter 2), the Government has launched reforms of the entire educational system. It is currently revising the law on education (1997) and is redefining the system of secondary and higher education. The Ministry of Higher and Secondary Specialized Education is planning to introduce curricula with a competency-based approach that aligns more closely with the needs of the modern economy. The Concept for the Development of the Higher Education System until 2030[8] sets a goal of seeing at least 10 Uzbek HEIs rank in the top 1,000 in international academic rankings.

Key legislative documents for innovation policy have been developed, albeit with a lack of coherence and remaining legal gaps

Legal frameworks form the conditions that enable or prevent innovative activities. Weak enforcement of laws, high complexity of legislation and insufficient capabilities of government authorities to draft legal acts represent significant barriers to innovation policy in Uzbekistan. Although the problem of legal gaps in innovation policy is still very acute, the Government has recently taken several positive steps towards developing key guiding documents for science and innovation.

In 2020, Uzbekistan adopted the law on innovative activity,[9] which identifies priority areas for strengthening research and innovation, laying the foundation for bolstering the innovation infrastructure and outlining government measures for innovation support, including fostering public-private partnerships and facilitating international cooperation in science and innovation. The law on science and scientific activity[10] declares key principles for academic research and for building the foundation for further developing research organizations.[11]

The legal frameworks for innovation and competition are improving, with international support.

Uzbekistan took a major step forward by introducing regulatory impact assessments to systematically analyse and adjust existing laws and new legislative initiatives to make them compliant with the competition law. The Government designed and implemented competition impact assessments, leveraging technical assistance from the OECD to foster an evidence-informed culture of policymaking and improve the effectiveness of policy initiatives. Furthermore, in collaboration with the European Bank for Reconstruction and Development, Uzbekistan is drafting a new competition law, with one of the major changes being to include policy mechanisms and legal actions against cartel agreements.

Despite progress in advancing legislation related to innovation and competition, the rule of law in Uzbekistan remains weak (chapter 1). Legal frameworks exhibit various challenges ranging from gaps to inadequate enforcement. Key fundamental terms such as "start-up",[12] "business incubator" and "spin-off" are still missing in the civil law,

Review of the current legal framework nonetheless shows remaining gaps and inefficiencies.

preventing the development of supporting regulations. Formulation and amendments of laws are frequently carried out through decrees. The current quality of laws and bylaws thus produces uncertainties and obscurities, making it challenging to follow legal principles. This allows for multiple interpretations by public administrations and ultimately results in inconsistent implementation of legal acts (OECD, 2021). Administrative procedures in Uzbekistan are consequently very complex, expensive and time-consuming, especially regarding technology licensing and customs regulations (chapter 4).

Insufficient public policy coordination, unclear mandates and limited institutional capacities constrain the cumulative effect of policies and support mechanisms

Because innovation policy involves multiple public and private stakeholders, effective coordination of policy is essential for laying a solid foundation for coherent agenda setting and for developing positive synergies across policy initiatives. The innovation strategies of Uzbekistan assign objectives to various ministries and agencies; however, the current mechanisms for coordinating innovation policy initiatives lead to duplicated functions and fragmented efforts and resources among public institutions.

A holistic, integrated view of innovation policy can enable the Government to maximize synergies and coherence across public institutions.

Addressing this issue requires a broad approach to innovation policy governance through comprehensive strategies and planning instruments that encompass and align all policies and mechanisms that directly and indirectly support or affect the NIS and ensure synergies – and efficient mechanisms for coordinating those strategies and instruments. For example, the creation of joint working groups across the Government, bringing together experts from different departments to cooperate on designing and implementing innovation policy initiatives, would enhance both the coherence and the complementarity of policies *(recommendation 3.1.1)*.

Policy coordination is inhibited by unclear mandates between regional administration (khokimiyat) departments and regional departments of national ministries. According to legislation,[13] the head of the subnational entity (region or municipality) exercises full administrative powers under a one-person leadership structure and bears full responsibility for subordinate government bodies. Establishing clear mandates for local departments of national ministries and for khokimiyat departments will strengthen coordination of policy design and implementation across all levels *(recommendation 3.1.2)*.

Developing public officials' capacity for managing innovation policy will be crucial to ensure initiatives are implemented effectively.

Continuous investment in building local capacity and updated support for developing skills of public officials will be crucial to ensuring sufficient coordination across public sector agencies and effective collaboration with private sector actors, as well as improving capacities in design of industrial and innovation policy and in administrative implementation of policies. To date, Uzbekistan has experienced shortages of innovation specialists in both the public and the private sectors. Although support for developing civil servants' skills is provided by the Academy for Public Administration[14] and available in collaboration with international donors,[15] support for developing innovative skills is not available, and local HEIs do not offer any academic programmes or training opportunities in innovation management and operational excellence. The pool of qualified human capital is limited and in part confined to specialists who have previously worked in foreign firms. Utilizing the training potential of foreign firms operating in Uzbekistan and utilizing the skills of the Uzbek diaspora (box 3.5) are both important to further enhance the availability of human capital in Uzbekistan.

Box 3.5 Engaging the Uzbek diaspora to promote innovation

Engaging the diaspora has significant potential – in terms of economic benefit, social capital and technological advancement – for boosting innovation for sustainable growth and moving towards a circular economy. The diaspora can contribute to innovative growth through their skills, experience, connections, ideas and capital for innovative, often export-oriented initiatives and help diminish the risk of innovation by navigating through different environments effectively. Meaningfully engaging with citizens abroad and sustaining effective relationships built on trust is important to capitalize on the opportunities offered by the diaspora. Encouraging "circular migrants" – professionals who have work experience and qualifications acquired abroad (UNECE, 2016) – to return to Uzbekistan can bring expertise and skills essential for innovation. In addition, many such migrants choose to become entrepreneurs using their savings, access to resources, cross-border social networks and ideas for innovation (Wang, 2020).

The Uzbek diaspora can provide significant benefits to innovation by facilitating technology transfer in knowledge-intensive sectors. It can also have a positive effect on export channels, for example by improving the efficiency of agricultural export through SMEs, specifically in the fruit and vegetable trade (see box 1.1 in chapter 1), with expertise and networks gained in foreign markets. Most policy mechanisms dedicated to the diaspora focus on sending Uzbeks abroad for education or on fostering cultural and social ties with countries to which Uzbeks have migrated. One such is the Buyuk Kelajak, an expert council on development strategies composed of nearly 300 Uzbeks living abroad. The El-yurt Umidi Foundation promotes dialogue with Uzbeks living overseas, recruiting highly qualified specialists for senior government positions (Eraliev, 2019). While these are certainly steps in the right direction, several factors – perceived bureaucratic inefficiency, a need for further public administration reforms, and insufficient health and education services for children – currently hinder return migration (Eraliev, 2019).

A couple of sectors of the economy can be improved through the support of diaspora networks. First, the contribution of the diaspora to science and technology can strengthen the transfer of technology, which would be especially effective with Uzbeks living in Europe, South Asia and North America who work in knowledge-intensive sectors. The same holds true for the financial market development initiated by the Government after 2016. Second, diaspora networks could improve the efficiency of agricultural exports, especially in the case of SMEs. Migrants moving from rural areas of Uzbekistan to other countries of the Commonwealth of Independent States such as Kazakhstan, the Russian Federation and Ukraine are employed in the fruit and vegetable trade. Strengthening their connection to their home country could positively affect export channels in the sector through the sharing of knowledge of external markets and connections to important stakeholders.

Increasingly, UNECE Member States recognize the potential of diaspora populations, especially for economies in transition, and are introducing policy mechanisms and initiatives to use them more systematically. UNECE supports these efforts through regional policy dialogue, for example at a webinar called "Leveraging the Diaspora for Innovation" at the 14th session of the UNECE Committee on Innovation, Competitiveness and Public-Private Partnerships,[a] and through normative work, such as a dedicated chapter on leveraging diaspora for innovation in the *Innovation for Sustainable Development Review of Moldova* (UNECE, 2022) and the *Innovation for Sustainable Development Review of Armenia* (forthcoming).

Source: UNECE, based on Abdulloev, Epstein and Gang (2020).
[a] UNECE, Leveraging diaspora for innovation for sustainable development, 15 June 2021, https://unece.org/media/news/357433.

Public sector capacity could be improved by creating public sector innovation labs that introduce and diffuse organizational innovations within government for improved efficiency and efficacy of public services and policy interventions. Compared with traditional mechanisms, such labs are more agile, adapt experimental models to address socioeconomic challenges and provide space for government officials to spur innovation in policymaking (Roth, Asmi and Husar, 2020). At the same time, the Government

needs to introduce retraining opportunities for government officials, leveraging best international practices in innovation and project management. Capacity-building should also be a compulsory component of the administrative costs of all funded programmes, percentages of which should be agreed upon depending on the individual features of each of the programmes *(recommendation 3.1.3)*. Outsourcing of policy design should be limited or should include a component of local capacity-building.

Opportunities for strengthening communication channels and coordination mechanisms with the private sector and civil society are not yet fully explored

Important to ensuring effective coordination of innovation policy in the development of policy initiatives will be to introduce efficient consultations and engagement mechanisms among public bodies as well as with the private sector.

Adding more public and private stakeholders and incorporating cross-cutting areas of STI policy will make the Republican Council of Science and Technology more effective in coordinating innovation policy.

In an effort to support coordination of policy, Uzbekistan established the Republican Council of Science and Technology in 2019. It is chaired by the Prime Minister and includes the President of the Academy of Sciences, the Minister of Innovative Development, the Minister of Higher and Secondary Specialized Education, the Adviser to the President and 24 representatives of HEIs and PROs. Other government departments and the private sector are less represented in the Council, with representatives from only four companies, three of which are State-owned. To serve as an effective platform for aligning private and public interests on innovation policy, the Council should increase participation by other relevant ministries, such as the Ministry of Agriculture and Water Resources, as well as representatives from the private sector *(recommendation 3.2.1)*.

Regular meetings of the Council, which are organized once every six months, mainly focus on operational issues such as the State prize in science and technology. To be an effective instrument for innovation policy coordination, the Council should address issues directly related to cross-cutting coordination of STI policy initiatives across the entire NIS, encompassing both public and private actions. Aside from consulting functions, the Council should have sufficient legal powers to realize its vision effectively.

To align interests, mechanisms for consulting with the private sector are needed throughout the policy development cycle; they can be piloted in selected sectors.

Uzbekistan also does not have effective channels to coordinate innovation policy initiatives with private business and civil society. Developing innovation policy initiatives in isolation, without feedback from the private sector, decreases their effectiveness and can result in undesired negative consequences for the functioning of the NIS. Therefore, efforts need to be directed towards introducing consultations with the private sector and civil society at all stages of the policymaking cycle, covering ad hoc evaluations, interim assessments and ex-post evaluations. To understand how best to engage the private sector and civil society, these efforts could be piloted in two to three sectors, such as information and communication technology, or dedicated to socioeconomic challenges. This would make it possible to try out various mechanisms or initiatives and then systematically scale up those that are most effective *(recommendation 3.2.2)*. In this vein, the third EPR of Uzbekistan also calls for "strengthen[ed] efforts to establish an effective and transparent public-private partnership (PPP) framework that meets advanced international standards as well as the development of administrative capacities and competencies for the evaluation of the benefits and costs of PPPs" (EPR recommendation 3.7).

Ensuring the effective implementation of integrated e-governance and digital public services will require strengthened coordination

With the expansion of e-governance services, public sector innovation is growing, although coordination challenges remain.

Digitalizing public services supports efficient provision of such services across public institutions. Uzbekistan has made significant progress in and actively supports the digitalization of public services – improving on the GII indicator *Government's online service*[16] from a rank of 72/141 in 2015 to 46/132 in 2021[17] (Cornell University, INSEAD and WIPO, 2015; WIPO, 2021c). The MoDICT is the main authority on the digital economy and e-government in the country's effort to modernize the national digital infrastructure and skills capacity for e-governance under the Digital Uzbekistan 2030 strategy.[18] It has established the Single Portal, an electronic government platform for government services.[19] In 2020, about 30 per cent of the 700 information systems of government institutions were integrated into the platform. The Government has set out to increase the share of public services available electronically to 60 per cent (of all public service offerings) by 2022 and up to 80 per cent by 2025.[20] Furthermore, the Institute for the Development of Digital Technologies and Artificial Intelligence, established in 2021 under the MoDICT, has the primary focus of organizing research aimed at widespread implementation of the national digital strategy.[21] The pilot project "Digital Tashkent" (2020),[22] a single platform for digital services and software, was recently implemented by the United Nations Development Programme and the MoDICT to strengthen the digitalization of public services in education, health, infrastructure (utilities and transport), and retail and wholesale trade in the capital.[23]

However, further room remains for improvement. In the 2020 United Nations E-Government Survey, Uzbekistan ranked 87/193 in the E-Government Development Index, with a value of 0.667. This was an improvement from 2018 (0.621) but lower than other countries in the region, such as Kazakhstan (29/193, value: 0.838) and Kyrgyzstan (83/193, value: 0.675). Interviews indicated that the reason for the lagging activities in e-government was the dispersion of responsibilities across government organizations. Consequently, recent reforms to concentrate e-governance activities under the MoDICT may yield significant improvements in this regard.

Reinforcing and coordinating the right policy support mechanisms is essential to effectively leverage the potential of human capital for innovation

Ensuring sufficient availability of resources and capacities is important to improve the effectiveness of the growing number of innovation policy instruments.

To enable innovation-driven growth effectively, policymakers need to introduce the right mechanisms to defray the risks of experimentation. In Uzbekistan, several direct and indirect policy tools are in place to support innovative development. Most target research commercialization and (digital) start-up creation. However, obstacles to innovative development remain, such as insufficient skills and resources and an innovation infrastructure that is not yet fully developed (table 3.2; chapter 4). The perceived lack of need for innovation and the low demand for new products and services reflect structural features of the economy, which is dominated by resource-based and traditional sectors that are not technologically dynamic.

Table 3.2 Constraints on innovation activity, 2019
(Per cent of respondents who perceived as a risk)

Lack of finance	23.1
No need for innovation[a]	14.7
High cost of innovation	12.9
Lack of qualified personnel	11.0
High economic risk	9.3
Low demand for new products and services[a]	8.0
Lack of information on new technologies	7.2
Undeveloped innovation infrastructure	7.2
Lack of information on sales markets	6.5

Source: UNECE, based on State Statistics Committee of Uzbekistan (2020).

[a] Based on the results of a sample survey, according to the "Questionnaire for the survey of innovative activity of business entities". The lack of need for innovation and the low demand reflect the structural features of the Uzbek economy, which is dominated by resource-based and traditional sectors that are not technologically dynamic.

Ensuring sufficient support for and awareness of skills development is crucial to strengthening the absorptive capacity of the private sector

A central challenge to innovation in Uzbekistan is the capacity of private sector firms to absorb and assimilate external knowledge, a core competency that is needed to improve firm productivity and competitiveness in knowledge-based economies (chapter 2). Firms need to be equipped with the right organizational and managerial skills to utilize new and better management processes (process innovation) and systematically identify, adopt and experiment with new technologies and ideas for creating value. This can have a direct, positive effect on business efficiency and productivity growth. Support for skills development in Uzbekistan is expanding but still at an early stage. Skills shortages are especially prominent among SMEs, as they have less access to good practices and lack both the understanding of what skills are needed and the resources to obtain the right support.

Several governmental and non-governmental institutions offer support for developing entrepreneurial skills.

Public support for entrepreneurial skill development for SMEs is mainly coordinated by the EDA. Together with relevant ministries and agencies, it offers informational and training services for entrepreneurship and business development, for example through free telephone and online consulting, as well as training centres[24] and business incubators.[25] The agency also provides financial support for training at public as well as private centres through the State Fund for Entrepreneurship Support. With the Graduate School of Business and Entrepreneurship, the EDA planned to establish a Unified Entrepreneurship Education System in 2022 (1 January), a full-fledged system to provide entrepreneurship training based on international standards and in cooperation with international organizations, such as the International Labour Organization.

The Ministry of Employment and Labour Relations offers training and re-training of the unemployed (free training) as well as the employed (paid training) workforce,[26]

both in person and online. In addition, two targeted programmes provide business and entrepreneurial skills development – "Every Family Is an Entrepreneur", aimed at family-owned microfirms in the regions, and "Youth Is Our Future", aimed at supporting development of entrepreneurial skills among the younger population. Moreover, the Small Businesses and Private Entrepreneurship Export Promotion Fund, under the National Bank of Uzbekistan, covers the costs for support from foreign trainers to enhance the business and professional skills of local firms.

Non-governmental support for developing skills is provided by the Chamber of Commerce and Industry, the largest provider of training programmes for entrepreneurs, unemployed people and youth, as well as by various industry associations[27] and international projects funded by donors such as the Asian Development Bank (ADB).[28] In collaboration with four of the largest commercial banks, the Chamber conducts joint training programmes aimed at educating young people on business development.

Despite some available support, many SMEs lack the managerial and organizational skills necessary for improving productivity.

Nevertheless, many SMEs still lack skills needed to improve the productivity and competitiveness of business activities, impeding data-driven decision-making and the overall capacity to integrate new technologies (chapter 5). This lack calls for increased efforts towards systematically building organizational and technological capacities of firms to create the "missing middle" of enterprises capable of absorbing new ideas *(recommendation 3.3.1)*. Conducting a comprehensive assessment of the skills required in the labour market and the supply of skills development support will be important to ensure the quality and relevance of training. Identified managerial and organizational skills gaps can be addressed through targeted programmes, and more general gaps could further be addressed by integrating them into general reforms of secondary and higher education curricula *(recommendation 3.3.2)*. Effective marketing and outreach to raise awareness of training services and the potential benefits they provide to SMEs, for example through joint initiatives with industry and trade associations or other business collectives, will be important to spur SMEs to participate in skills development *(recommendation 3.3.3)*.

Uzbekistan needs to further diversify and facilitate access to finance for innovation, particularly in the early stages of firm development

Difficulties in accessing financing for innovation represent a significant obstacle to innovative activity (table 3.2), especially for pre-seed and seed funding. Most of the funding is public, and the venture capital market is underdeveloped. Direct funding for innovation in Uzbekistan is mainly available through bank loans or competitive grants, awarded by the Fund for Science Financing and Innovation Support[29] under the MoID, through start-up competitions for research and HEIs, and through other fairs organized by the Ministry.[30] SMEs receive some loan support from the State;[31] however, given the high risk of new ventures, loans for innovation usually entail high collateral requirements and interest rates (chapter 1). Furthermore, the Chamber of Commerce and Industry provides loans with low interest rates and without collateral requirements to entrepreneurs to start their own business. Indirect financial support is mostly limited to resident firms in STPs and free economic zones (chapter 4). The Fund for Science Financing and Innovation Support also offers grants for intellectual property registration abroad and for modern equipment for scientific laboratories at HEIs as well as for short-term research internships for young researchers and visits of leading international scientists[32] to Uzbekistan.

Financial support for innovation, especially in (pre-)seed phases of growth, need to be expanded and diversified.

Yet, more than half of company expenditures on innovation were covered by their own funds in 2019, while just 31 per cent of small and microfirms and 16 per cent of large and medium enterprises relied on loans from commercial banks (State Statistics Committee of Uzbekistan, 2020). Most start-ups in 2019 were funded by the founders themselves, their friends or their family (87 per cent); only 10 per cent managed to attract seed investment and 3 per cent were funded by grants (Venture Capital Association of Uzbekistan, 2020).

To stimulate innovation by incentivizing investment in the creation and acquisition of knowledge, it will be important for Uzbekistan to further diversify financing available for innovation, particularly in the riskier pre-seed and seed phases of growth (Elçi, 2020), linking such financing to business support services. Doing so can then further catalyse and crowd in private equity and support capital market development, for example with ongoing efforts to support the emergence of a venture capital market as well as by supporting the creation and engagement of angel investor networks.

Support mechanisms for creating start-ups are being introduced to promote innovation, but their coordination and sustainability need to be ensured to improve their effectiveness

Promoting innovation, start-up creation and entrepreneurship requires governments to invest in establishing support mechanisms and collaboration platforms that provide the necessary tools for entrepreneurs and start-ups to develop and test innovative ideas and, at the same time, to mitigate the risks associated with the uncertainty of innovation. Uzbekistan is in the process of establishing various policy support mechanisms, such as business incubators, STPs, accelerators (chapter 4) and innovation platforms, within the growing start-up ecosystem, as well as several regularly organized start-up competitions (see table A3.1 in the annex), paving the way for the emergence of a vibrant start-up scene. Start-up activity is increasing, mainly in the capital,[33] with the tally of start-ups reaching 1,320 by 2020 – with 83 per cent of them created in the preceding two years (TUZVentures and IT Park, 2021).

As highlighted in the United Nations Educational, Scientific and Cultural Organization (UNESCO) report, "Mapping Research and Innovation in the Republic of Uzbekistan" (Elçi, 2020; box 3.6), there has also been a wave of donor-driven initiatives to support entrepreneurship. Yet degrees of coordination between these initiatives are still low and most support activities halt when donor financing runs out. Establishing effective processes to coordinate, implement, monitor and evaluate the scale-up of donor-funded projects will be crucial to ensure their effectiveness and the sustainability of their impact (Elçi, 2020).

Entrepreneurship and start-up activity is growing but not yet notable among the broader population, leaving further room for policy to incentivize start-up creation.

Given the recency of measures and the novelty of the concept of start-ups in Uzbekistan, entrepreneurial and start-up activity is not prominent among the broader population, thus indicating much potential for improvement. Insufficient synergies between innovation promotion initiatives further limit their effectiveness within the NIS (Enpact Data Lab, 2019). This highlights the need to strengthen support for start-up creation, provide incentives for cooperation on innovation support initiatives and enhance understanding of the benefits of entrepreneurship – for example, through awareness campaigns and outreach events telling success stories. This includes targeted start-up support towards greening industry, as highlighted in the 2020 UNECE EPR. Specifically, recommendation 15.1 of the review states that "in order to support the introduction of green technologies in industry the government will need to create economic and

financial incentives for industrial enterprises to move towards green technology as well as foster the creation of small and medium-sized enterprises and start-ups focused on green technology".

Although some competitions target female-led innovative start-ups, women overall remain underrepresented in start-up activity. In 2020, of the 223 (tech) start-ups surveyed, 87 per cent of the founders were men (TUZVentures and IT Park, 2021). To address this gap, it will be essential to educate women on the benefits of start-ups and create additional targeted measures *(recommendation 3.4.1)*. An example of international support in expanding and strengthening the entrepreneurial spirit within a country is the Empretec programme of the United Nations Conference on Trade and Development (UNCTAD) (box 3.7).

Box 3.6 UNESCO study: "Mapping Research and Innovation in the Republic of Uzbekistan"

UNESCO is conducting a project in support of STI development in Uzbekistan, funded by the Islamic Development Bank. As part of the first phase, UNESCO launched a country profile in October 2020, "Mapping Research and Innovation in the Republic of Uzbekistan", published as volume 10 in UNESCO's GO-SPIN country profiles series. The report provides an overview of and broadly assesses the STI system. The focus is on understanding the current context of STI in terms of R&D and innovation by looking at indicators, mapping the legal framework and examining available coordination mechanisms, key institutions and players, and the main policy instruments. Drawing on the findings of the profile, UNESCO has cooperated with the MoID in the development of the national STI policy, which is at the stage of finalization.

To ensure synergies and complementarity with this I4SDR, UNECE has examined the findings and recommendations of the UNESCO country profile and is collaborating with UNESCO on peer review and potential joint activities between the two projects.

Source: UNECE and UNESCO (Elçi, 2020).

Box 3.7 UNCTAD programme: Empretec

Continuous training and support will be necessary to enhance entrepreneurial skills and financial literacy and to help to bridge the gender gap among SMEs and entrepreneurs. UNCTAD offers the Empretec programme to support capacity-building to promote entrepreneurship, especially among micro, small and medium-size enterprises in developing and transition economies. It facilitates business expansion, moving towards sustainable and inclusive development, including development of small suppliers, and social and green entrepreneurship. Consisting of a network of national centres in 40 countries, the programme's core products include the Entrepreneurship Training Workshop, which promotes entrepreneurial development, specifically through efforts targeted towards vulnerable groups such as women and youth. According to the 2020 report of the United Nations Secretary-General reviewing progress in the implementation of General Assembly resolution 73/225 on entrepreneurship for sustainable development, an impact assessment of Empretec in the Russian Federation revealed that 87 per cent of participants found Empretec training "helpful in overcoming their current business challenges".[a]

Source: UNECE, based on UNCTAD, https://empretec.unctad.org.
[a] UN Secretary General (2020), Entrepreneurship for sustainable development: report of the Secretary-General, A/75/257, 27 July, p.7.

To systematically develop human capital for innovation, Uzbekistan needs to boost enrolment in higher education and improve its quality, as well as reform R&D governance and spending

The low tertiary enrolment rate and insufficient quality of education constrain innovation-based growth in the country (chapter 2). On the one hand, as mentioned earlier, the Government has been quite active in modernizing the education system, including capacity-building and infrastructural improvements. On the other hand, the quality of educational programmes in national HEIs still has considerable room for improvement to meet the current and future labour demand of the private sector.

Addressing the skills gap and leveraging the country's large youth population for innovation requires increasing rates of tertiary enrolment and adapting curricula to labour-market needs.

Given the scale of this challenge and the vast opportunities that improved higher education can bring, it is indispensable that the Government make greater enrolment in higher education, especially among women and in postgraduate programmes, a policy priority. Improving the quality of education and updating the curricula in HEIs to align them more closely with business needs and build on synergies with research and business activities will be essential. Although skills in science, technology, engineering and mathematics are fundamental for national competitiveness in global value chains, it is also important to invest in the development of managerial capabilities. Organizational innovations such as operational excellence programmes (Lean and Six Sigma), for example, have very limited traction in Uzbekistan.

Another pertinent challenge for the higher education system is the high level of brain drain, or permanent loss of skilled workers or students (Cavallini and others, 2018). As graduates emigrate from the country before they can contribute the cost of their training back to the economy in the form of taxes and improvements in productivity, the return to the Government on the investment in education is reduced. No official statistics provide exact figures on brain drain in Uzbekistan, but the estimated number of skilled workers living abroad is in the high thousands. As a result, the country faces a lack of skilled professionals in key areas of economic activity (Anderson and others, 2020). Therefore, in addition to educational reform, efforts to improve working and living standards, especially for early-career workers, need to be strengthened to ensure that graduates remain in Uzbekistan. Some short-term measures to halt brain drain could include salary top-ups, placement schemes or tax exemptions for young professionals.

To support productivity gains from organizational innovations, Uzbekistan needs to establish research teams that proliferate knowledge on organizational innovations in the public and private sectors. Furthermore, strengthening the network of vocational colleges, a legacy from pre-independence times, can offer powerful means for upward social mobility as well as a sufficient supply of the skills required for economic modernization and for a gradual move towards more advanced production stages (chapter 5).

Planned increases in R&D investment must be accompanied by governance reforms, to ensure R&D support is catalytic.

Existing low levels of public R&D financing (chapter 2) cannot support research excellence; they can only maintain research activities, with no possibilities for scaling up. An increase of public R&D funding alone, however, cannot generate desirable outcomes for socioeconomic development, as low funding is aggravated by allocation challenges. Increased funding should come in tandem with governance reforms and the development of strong linkages among innovation policy stakeholders. Specifically, the majority of available funding is distributed in the form of institutional funding mechanisms, whereas project funding has a very low share.

Public spending should play a catalytic role for R&D growth and mobilize private sector resources towards innovative initiatives that have high potential for social returns. For balanced development of the research system, Uzbekistan needs both institutional funding to ensure uninterrupted functioning of research activities and project funding to foster a culture of research excellence and steer research towards socioeconomic and environmental priorities. To advance science and innovation, the Government has initiated the restructuring of the system of public R&D funding by developing competitive funding schemes, diversifying funding sources and increasing available funds[34] (MoID, 2021).

Aligning policy support to needs and emerging constraints requires continuous updating and improving of innovation statistics and evidence-based policy design

Structural and functional reform of national statistics on STI will be important for all stakeholders to be able to adequately assess and implement innovation initiatives and activities

Statistical STI data are instrumental for making evidence-based decisions on innovation policy. To be valuable for users, data should be timely, consistent and internationally comparable. This is essential for various innovation stakeholders: for public authorities to plan, monitor, assess and evaluate innovation policy initiatives; for firms to formulate competitive strategic actions and make well-informed investment decisions; and for civil society to build national consensus on issues related to scientific and technological developments. To date, the quality and accessibility of statistical information in Uzbekistan is not sufficient to satisfy different groups of users, highlighting the need for structural and functional transformation of the national statistical system.

Consistent, accessible statistical information on innovation that meets standards is important so that stakeholders can accurately formulate and evaluate strategic innovative actions.

To reinforce evidence-based policymaking, the State Statistics Committee of Uzbekistan initiated reforms to harmonize national statistics with international standards. That includes implementing the 2008 System of National Accounts standards by December 2021 and the International Monetary Fund's Special Data Dissemination Standard by late 2022. In collaboration with UNESCO, the Government is also working on adopting the OECD and Eurostat standards on the collection and reporting of statistical STI data. The *National Strategy for the Development of Statistics 2020–2025* (State Statistics Committee of Uzbekistan and World Bank, 2019) and other documents list the harmonization of national statistics with international statistical standards as the main priority and outline measures to improve statistical classifications and collection, and analysis of statistical data. In addition to other ministries and agencies, the Centre for Scientific and Technical Information (established in 2019 under the MoID) collects and analyses data on scientific activities and technological innovations, based on which it evaluates the effectiveness of state STI programmes and provides advisory services to public authorities. To improve the quality of statistical data, the Centre introduced new methodology and systematic approaches to data management.

Despite these efforts, reforms of national statistics are still in their infancy. The fragmented structure duplicates efforts in data collection, and the application of varying methodologies leads to inconsistency and incompatibility of data sets on STI. The scale and scope of data are poor and mainly available only in physical form *(recommendation 3.5.1)*;

often, data collection and data analysis methods used by Uzbek public authorities meet neither national quality standards nor international ones (e.g. the Frascati and Oslo Manuals) *(recommendation 3.5.2)*. To date, access to consistent statistical data is very limited, and policymakers, businesses and civil society receive information of varying quality and consistency. Some statistical information can only be compiled and accessed through special government requests *(recommendation 3.5.3)*. There is a need to build both the capacity of users of official STI statistics and a strong dialogue between those users and the producers of national statistical data *(recommendation 3.5.4)*.

To ensure innovation policies create the desired impact, Uzbekistan should foster a culture of evidence-based policymaking by developing systematic approaches to monitoring, assessment and evaluation

In addition to reforms of national statistics, innovation policy requires development of a robust system of monitoring, assessing and evaluating innovation policy initiatives. It is crucial to ensure that policymakers have sufficient evidence for (i) formulating and designing policy interventions (ad hoc assessments) to identify threats and opportunities for future growth; (ii) timely adjusting policy initiatives (interim assessments); and (iii) drawing lessons for future planning (ex-post evaluations). Currently, government authorities do not have the capabilities or expertise for assessing and evaluating policy. Available mechanisms mostly target ad hoc assessments for grant selection, and other stages of policy evaluation are weakly developed or not present at all.

Applying international best practices for transparent, efficient innovation support can help stakeholders identify market failures and establish performance criteria for meeting innovation policy targets.

To further support innovation policy planning and high-quality priority-setting, Uzbekistan needs to consider using technology foresight, leveraging best international practices. Evaluation and assessment procedures should be further developed based on principles of accountability and transparency. While introducing new arrangements for assessing and evaluating outputs and outcomes of innovation policy initiatives, the Government needs to streamline reporting procedures to avoid creating administrative burdens for innovation policy stakeholders *(recommendation 3.6.1)*. In addition to enhancing STI data collection and interpretation, it will also be important to ensure evidence-based design of innovation policy by enabling government administrations to identify market failures, explore policy options and set clear performance criteria for innovation policy initiatives *(recommendation 3.6.2)*. Furthermore, to monitor the realization of innovation policy programmes, the Government could set up a policy mechanism to act as an "early warning" body that coordinates initiatives and, if necessary, undertakes corrective actions and addresses unforeseen problems *(recommendation 3.6.3)*.

Thorough collection of data on environmental activity will also be important, as highlighted by EPR recommendation 4.1, which recommends that the Government, in collaboration with industry associations, "automate data collection, quality control and transfer in general towards the establishment of a continuous monitoring and real-time pollution data collection system". Recommendation 11.1 of the EPR also suggests adopting and ensuring "the implementation of a long-term state biodiversity monitoring and research programme, as part of the integrated system of state environmental monitoring". Based on this recommendation, the EPR also recommends ensuring "the establishment and operation of an efficient biodiversity information system, utilizing contemporary techniques for digitalized data acquisition, storage, retrieval,

processing and data set harmonization, with the objective to gather, store and share results of biodiversity monitoring, research programmes and projects carried out with the support of public funding, and provide access to this system (with differentiated access and data administration levels) for all stakeholders involved in biodiversity conservation initiatives" (recommendation 11.1). In addition, "ensur[ing] that a sectoral assessment of priority areas for research and innovation in line with the road map of the Strategy for Innovative Development for the period 2019–2021 is carried out would help identify resources needed for promoting applied research and technology development in the field of pollution prevention and control technologies" (recommendation 4.7). This will also be important to adequately inform policymakers about the main challenges that innovation will need to address in the long term to ensure sustainable development.

Policy messages and recommendations

Building on the analysis of this chapter, table 3.3 provides actionable recommendations to address the challenges in governance and support mechanisms of innovation policy in Uzbekistan, with the aim of improving the functioning of the NIS and strengthening its effectiveness. To complement the discussion, the next chapters look more closely at the effectiveness and impact of the various support elements within the innovation infrastructure of Uzbekistan (chapter 4) and discuss in-depth the state of science-industry linkages (chapter 5) and their future development in the country towards achieving innovation-led and sustainable growth.

Table 3.3 Summary of policy recommendations on innovation governance and instruments

Recommendation 3.1: Improve **coordination** of innovation policy initiatives across national and regional government authorities and **strengthen public capacities** for effective policy design and implementation.

Insufficient coordination among ministries and unclear mandates of regional departments of ministries and regional administration (khokimiyat), as well as insufficient institutional capacities, impede the effective design and implementation of innovation policy as well as synergies among policy areas related to innovation.

Actions	Priority	Time frame	Actors
3.1.1. **Adopt a holistic approach to innovation policy governance** through comprehensive strategies and planning instruments that encompass and align policies and mechanisms that directly and indirectly support or affect the NIS, and ensure synergies and efficient coordination mechanisms, for example by establishing joint working groups on innovation policy across the national government.	①	Medium-term	Cabinet of Ministers
3.1.2. **Clarify and streamline the mandates of regional departments of ministries and regional administration (khokimiyat) departments.** Eliminate duplication of functions and fragmentation of efforts and resources, and enhance synergies and complementarities to use public resources effectively for innovation.	②	Medium-term	Cabinet of Ministers
3.1.3. **Reinforce skills development of public sector institutions and agencies for innovation**, through public sector innovation labs and retraining opportunities in innovation and project management. Public sector capacity-building should be mandatory for all funded programmes.	③	Short-term	Cabinet of Ministers

/…

Table 3.3 Summary of policy recommendations on innovation governance and instruments (Continued)

Recommendation 3.2: Strengthen the **participation of all ministries relevant to innovation, the private sector and civil society** in designing, implementing and monitoring innovation policy initiatives.

Insufficient communication channels and coordination mechanisms among government, the private sector and civil society throughout the policy cycle undermine and inhibit the effectiveness of interventions. Setting up consultation mechanisms systematically to scout constraints and opportunities and developing targeted measures to address them is imperative for informing effective interventions.

Actions	Priority	Time frame	Actors
3.2.1. **Expand representation of private sector and other relevant ministries**, such as the Ministry of Agriculture and Water Resources, as members of the Republican Council of Science and Technology.	①	Short-term	Republican Council of Science and Technology
3.2.2. **Introduce consultations with the private sector and civil society** at all stages of the policymaking cycle covering ad hoc evaluations, interim assessments and ex-post evaluations, piloting efforts in two or three sectors and subsequently scaling up those that are most effective.	②	Medium-term	Cabinet of Ministers
Relevant UNECE EPR (2020) recommendation on **public-private partnerships**			
3.7. Strengthen efforts to establish an effective and transparent PPP framework that meets advanced international standards. Ensure that administrative capacities and competencies for the evaluation of the benefits and costs of PPPs are developed.			Cabinet of Ministers

Recommendation 3.3: Expand **policy support for enhancing the absorptive capacity** of the private sector to equip firms with managerial and organizational skills.

The private sector lacks a critical mass of capacity to systematically look for and absorb ideas and technology and scale up what works. Building managerial, technical and organizational skills are essential steps in improving these absorptive capacities.

Actions	Priority	Time frame	Actors
3.3.1. **Invest in** and reinforce skills development programmes to **systematically build organizational, managerial and technological capacities**, to create a critical mass of enterprises able to absorb and try out new ideas across the economy.	①	Medium-term	Cabinet of Ministers, MoHSSE, MoPE
3.3.2. **Align higher education curricula and vocational education systems** to respond better to the need for specific organizational, managerial and technological skills.	②	Medium-term	Cabinet of Ministers, MoHSSE, MoPE
3.3.3. **Implement effective marketing and outreach campaigns** to improve awareness of and participation in skills development programmes, for example through seminars and workshops organized together with industry associations, across regions and sectors.	③	Medium-term	EDA, together with relevant ministries and industry associations

Recommendation 3.4: Promote start-up creation by ensuring sufficient **coordination and awareness of innovation policy initiatives** to exploit the entrepreneurial capacity of the broader population, including targeted support for female entrepreneurs.

Uzbekistan has introduced a flurry of mostly donor-supported initiatives to promote entrepreneurship; however, low levels of entrepreneurial activities, especially innovative export-oriented entrepreneurship, undermine prospects for growth.

Actions	Priority	Time frame	Actors
3.4.1. **Strengthen the entrepreneurial culture** and enhance start-up support by incentivizing coordination between support initiatives. Improve understanding of the benefits of entrepreneurship through awareness campaigns and outreach events, for example through communicating success stories. Implement more targeted initiatives for women, especially in the regions, to engage in start-up activity.	①	Short-term	MoID

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Table 3.3 Summary of policy recommendations on innovation governance and instruments (Continued)

Relevant UNECE EPR (2020) recommendation on **greening the industry**		
15.1. Create economic and financial incentives for industrial enterprises to move towards green technology. Foster the creation of small and medium-sized enterprises and start-ups focused on green technology.		Cabinet of Ministers

Recommendation 3.5: Enable the **functional and structural transformation of the national statistical system** to provide policymakers, business and civil society with sufficient data on innovation.

The lack of accessible high-quality data on STI is a significant impediment to policymakers, business and civil society, as it is an important component for informing innovation policy design, measuring its impact and enabling businesses to make educated and evidence-based decisions.

Actions	Priority	Time frame	Actors
3.5.1. **Provide statistical data in a digital format**, and enable users to download and use statistical information for independent analyses.	①	Short-term	State Statistics Committee and the Centre for Scientific and Technical Information
3.5.2. **Harmonize national statistical data with international statistical standards**, in line with the Frascati and Oslo Manuals.	②	Medium-term	State Statistics Committee and the Centre for Scientific and Technical Information
3.5.3. **Expand the coverage and offerings of statistical indicators** on STI, leveraging best practices of national statistical offices around the world.	③	Long-term	State Statistics Committee and the Centre for Scientific and Technical Information
3.5.4. **Offer capacity-building opportunities for users of statistics** on STI.	③	Long-term	State Statistics Committee and the Centre for Scientific and Technical Information

Recommendation 3.6: Foster an **evidence-based culture of innovation policymaking** through a systematic approach to design and to monitoring, assessment and evaluation.

Ad hoc evaluations, interim assessments and ex-post evaluations of innovation policy initiatives are underdeveloped and do not systematically inform policy design.

Actions	Priority	Time frame	Actors
3.6.1. **Introduce ad hoc evaluations, interim assessments and ex-post evaluations** of innovation policy initiatives based on principles of accountability and transparency.	①	Medium-term	Cabinet of Ministers
3.6.2. **Ensure evidence-based design of innovation policy** by enabling government administrations to identify market failures, explore policy options and set clear performance criteria for innovation policy initiatives.	②	Long-term	Cabinet of Ministers
3.6.3. **Establish a policy mechanism to monitor the realization of programmes** and operate as an "early warning" body for a high-level coordination body with authority to undertake corrective actions and address unforeseen problems.	②	Medium-term	Cabinet of Ministers, MoID

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Table 3.3 Summary of policy recommendations on innovation governance and instruments (Concluded)

Relevant UNECE EPR (2020) recommendations on **environmental monitoring, biodiversity monitoring and research and scientific and technical innovation in pollution prevention and control**		
4.1. The State Committee on Ecology and Environmental Protection, in coordination with Uzhydromet and other relevant government bodies, automates data collection, quality control and transfer in general towards the establishment of a continuous monitoring and real-time pollution data-collection system, particularly with regard to the atmospheric air pollution monitoring network.		Cabinet of Ministers
4.7. Ensure that a sectoral assessment of priority areas for research and innovation in line with the road map of the Strategy for Innovative Development for the period 2019–2021 is carried out, and identify resources needed for promoting applied research and technology development in pollution prevention and control technologies.		Cabinet of Ministers
11.1. Adopt and ensure the implementation of a long-term State biodiversity monitoring and research programme, as part of the integrated system of State environmental monitoring, in cooperation with the Academy of Sciences, other relevant public academic and scientific research institutions and environmental non-governmental organizations. Ensure the establishment and operation of an efficient biodiversity information system, utilizing contemporary techniques for digitalized data acquisition, storage, retrieval, processing and data set harmonization, with the objective to gather, store and share results of biodiversity monitoring, research programmes and projects carried out with the support of public funding, and provide access to this system (with differentiated access and data administration levels) for all stakeholders involved in biodiversity conservation initiatives.		Cabinet of Ministers

Source: UNECE.

EDA = Entrepreneurship Development Agency, EPR = Environmental Performance Review, MoHSSE = Ministry of Higher and Secondary Specialized Education, MoID = Ministry of Innovative Development, MoPE = Ministry of Public Education, PPP = public-private partnership, PRO = public research organization, STI = science, technology and innovation.

Notes

1 Uzbekistan, On approval of the Strategy of Innovative Development of the Republic of Uzbekistan for 2019–2021, Presidential Decree No. UP-5544 of 21 September 2018, https://lex.uz/docs/3913186.

2 Uzbekistan, Action strategy on five priority areas of development of the Republic of Uzbekistan in 2017–2021, Presidential Decree UP-4947 of 7 February 2017, https://lex.uz/docs/3107042.

3 Uzbekistan, On approval of the strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period 2019–2030, Presidential Resolution No. PP-4477 of 4 October 2019, https://lex.uz/docs/4539506.

4 Uzbekistan, On approval of the Strategy of Innovative Development of the Republic of Uzbekistan for 2019–2021, Presidential Decree No. UP-5544 of 21 September 2018, https://lex.uz/docs/3913186.

5 The Presidential decree approving the Strategy of Innovative Development for 2019–2021 defines the main objectives of innovation policy.

6 Uzbekistan, Concept on the development of science until 2030, Presidential Decree No. UP-6097 of 29 October 2020, https://lex.uz/docs/5073449#5074964.

7 Uzbekistan, On measures for the creation of conditions for the accelerated implementation of technologies of artificial intelligence, Presidential Decree No. PP-4996 of 17 February 2021, https://lex.uz/en/docs/5297051.

8 Uzbekistan, On approval of the concept for the development of the higher education system of the Republic of Uzbekistan until 2030, Presidential Decree No. UP-5847 of 8 October 2019, https://lex.uz/docs/4545887.

9 Uzbekistan, On innovation activity, Law No. LRU-630 of 24 July 2020, https://lex.uz/docs/5155423.

10 Uzbekistan, On science and scientific activity, Law No. LRU-576 of 29 October 2019, https://lex.uz/docs/4825305.

11 The Government is also working on introducing modern principles of corporate governance, based on international practices, and improving legal conditions to attract foreign direct investment.

12 The Government is drafting a new law on start-ups.

13 Articles 103 and 104 of the Constitution of the Republic of Uzbekistan; Article 2 of the Law On State power in local authorities; Council of the Senate of the Oliy Majlis of Uzbekistan, On measures to improve the activities of local authorities, Joint Decision No. 2437-III of 3 April 2019, https://lex.uz/docs/-5291125.

14 The Academy for Public Administration provides training and retraining courses, both on- and offline, for civil servants at the managerial level and for local and national officials in public, economic and social management on a competitive basis (Uzbekistan, On measures to further develop the system of training, retraining and advanced training of management staff at the Academy of Public Administration under the President of the Republic of Uzbekistan, Presidential Decree No. PF-5139 of 2017, https://lex.uz/docs/-3300784).

15 An example is the EU-funded project called Improved Public Service Delivery and Enhanced Governance in Rural Uzbekistan, implemented by the United Nations Development Programme (European Commission, "Improving public services and strengthening governance in rural Uzbekistan", 13 October 2020, https://ec.europa.eu/international-partnerships/projects/improving-public-services-and-strengthening-governance-rural-uzbekistan_en).

16 Composite indicator of the United Nations E-Government Development Index (EGDI), which measures the governmental use of ICT for delivery of national public services (United Nations, 2020).

17 For comparison, on this indicator Uzbekistan ranked 10 positions lower than Switzerland (36/132).

18 Uzbekistan, On approval of the strategy Digital Uzbekistan 2030 and measures for its effective implementation, Presidential Decree No. UP-6079 of 5 October 2020, https://lex.uz/docs/5031048.

19 Ўзбекистон Миллий ахборот агентлиги (ЎзА), Зачем Узбекистану цифровизация?, (National News Agency of Uzbekistan, Why does Uzbekistan need digitalisation?), 14 May 2020, https://uza.uz/ru/posts/zachem-uzbekistanu-tsifrovizatsiya-14-05-2020.

20 In addition to boosting the country's ranking to 50 in the Electronic Government Development Index by 2025. Газета.uz, Исследование цифровой экономики Узбекистана: инвестиции в IT-сектор за 4 года выросли в 4 раза, (Gazeta.uz, Study of the digital economy in Uzbekistan: investments in the IT sector have increased by four times in four years), 5 May 2021, https://www.gazeta.uz/ru/2021/05/05/research/.

21 *The Tashkent Times*, "Mirziyoyev instructs to create research institute for development of digital technologies and artificial intelligence", 19 February 2021, https://tashkenttimes.uz/national/6435-mirziyoyev-instructs-to-create-research-institute-for-development-of-digital-technologies-and-artificial-intelligence.

22 Implemented on the basis of Presidential Decree No. PQ-4642, On measures for the widespread introduction of digital technologies in the city of Tashkent, 17 March 2020, https://lex.uz/docs/-4767514.

23 By 2023, such platforms will also appear in other regions of the country.

24 There are 550 non-governmental private training centres.

[25] Uzbekistan, On effective organization of the Agency for Entrepreneurship Development under the Ministry of Economic Development and Poverty Reduction of the Republic of Uzbekistan, Decision of Cabinet of Ministers No. 77 of 17 February 2021, https://lex.uz/docs/5293707.

[26] This applies to individuals who are changing their job or profession, who can take a two- to three-month paid course. Most of the training is used by unemployed workers.

[27] Since November 2020, the EDA reimburses 70 per cent of expenses by youth and women on professional and business skills training provided by non-governmental educational organizations (Uzbekistan, On additional measures to improve the system of involving the population in entrepreneurship and the development of entrepreneurship, Presidential Decree No. PP-4862 of 13 November 2020, https://www.lex.uz/uz/docs/5045895?query=4862).

[28] An example is the recently approved project "Programme Skills Development for a Modern Economy of Uzbekistan" (2021–2027), financed by the ADB and implemented jointly by the Ministry of Employment and Labour Relations and the Ministry of Higher and Secondary Specialized Education. The project aims to support and expand market-driven skills development through professional training centres and through technical and vocational education and training colleges (ADB, Uzbekistan: Skills Development for a Modern Economy Project, 2020, https://www.adb.org/projects/51012-003/main#project-pds).

[29] Uzbekistan, On improving the public administration system in the development of scientific and innovative Activities, Presidential Decree No. UP-6198 of 1 April 2021, https://lex.uz/docs/5352270.

[30] As of November 2021, the MoID had funded 90 start-ups for $10 million and was funding 594 innovative scientific projects.

[31] According to the EDA, as of April 2020, more than 15,000 SMEs had received compensation for their bank loans through the EDA, with 5 per cent of the interest rate (24 per cent) subsidized by the State Fund for Entrepreneurship Support. The criterion for this subsidy differs between sectors. So far approximately 1 per cent of firms have failed to meet the requirements. Preferences for compensation and loans are provided to women and youth – at least 25 per cent of those receiving compensation must be women.

[32] Compensation for visits of international scientists covers renumeration, transportation and other costs.

[33] Some 56 per cent of start-ups were established in Tashkent. At least 50 per cent of founders moved to Tashkent from other regions, where the shares of start-ups are minor (between 5 per cent and 9 per cent of all start-ups).

[34] The Government aims to increase the total share in GDP of science funding to 1.2 per cent by 2025 and 2 per cent by 2030, whereas the share of private sector investment in R&D (out of total funding for science), at 8 per cent in 2020, is to reach 20 per cent by 2025 and 30 per cent by 2030 (Uzbekistan, Concept for the development of science until 2030, Presidential Decree No. UP-6097 of 29 October 2020, https://lex.uz/docs/5073449#5074964).

Annex

Table A3.1 Start-up competitions in Uzbekistan

Name of initiative	Time frame	Organization(s)	Services provided
Practical and innovative projects within the framework of state programmes on scientific activity[a]	Held monthly since 2018 – as of September 2021, 54 rounds have taken place (fundamental, applied and innovative)	MoID	Grant – SUM 1.29 trillion allocated from the State budget for the implementation of programmes and projects on scientific and innovative activities in 2019–2021
Joint start-up competitions	Held every three to five months since 2019	MoID, together with individual countries, including Belarus, Germany, Hungary, the Russian Federation and Turkey	Grant
Youth Academy competitions	Six competitions held since 2018	Youth Academy, under the MoID, Chamber of Commerce and Industry and El-Yurt Umidi Foundation	Grant, trainings and internships – 115 projects funded, worth SUM 35 billion
Women's grant	Held annually since 2020	MoID	Grant
Thematic start-up competitions targeted towards specific sectors	Since 2018 (sporadically)	MoID	Grant
Start-up competitions under Ris	Since 2020	Example: Tashkent Financial Institute held a competition in April 2021, where 8 projects[b] were selected out of 30 applications and are undergoing incubation with the support of the IT Park.	Grant; incubation services

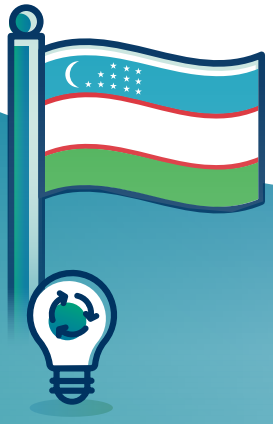
Source: UNECE.

[a] In 2021, 104 start-up projects were funded, all created under research institutes and HEIs.

[b] These projects are not only in the financial sector (fintech) but also in other sectors; e.g., platforms for student residents and online sports. Projects were selected on the basis of evaluation by experts, representatives of IT Park and the research institute, with these requirements: feasibility and innovativeness, engagement of students in the project and viability as a start-up.

Chapter 4

STRENGTHENING THE INNOVATION INFRASTRUCTURE TO SUPPORT INNOVATION-LED GROWTH



Main messages

- In line with recent reforms to strengthen innovative development, Uzbekistan is introducing and expanding a variety of mechanisms in the innovation infrastructure, ranging from innovation centres and incubators to science and technology parks (STPs). The infrastructure is at an early stage of development as these mechanisms do not yet fully support innovative initiatives, such as the commercialization of research results.
- Uzbekistan has launched a range of free economic zones (FEZs) to attract foreign investment and promote integration in global value chains (GVCs). Yet, lacking infrastructure, their cumbersome administration and ineffective support for networking and cooperation among companies constrain the creation of innovation dynamics.
- STPs have the potential to play a catalytic role in digital transformation and technology transfer, but that potential is held back by gaps in regulation, institutional capacities and firms' absorptive capacity – especially in areas such as digital trade, e-commerce, three-dimensional (3D) printing, artificial intelligence, big data and the Internet of Things.
- The numbers of innovation development centres, business and technology incubators, accelerators and similar initiatives have grown over the past years, but limited skills and capacities, resources (such as funds for early-stage finance) and awareness constrain their effectiveness. Targeted support mechanisms for new and emerging technologies such as green technologies are not yet available.
- To ensure that mechanisms introduced in the innovation infrastructure support innovative activity effectively, it is important for policymakers to examine the impact of existing measures, gradually reforming those that are not effective and scaling up those that are successful.

Recommendations at a glance: Enhancing the innovation infrastructure to support innovation-led growth

Recommendation 4.1: Create the necessary framework conditions to strengthen the business environment, and increase FDI in innovation projects in order to facilitate innovative development.

Actions	Priority	Time frame	Actors
4.1.1. Strengthen the market for certification and standardization services.	②	Medium-term	Uzbek Agency for Technical Regulation
UNECE EPR (2020) recommendation on analytical laboratories			
4.2. Ensure the accreditation of all analytical laboratories under concerned ministries.			Cabinet of Ministers
4.1.2. Ensure adequate enforcement of IP legislation.	③	Short-term	Intellectual Property Agency

Recommendation 4.2: Expand the infrastructure and administrative capacities of FEZs to increase their effective support for attracting FDI and channelling it to innovation projects, as well as facilitating access of resident firms to GVCs, and strengthen governance processes to engage all relevant stakeholders in the decision-making processes of FEZ development.

Actions	Priority	Time frame	Actors
4.2.1. Invest in the transportation road asset management system, including improving access to GVCs.	②	Medium-term	MoIFT
4.2.2. Streamline customs and administrative procedures at FEZs.	②	Short-term	MoIFT
4.2.3. Develop and ensure the efficient functioning of critical infrastructure at FEZs, to reduce electricity losses and energy intensity in transmission and distribution networks.	③	Medium-term	MoIFT
4.2.4. Establish a regular mechanism of performance evaluation, especially for FEZs with significant amounts of public investment.	①	Short-term	MoIFT
4.2.5. Introduce mechanisms for participatory FEZ governance, and integrate local governance levels into decision-making processes.	②	Medium-term	MoIFT
4.2.6. Build more linkages with international innovation projects and with existing and emerging strategic efforts on industrial policy and cross-border cooperation with FEZs in other countries – especially in renewable energy sources and energy efficiency, as well as in the digital economy.	②	Medium-term	MoIFT
4.2.7. Facilitate the creation of clusters with companies inside and outside FEZs.	②	Medium-term	MoIFT

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Recommendation 4.3: Improve the effectiveness of innovation centres[a] and incubators[b] by clarifying strategic frameworks, providing support in developing sustainable capacities for providing services to start-ups and further facilitating access to finance.			
Actions	**Priority**	**Time frame**	**Actors**
4.3.1. Clarify definitions and the strategic frameworks of innovation centres and incubators.	①	Short-term	MoID, HEIs
4.3.2. Set up a clear and transparent system of criteria for evaluating financial requests of start-ups, and streamline the financing process.	②	Medium-term	MoID, HEIs
4.3.3. Introduce incentives for specialists in innovation management, and strengthen the capacity of staff at innovation centres and incubators.	②	Medium-term	MoID, HEIs
Recommendation 4.4: Enhance the functioning of STPs[c] by improving and expanding regulatory frameworks to benefit from ongoing efforts towards digitalization and IT innovations.			
Actions	**Priority**	**Time frame**	**Actors**
4.4.1. Support the further development of regulatory frameworks for STPs, and encourage the absorption of ideas and technologies.	②	Short-term	IT Park, MoDICT, MoID
4.4.2. Ensure the provision of high value added services at STPs.	②	Medium-term	IT Park, MoDICT, MoID
4.4.3. Address emerging digital barriers to business development.	③	Short-term	IT Park, MoDICT, MoID
Recommendation 4.5: Adequately equip accelerators with the resources necessary to provide comprehensive and effective support to foster start-up creation.			
Actions	**Priority**	**Time frame**	**Actors**
4.5.1. Conduct studies on barriers and drivers of start-ups in the regions.	①	Short-term	MoID, HEIs, research institutes
4.5.2. Expand consultation services at accelerators to include information and training on financing available for innovation.	②	Short-term	MoID, HEIs, research institutes
4.5.3. Create targeted start-up accelerators in emerging and promising fields such as green technology.	②	Medium-term	MoID, HEIs, research institutes
4.5.4. Create platforms to facilitate the exchange of information and enable networking between investors and start-ups.	③	Short-term	MoID, HEIs, research institutes

Source: UNECE.

FDI = foreign direct investment, FEZ = free economic zone, GVC = global value chain, HEI = higher education institution, IP = intellectual property, MoDICT = Ministry of Development of Information and Communication Technologies, MoID = Ministry of Innovative Development, MoIFT = Ministry of Investments and Foreign Trade, STP = science and technology park.

[a] Innovation development centres are seen as the bridges between science, academia and production that facilitate the implementation of scientific and innovative solutions in various economic sectors.

[b] In Uzbekistan there are two kinds of incubators: business incubators and technological incubators. Business incubators are considered to be a promising policy mechanism for supporting entrepreneurship throughout the initial steps of the innovation development life cycle. Technological incubators support the development of new technologies such as digital technologies.

[c] STPs have a broader mission than, for example, innovation centres. STPs are organizations managed by professionals with the aim to increase the wealth of the community and promote a culture of innovation and make knowledge-based institutions more competitive.

Uzbekistan is in the process of setting up a comprehensive innovation infrastructure, but its capacities and effectiveness have room for improvement

To complement the expansion of the legislative and institutional framework and the introduction of innovation policy instruments, Uzbekistan is setting up various facilities and mechanisms within the national innovation system (NIS) as part of the innovation infrastructure. Nevertheless, like the NIS overall (chapter 3), the innovation infrastructure is still at an early stage of development as existing capacities do not yet fully support innovative start-ups.

Effective innovation infrastructure needs to provide sufficient support through all stages of the innovation process.

Innovation infrastructure (box 4.1) is frequently identified through the capacity of a nation to innovate, which can include several stages of the innovation process, from the appearance of an idea to its further development; its transformation into improved products, processes or services; and its further market deployment. Such infrastructure consists of several elements, among them FEZs,[1] business and technology accelerators and incubators, and STPs and innovation centres (box 4.2). Often innovation infrastructure is considered a key factor for the economic growth and economic competitiveness of a country (World Bank, 2020).

Uzbekistan has set ambitious targets, accompanied by significant policy efforts, for developing innovation infrastructure, including significant improvement of the entrepreneurship ecosystem. In recent years, the Government has increased the number of FEZs, expanded start-up support in the regions by establishing several STPs focused on digitalization, and introduced various innovation centres and business incubators to enable early-stage support for new firms. Although these efforts indicate remarkable progress, remaining challenges impede the effectiveness of these mechanisms.

Box 4.1 Innovation infrastructure

Supporting infrastructure can be divided into two main types: physical and virtual.

Physical infrastructure refers to the facilities, tools and scientific instrumentation that the scientific and technological communities use to carry out research as well as the locations offered to host spin-off companies and all other organizations involved in the process. Common types of physical infrastructure include the following:

i) Technology transfer offices to transfer and commercialize technology outwardly as well as absorb and adapt technology from elsewhere[a]
ii) Industry liaison offices to develop cooperation between research and industry
iii) Proof-of-concept centres to verify that new products and services will function
iv) Prototype development support to demonstrate that new products and services will function
v) Market and competitor intelligence surveillance facilities to assess the market potential of commercialized technologies
vi) Quality infrastructure such as systems for metrology, standardization, testing, quality management, certification and accreditation, and assessment of conformity and quality, as well as incubators to grow early-stage businesses
vii) Scale-up centres for conducting industrial production testing
viii) Investment funds (seed capital and later stage) to support business development
ix) Multifunctional industrial platforms offering a diversity of physical facilities
x) Funding for technology transfer and innovation, e.g. from a national innovation fund

Virtual infrastructure refers to personal contacts, networks and knowledge intermediaries as well as brokers. Personal contacts and networks, e.g., generated through individual working relationships between researchers in business and those at universities and public research organizations, can be effective starting points for licensing and joint R&D contracts between universities and companies, with potential for formalizing research results though technology transfer offices. Virtual infrastructure also includes intellectual property (IP) laws, regulations and practices that support technology commercialization.

Source: UNECE.

[a] Technology transfer is the transfer of knowledge and technological components, such as machinery and equipment, production processes and software, from one stakeholder to another (UNCTAD, 2014; European Union Regulation on Technology Transfer Block Exemption. Commission Regulation (EU) No. 316/2014 of 21 March 2014 on the application of Article 101(3) of the Treaty on the Functioning of the European Union to categories of technology transfer agreements).

Box 4.2 Elements of innovation infrastructure

FEZs or free economic zones are a kind of special economic zone (SEZ) designed by national trade and commerce administrations to facilitate economic activities through the reduction of taxes and other payments, as a vehicle to promote innovative activity.

Business incubators help start-up companies and individual entrepreneurs to develop their businesses while offering a range of business services, from training in management to providing office space and facilitating access to financing.

Technology incubators support the commercialization of new and complex technologies on their way from innovation to market deployment.

STPs are typically industrial parks with several research institutes, which often connect universities and facilities for technology transfer, advanced training and start-up funding as well as providing awareness-raising measures for new technologies.

Accelerators provide companies with access to mentorship and networks of investors and peers. They usually target start-ups that have moved beyond the establishment stage and provide growing companies with access to logistical and technical resources.

Source: UNECE.

These challenges include weak framework conditions, underdeveloped logistical infrastructure and related critical infrastructure support for FEZs, sparse linkages between initiatives, low levels of participatory governance, a limited regulatory framework for digitalization and regional integration, and a lack of sustainable capacities in providing services to start-ups. Some of these mechanisms are set to be improved in the forthcoming innovation strategy (2022–2030).

The following discussion examines the existing framework conditions for innovation and the elements in place in the innovation infrastructure, with a focus on physical infrastructure, by reviewing the impact and effectiveness of FEZs, innovation centres and business incubators, STPs and accelerators in supporting entrepreneurs and firms across sectors in systematically experimenting and trying out new ideas. The elements of the physical infrastructure are discussed in order by when they were established, starting with initial initiatives to spur innovation, such as FEZs.[2] The resulting recommendations highlight that Uzbekistan needs to ensure the smooth functioning of its innovation infrastructure by strengthening current capacities and creating a framework to nurture entrepreneurs.

Ensuring adequate framework conditions, such as support for standardization and IP enforcement, is essential in providing a conducive environment for private sector innovation

First, support for standardization and quality certification is an essential framework condition for firms to develop and improve products and processes according to international standards and to facilitate the integration of small and medium-size enterprises (SMEs) into GVCs. In Uzbekistan, the market for certification services and the institutional and regulatory structure are still underdeveloped. In 2019, 8.3 per cent of firms had an internationally recognized quality certification, a lower share than both the global average (14.8 per cent) and the Europe and Central Asia average (21.6 per cent) (World Bank, EBRD and EIB, 2019).

With international support, the Government is reforming the underdeveloped system for quality assurance and standardization.

Reforms to improve the environment for technical regulation and standards are under way. In June 2021, a Presidential decree announced the creation of the Uzbek Agency for Technical Regulation[3] under the MoIFT. The road map "On the development of the national quality infrastructure in 2021", includes provisions for improving standardization, conformity assessment and accreditation processes; accelerating the adoption of technical requirements based on international standards; introducing the use of ICT for standardization; establishing quality management systems; and building capacity through trainings in standardization. Other agencies and export- and sector-specific associations – for example, the Association of Exporters,[4] Uzeltexsanoat Association (in the electrical industry) and UzTextileIndustry Association (in the textile industry) – also foster the implementation of international standards and support enterprises in obtaining certificates within the respective sectors. A series of international support programmes are being conducted in the country to assist firms in targeted sectors, such as the cotton and textile industry, in implementing and harmonizing their quality assessment systems. Such programmes include those conducted in collaboration with UNECE (box 4.3 and box 4.4), the International Finance Corporation (IFC, 2019) and the German Corporation for International Cooperation (GIZ, 2020). Uzbekistan has close ties with the Eurasian Economic Union (EEU) and aims to bridge standards for exporting goods and services towards those of the EEU.

However, as certification and standardization previously were internalized within State-owned enterprises (SOEs) (chapter 1) and ministry structures, the market for these services is not yet developed. In a liberalized market economy, these services are considered knowledge-based services and are conducted by independent public agencies or certified private laboratories. Therefore, one of the priorities of the Government should be to consider the option that certification and standardization be provided by independent public agencies or certified private laboratories *(recommendation 4.1.1)*. For example, the UNECE EPR of Uzbekistan suggests ensuring the "accreditation of all analytical laboratories under concerned ministries and agencies with responsibilities in the implementation of the Programme of Environmental Monitoring" (recommendation 4.2).

Box 4.3 Regulatory and Procedural Barriers to Trade in Uzbekistan

To address challenges in customs regulations and in trade, a UNECE study on Regulatory and Procedural Barriers to Trade in Uzbekistan is conducting an in-depth analysis of the non-tariff measures governing trade in goods, including those underpinning trade facilitation, technical regulations and quality infrastructure (standardization, accreditation, conformity assessment and metrology), using the UNECE survey-based evaluation methodology. The aim is to identify regulatory and procedural trade barriers throughout the country's supply chains and their implications for structural transformation and for achievement of the SDGs. The study is considering emerging needs and challenges created by the COVID-19 pandemic and provides action-oriented recommendations. Its recommendations are being developed in close consultation with public and private sector stakeholders, with a view to supporting a whole-of-government approach to trade development and economic cooperation. This UNECE study will be published in the second half of 2022.

Source: UNECE.

Box 4.4 Uzbekistan's development strategy in the cotton and textile industry

Integral to sustainability and innovation in the economy, Uzbekistan's development strategy in the cotton and textile industry is rapidly changing towards implementing responsible practices.

As part of the agribusiness sector (see box 1.1 in chapter 1), cotton is a commodity and an intermediate good that contributes to the country's participation in regional and global value chains (UNIDO, 2021). In 2020, Uzbekistan was the seventh largest cotton producer, and the cotton and textile industry employed about 30 per cent of the workforce (GIZ, 2020). Cotton represents a significant part of local agriculture, occupying about 1 million of the 3 million hectares of irrigated, arable land. The cotton industry is the foundation of the entire textile industry in the country, which accounts for about 30 per cent of exports. In 2020, exports of textile products generated almost $2 billion – and they could generate up to $7 billion if issues in the textile value chain are addressed successfully. However, owing to inadequate farming practices inherited from the Soviet Union, the industry features excessive use of chemicals and wasteful irrigation, which has caused environmental damage such as soil degradation and salination.

A key strategic factor for sectoral change in recent years has been the shift to extend production activity from growing cotton to developing a textile supply chain from the field to ready-made garments. Since 2017, investment has amounted to $3.2 billion, earmarked for a development strategy focused on export growth and smart agriculture improvement.[a] Private sector entrepreneurs played a key role in bringing in new technologies and digital solutions to decrease the amount of human work needed, thus paving the way to eliminating mobilized labour in the cotton industry. For instance, the introduction of innovative water-saving irrigation techniques has been addressing soil degradation while improving productivity and resource utilization efficiency.[b] As part of the development strategy to make Uzbek textile and garment products more appealing to international consumers, the private sector has made important efforts to advance transparency and sustainability by introducing international certificates and standards for safe, eco-friendly and organic products.[a]

Since 2019, UNECE has been implementing the project "Enhancing Traceability and Transparency for Sustainable Value Chains in the Garment and Footwear Sector"[c] jointly with the International Trade Centre and with the support of the European Union. The United Nations-brokered policy recommendations and implementation guidelines, and an information exchange standard and call to action known as The Sustainability Pledge[d] were adopted at the 27th Plenary of the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT)[e] Working Party in April 2021. When implemented, the toolkit of measures developed will enable garment and footwear companies to track and trace their materials and products through the value chain and to make verifiable claims about their sustainability performance. Together with sustainability, the other disruptive transformation that will affect production and consumption habits in the garment and footwear industry is digitalization (i.e. blockchain, artificial intelligence, Internet of Things). In fact, technology can support policy approaches in scaling up innovative solutions and partnerships to accelerate the transition towards sustainable production and consumption and a circular economy, in line with the 2030 Agenda.

In this context, since 2020 UNECE has been exploring the enabling role of blockchain technology in implementing a traceability framework to advance due diligence and sustainable and circular value chains in the cotton and leather industries. The UNECE blockchain platform aims to demonstrate end-to-end traceability of cotton-based products, from farm to consumer, building on the identification of the key data, documents and certificates that value chain actors need to exchange in order to claim sustainability performance.

Source: UNECE.

[a] Uztextileprom, UNECE Regional Forum on Sustainable Development, Session 3-2: Making sustainable production and consumption work for the circular economy of tomorrow, 2021. https://www.youtube.com/watch?app=desktop&v=P1oalMl6e1A.

[b] World Bank Group and IFC, UNECE Regional Forum on Sustainable Development, side event: Building back better post-COVID19 with Blockchain, 2021. https://www.youtube.com/watch?app=desktop&v=XY_UnfAjALw.

[c] UNECE, Traceability for Sustainable Garment and Footwear, https://unece.org/trade/traceability-sustainable-garment-and-footwear.

[d] The Sustainability Pledge, http://thesustainabilitypledge.org/joinus.html.

[e] United Nations Centre for Trade Facilitation and Electronic Business, https://unece.org/trade/uncefact.

Some positive strides in this direction can already be observed. As of June 2021, 1,078 entities operated in the sphere of standardization and certification, 836 of which were private and the rest established under government authorities as well as under SOEs and their specialized certification bodies.

Ongoing efforts to strengthen the IP regime will better incentivize businesses to undertake research activities and reap rewards from their research.

Second, a balanced IP regime can spur not only private investment but also commercialization, as it enables the efficient licensing of innovations to fully harness economic gains from research activities. Such a regime complies with international rules such as the Agreement on Trade-related Aspects of Intellectual Property Rights and related conventions of the World Intellectual Property Organization, offers development flexibilities such as compulsory licensing and incorporates a good understanding of international IP laws. IP legislation in Uzbekistan is undeveloped, although reforms and support mechanisms for valuing and registering IP are expanding.

The country is reforming the IP regime by introducing additional mechanisms to support IP protection and skills development for IP registration. Activities of the Intellectual Property Agency, the main agency tasked with developing the IP regime, are expanding.[5] New provisions include reduced legislative restrictions on IP registration, accelerated examination procedures for IP, coverage of IP registration expenses for exporting companies and promotion of trademark registration in business registrations. Furthermore, a new resolution[6] includes the provision of dedicated skills development for IP, while the Ministry of Justice, the Ministry of Higher and Specialized Secondary Education and the Intellectual Property Agency are to support the phased introduction[7] of IP courses into training services at educational organizations and advanced and retraining centres. The Government is also introducing a system of digital label tracing to protect IP against counterfeit tobacco, alcoholic beverages, and medical products and appliances.[8]

Despite recent improvements, such as expanding the pool of patent attorneys and implementing adequate IP approval fees, IP registration procedures are slow and enforcement is still a challenge. Completing registration of a patent takes two to three years, registration of industrial design between one and two years, and registration of a utility model 6 to 12 months. At times inventors must resort to scientific publication as an alternative means of preventing others from copying their technical knowledge. Enforcing IP legislation is vital for innovators to be able to protect and reap benefits from their innovation *(recommendation 4.1.2)*.

Despite the growing number of FEZs, their insufficient infrastructure and governance inhibit their effectiveness and impact in boosting FDI for technology upgrading

The Government considers FEZs an important element of innovation policy. Since 2008, Uzbekistan has established 21 FEZs in 13 regions, and 6 are under development. Many FEZs result from bilateral partnerships or development programmes and specialize in specific industries, such as manufacturing, pharmaceuticals, financial services or high-tech products. Given the geographic location of Uzbekistan, FEZs represent a significant opportunity for supporting the country in becoming a major logistics, trading and production hub for regional and transcontinental transportation routes in Eurasia.

The Government is also developing small industrial zones in each municipality of Uzbekistan. The 149 current zones are seen as local hubs for industry, investment and innovation.

Since April 2021, the Government has also been establishing youth industrial and entrepreneurship zones. Their aim is to concentrate young people's business initiatives into a single hub. Several such zones are in the planning or organization stages in various regions.

The Government has established SEZs, including FEZs, to support the production activities and capacities of Uzbek firms.

Governed under the law on special economic zones (2020),[9] the law on free economic zones and other decrees,[10] the main activities of companies located in FEZs are the production of both domestically and globally competitive products.[11] FEZs are exempt from land and income tax, tax on property of legal entities, and tax on the improvement and development of social infrastructure,[12] and residents of FEZs enjoy customs duty exemptions. FEZs also stimulate support for innovation by providing logistics, trading and production opportunities. Yet, FEZs are still predominantly oriented towards the domestic market, with exports amounting to between 11 and 12 per cent of total production at the three major zones.

FEZs require better logistical infrastructure in order for firms to produce and develop effectively.

Essential to further integrating FEZs into regional and global value chains will be to address the underdeveloped support for logistics, the tedious administrative procedures and the lack of broader support throughout various sectors and regions for all companies instead of the creation of a few privileged ones with insufficient provision of critical infrastructure for all, such as power supply. The development of logistical infrastructure is essential for stimulating investment in innovation projects to deliver services and products to local and international markets. Only a few FEZs are connected to international logistics centres, and the quality of domestic logistics services and the competencies of logistics personnel are both low. Many FEZs are not connected to important roads and railways and lie outside of main economic centres. The overall condition of the transportation infrastructure is of poor quality owing to insufficient maintenance. To address these challenges, Uzbekistan needs to invest in improving the road asset management system, improve the quality and extent of transportation infrastructure, and support capacity-building of logistics personnel *(recommendation 4.2.1)*. The integration of Navoi airport with the Navoi FEZ is a step in the right direction.

Remaining administrative hurdles and insufficient critical infrastructure at FEZs inhibit investment and realization of export opportunities, regional integration and innovation.

The lengthy procedures to obtain border documents, the high number of administrative steps and the frequently changing regulations hinder FEZs in their efforts to become regional hubs. According to various international assessment tools, such as the World Bank's Ease of Doing Business index, complex administrative procedures are one of the major barriers to investment in innovation because they bring uncertainty to investors. Most international logistics centres in Uzbekistan, which are largely owned and managed by foreign companies, remain inadequate because of inefficiencies in customs and border clearance. Government efforts, such as the plans for introducing Single Window procedures for customs clearance, electronic submission of documents and reduction of documentation requirements, are an important positive development towards regional integration. Further efforts should focus on reducing the number of administrative procedures and introducing e-governance practices *(recommendation 4.2.2)*.

In addition to the underdeveloped quality infrastructure and ICT infrastructure (chapter 2), the efficiency of FEZs is constrained by the relatively poor quality of utilities and critical infrastructure such as electricity supply and transportation, and the limited renewable energy sources. The quality of the infrastructure is also an important factor that influences

investment in innovation projects. Despite recent investments in transmission and distribution networks, electricity losses are high and compounded by high energy intensity (chapter 1).[13] Several FEZs have started introducing renewable energy sources and energy efficiency measures; however, they need more support in terms of investment costs, human resource capacities, and technology and knowledge transfer *(recommendation 4.2.3)*.

The governance framework of FEZs shows some gaps. Most initiatives are introduced in top-down processes, missing out on the potential benefits of participatory governance. The lack of linkages between firms both internal and external to FEZs also leaves substantial potential for collaboration and resource pooling unexploited.

To understand firms' capacities and make FEZ support more effective, FEZs need to conduct regular evaluations and consistently monitor performance and include feedback from local stakeholders in their governance.

FEZ development policies are not yet implemented in a consistent, transparent and predictable manner with responsibilities clearly defined, thus inhibiting effective governance. Such situations create uncertainty for investors and hinder investment in innovation projects. To evaluate the success of FEZs in reaching their goals, a mechanism for regular performance evaluation, including a monitoring and evaluation system, needs to be established. This is especially important for zones where the level of public investment is significant. This mechanism should be combined with long-term zone development plans based on identifying and strengthening capabilities of resident firms as well as their competitive advantages. These plans include those that arise from the ongoing regional integration processes within the EEU, with the European Union and within the Asia region. They also include processes of digital transformation and transition to a green economy, as well as financial efforts to ensure the financial and fiscal sustainability of a zone, especially considering the potentially high upfront investment costs *(recommendation 4.2.4)*.

Current governance mechanisms do not yet facilitate the incorporation of local knowledge and feedback as well as the needs of local communities into initiatives for FEZ development. This local input is needed for efficient implementation of initiatives, to ensure local buy-in and to strengthen the engagement of all relevant stakeholders. Encouraging participation by local communities is essential not only to address associated risks of investment in innovation projects, but also to create positive impacts of investment in local communities and to make them more sustainable. Combining top-down and bottom-up governance elements will address procedural justice, namely how feedback and opinions are included, and output justice, namely how risks, benefits and costs of initiatives are spread between stakeholders and levels of governance. New governance mechanisms are needed to integrate local feedback and, more importantly, to reach compromises on policy solutions in instances where preferences diverge between stakeholders *(recommendation 4.2.5)*. Participatory governance in Austria is an example of how feedback from relevant stakeholders in infrastructure can be included in policy- and decision-making processes (box 4.5).

Greater coordination of international projects can significantly improve effectiveness of support.

Several international projects that target the deployment of innovative technologies, especially in agriculture – including water- and energy-saving technologies and renewable energy sources – are not connected to the activities of FEZs. Stronger links between international projects and FEZs will enable the creation of synergies in programmes and activities and provide additional benefits, such as improving critical infrastructure for water, energy, transportation and telecommunication networks.

Box 4.5 Participatory governance of energy transition in Austria

Examples of best practices of participatory governance can be seen in the climate and energy model (CEM) in Austria, which shows some similarities to FEZs in terms of regional-level activity and a combination of top-down and bottom-up governance elements. The energy transition effort in Austria, which aims to decarbonize energy generation through renewable energy sources and energy efficiency measures, includes targets set at the national governance level and implemented at the local level in so-called CEM regions. Some of these regions have established energy groups. These groups meet four times per year and all interested people can join them. Participants discuss energy transition measures suggested at the national level for their region and propose their own measures. Their suggestions are communicated to the national level; after evaluation of the feasibility of measures, financial resources are allocated for their support. Other regions establish capacities at the local level for participatory governance of energy transition; these are frequently represented by CEM managers, who are the driving factors in energy transition and are responsible for collecting feedback from all interested participants and implementing suggested measures after their feasibility evaluation.

Source: Komendantova and others (2021).

Reviewing and ensuring sufficient follow-up on donor-supported innovation projects as well as creating synergies between them and aligning them with existing and emerging industrial policy efforts are essential to improving the effectiveness of support and the willingness of investors to invest in innovation projects, including those that target a green and digital economy *(recommendation 4.2.6)*.

The insufficient linkages between firms within and outside FEZs could be addressed by creating clusters of companies to provide opportunities for collaboration, pool resources, share facilities and build capacities to support innovation projects. Also, further research is needed on the development of various instruments to incentivize innovative development, as well as to provide equal support for innovation across Uzbekistan and not only in some specific areas *(recommendation 4.2.7)*.

Effective support of innovation development centres and business incubators is inhibited by lack of infrastructure, low awareness and limited access to finance

A growing number of innovation centres aim to support commercialization and start-up development.

Innovation development centres are the bridges between science, academia and production that facilitate the implementation of scientific and innovative solutions in economic sectors. These centres, also called centres for innovative growth, have been created throughout Uzbekistan (see table A4.1 in the annex), aimed at fostering regional innovative development based on local specialization. These centres support development and implementation of innovative projects through the creation of start-ups and the commercialization of the results of scientific activity and research (figure 4.1),[14] targeting youth in particular. The MoID oversees the entire process of developing innovation centres, and the Government provides additional support by exempting them from all types of taxes and payments. Several innovation centres in various regions are being developed to support start-ups in the ideation phase and to provide informational services on legal frameworks, funding possibilities and other related issues for business development.

Figure 4.1 · Activities of innovation centres

Source: UNECE.

Under the Academy of Sciences and other government authorities, several innovation centres have also been created to support scientific research, dissemination, commercialization and technology transfer. For example, the Institute of Irrigation and Agricultural Mechanization has innovation centres in several departments dealing with areas of research such as the water-energy nexus, mechanization and automation of processes, and digital technologies. In these centres representatives from industry facilitate effective implementation of research results; representatives of laboratories participate in working commissions and groups at various ministries to facilitate the transfer of scientific results and to bridge the "science and policy divide" (Komendantova and others, 2014).

Established business and technology incubators provide a range of services and platforms for investors and start-ups.

Incubators in Uzbekistan are of two kinds: business incubators and technology incubators. Business incubators are a promising policy mechanism for supporting entrepreneurship throughout the initial stages of the innovation development life cycle (Mian and others, 2020) (box 4.6). They provide a range of services for start-ups, including physical infrastructure, simplified legal procedures, legal and financial consultancy, and networking opportunities. Business incubators also serve as a platform for investors and start-ups, as well as facilitating access to international experience and knowledge on operating start-ups. An example are the business incubators established for SMEs in the textile (cotton) industry. Technological innovation at these incubators focuses on developing sustainable cotton value chains, including organic farming and more sustainable business models. Although most SMEs work in the domestic market, business incubators also support innovative products and services that are export-oriented by providing advice on certification and licensing, quality management and potential opportunities in global markets.

Technology incubators provide support for the development of new technologies such as digital ones. As of July 2020, Uzbekistan had three main technology incubators: GameDev Goethe, established by the Goethe Institute in Tashkent to provide support to the gaming industry; the IT Park Incubation; and the Online Pre-accelerator, established under the IT Park. Another technology incubator, based on international best practices, was created in Tashkent in 2020 by the National University of Uzbekistan and Tashkent State Technical University. It provides incubation services to university students and graduates in the form of consultations with specialists and provision of workspaces, as well as various competitions, hackathons and workshops. It also fosters collaboration

Box 4.6 UNECE policy handbook: Business Incubators for Sustainable Development in the SPECA Subregion

Incubators play a significant role in innovative development as they can help build and improve innovation systems. They help to enable the innovation needed to deliver the SDGs. In transition economies in particular, business incubators have substantial potential to improve economic competitiveness and tackle various social challenges. As part of the innovation infrastructure, business incubators catalyse innovative entrepreneurship by providing incentives, support, connections and an enabling environment for people who want to develop and try out new ideas. When effectively structured and coordinated with other support mechanisms, they can be a vital tool to support the initial stages of the life cycle of innovative initiatives – pre-seed, seed, start-up and scale-up. The number of incubators around the world is thus growing, reaching more than 7,000 in 2019.

In an effort to support policymakers in UNECE transition economies in establishing and expanding business incubators for innovation-led growth, the United Nations Special Programme for the Economies of Central Asia (SPECA) in 2021 launched the UNECE policy handbook on "Business incubators for sustainable development in the SPECA subregion", during the second session of the SPECA Working Group on Innovation and Technology for Sustainable Development (2021) (box 3.2).

Findings presented in the handbook show that although the SPECA countries have already set up several enterprise and innovation support institutions and are planning more, significant gaps remain before this infrastructure can play a systematic, catalytic role in enabling and supporting broad experimentation with new ways of creating value. Incubators face a number of challenges associated with poor infrastructure development (including ICT), limited private sector R&D, lack of incentives to start a business, gaps in accessing finance and issues in developing human capital. Building on the progress already achieved by SPECA countries, enhanced structural reforms to further improve the business environment are a priority and would enable incubators to fulfil their potential to support the development of new ventures. To be effective, incubators also require skilled and suitably resourced staff with a solid understanding of the market and the nature of innovative ventures, as well as realistic and sustainable business models in line with the goal of the incubators.

Source: UNECE.

with local universities and STPs. In addition, the Chamber of Commerce and Industry has established business incubation centres and platforms to support the business community across the country.

Unclear strategic objectives, inadequate administrative procedures and lack of capacities impede the effectiveness of incubators' support.

Despite these efforts, many of these innovation centres and incubators lack a clear business or activity profile and in many of them inadequate evaluation and administrative procedures inhibit financial support for firms. These centres and incubators have different interpretations of the main goals, directions and functions across regions, varying from "business instrument for generating profits" (Enpact Data Lab, 2019) to "platform for connecting main stakeholders and developing favourable conditions for innovative activity" (Scaramuzzi, 2002). Many lack a standard business model and are not yet equipped with the infrastructure necessary to effectively provide rental working spaces for start-up companies. After clarifying the definitions and strategic objectives of these centres and incubators, it will also be necessary to expand their capacities and infrastructure (UNECE, 2021c) to support start-ups, not only in large urban areas, such as Tashkent, but across the country *(recommendation 4.3.1)*. A transparent and clear system of criteria for evaluating financial requests of start-ups – important for effective support (UNECE, 2021c) – is largely missing, and the lengthy process of financing, owing to the several administrative steps and complicated reporting procedures, limits support for innovation funding *(recommendation 4.3.2)*.

At many of the innovation centres and incubators, staff also lack the skills necessary for managing innovation processes, disseminating knowledge and implementing innovations and technologies in the regional economy. This challenge is compounded by short-term financing and low wages for specialists. Building the capacity of specialists is important to improve the efficiency of the support that innovation centres and incubators provide *(recommendation 4.3.3)* (UNECE, 2021c).

Essential support to innovation centres and business incubators includes both diversifying financing mechanisms, especially for commercializing early-stage research, and strengthening the IP regime. Further development of such supporting infrastructure is expected in the forthcoming draft of the Strategy for Innovative Development (2022–2030) (table 3.1), which includes measures to strengthen support for start-ups.

STPs, essential to the innovation infrastructure, lack a regulatory framework and sufficient capacities to fully benefit from ongoing digitalization processes

STPs are an essential element of innovation infrastructure for ICT. They support private companies, including start-ups, in attracting investment and developing a digital economy. They are critical for technology transfer. The Government has made significant efforts to create a regulatory framework for facilitating technology transfer; however, there is no legal act regulating technology transfer and defining it (Oqyulov and Tursunov, 2020).

Positive strides in expanding the ICT infrastructure are the establishment of STPs and related platforms, which support technology transfer and provide incentives for innovative development.

Along with other platforms for innovation, two technological parks have been established, the Technopark Yashnabad and the IT Park, both in Tashkent. The MoDICT, in cooperation with the Software Technology Park of India, created the IT Park in 2019, with a focus on support for developing and exporting software products and information technology in the IT sector. The IT Park, which acts as an extraterritorial FEZ for IT companies, provides residents with preferential loans[15] along with exemptions from taxes,[16] one-time social payments and mandatory contributions to the State trust fund until 2028. It also provides ICT training to young people as well as cooperating closely with the Venture Capital Association of Uzbekistan, which regularly organizes presentations of start-up projects and meetings with investors.[17] Subsidiaries of the IT Park in the regions also cooperate with universities on developing technologies, such as 3D printing, artificial intelligence, big data, blockchain and IT technology necessary for the Internet of Things.

The Technopark Yashnabad, created in 2017, focuses on a variety of priority areas: chemical technology, biotechnology, pharmaceuticals, medical biotechnology and plant protection products, materials science, metal processing technologies, earthquake-resistant and building materials, the food industry, energy conservation, production of alternative and renewable energy sources, electronic measuring instruments, robotics, mechanical engineering and electrical engineering. Resident firms[18] enjoy benefits such as exemption from payment of land and property taxes for legal entities, and exemption from all customs payments except value added tax and customs duties for equipment, raw materials, reagents, components and building materials that are not produced in Uzbekistan.

Several platforms for innovation exist, including technical prototyping platforms for innovation and invention that are part of a network of laboratories for research and innovation in various countries. One example is the New Uzbekistan University, established

in 2021, which plans to host such a platform for programmes to be developed jointly with the Massachusetts Institute of Technology and the Munich Technical University.[19] Another example is the International High-Tech Innovation Centre Delta City,[20] which was created in Tashkent in 2018. The Fund for Support of Digital Economy Development (known as the Digital Trust) provides financial support for the digital economy and start-ups. In addition, the National Office for Innovation Implementation and Technology Transfer, established in 2021, helps deploy technological innovation in various areas, including 3D prototyping, information technology, robotics and 5G.

Despite positive efforts towards digitalization, the regulatory and institutional frameworks for the digital economy as well as the necessary capacities of STPs are not yet fully developed.

Nonetheless, to fully harness the benefits of policy support for digitalization, further room remains for improvement in the regulatory framework. Such improvements include establishing an adequate regulatory and institutional framework – especially for areas such as digital trade, e-commerce, 3D printing, artificial intelligence, big data and the Internet of Things, and creating suitable conditions for financing infrastructure and projects needed for digitalization, as well as policy mechanisms for monitoring the progress towards achieving policy targets. To address these improvements, priorities for the country should be to leverage international best practices and international regulations for the digital economy *(recommendation 4.4.1)*. Enhancing the standardization and quality certification system regarding innovations in the digital economy will also be important.

Uzbekistan has ambitious targets in digitalization. It is a potential hub for outsourcing ICT services. To guarantee that the digital transition is sustainable and inclusive, it is essential to create capacities to participate in the digital transformation and to foster technology transfer. This requires reinforcement of high value added capacity-building services, such as incubation processes, trainings and consultations, delivered both by the STPs directly and through other external providers *(recommendation 4.5.2)*. Efforts to expand the digital infrastructure, especially in the regions, and to both raise awareness of and strengthen inclusive digital education should also address such barriers as the fragmented digital market, the risk of cybercrime and the insufficient opportunities to invest in developing networks further *(recommendation 4.5.3)*. Improving the procedures and admission criteria for the selection of STP resident firms will also reduce the perceived risks of investors and strengthen trust.

Accelerators need strengthened capacities to support access to finance and should introduce targeted support for green growth

In comparison with incubators, which support start-ups in the inception phase, accelerators provide services to start-ups in the growth and maturing phase of the development life cycle. They also standardize some services to reach economies of scale, such as standardized seed-funding terms upon entry, structural educational programmes and mentorship – the latter being at the core of accelerator activity and especially significant for first-time entrepreneurs. Although Uzbekistan has established various accelerators within the NIS (see table A4.2 in annex), they do not yet comprehensively cover innovation support either in the regions or for emerging green and circular technologies.

Several accelerators provide support for start-ups in later stages of growth but are concentrated in Tashkent.

For balanced socioeconomic and technological development it is necessary to facilitate the development of start-ups across the country, beyond Tashkent, and include other large cities so as to benefit from agglomeration externalities. Additional studies on barriers and drivers for the development of start-ups in the regions, identifying which measures are successful and which are not, can provide an overview of the main gaps

to address in order to provide start-up support in larger cities across the country. Large corporations can support efforts by organizing fundraising and networking events, establishing partnerships or providing corporate venture capital *(recommendation 4.5.1)*.

Creating various financial tools to support SMEs at the stage of accelerated growth will be important, as the scarcity of domestic financial resources for innovation remains one of the key bottlenecks in the growth of start-ups (chapter 3). Accelerators could facilitate access to finance by expanding training and consultation services on available financing and by introducing mechanisms for matching with international donors and private investors *(recommendation 4.5.2)*.

Targeted support for emerging sectors, such as renewable energy, is missing.

Additional support through targeted accelerators for specific and promising areas such as green technology, renewable energy and energy efficiency measures can provide further support for the emergence of innovative start-ups in important areas of the economy that promote environmental sustainability. These accelerators can play an important role in coordinating and formulating technology networks with various actors in the field of green growth, including researchers, policymakers and entrepreneurs. To create and maximize synergies and reduce overlap in support efforts, it will also be important to ensure sufficient alignment between innovation support initiatives in these sectors and overall sectoral policies and strategies *(recommendation 4.5.3)*.

Greater integration of accelerators with regional development entities and universities, for example through dedicated platforms, can further facilitate the exchange of information and networking between investors and start-ups, including start-ups in the regions. Involving university alumni networks can strengthen overall accelerator development by attracting returning entrepreneurs who can provide expertise and mentoring to start-ups *(recommendation 4.5.4)*.

Policy messages and recommendations

Uzbekistan has made substantial progress in expanding the innovation infrastructure through the establishment of FEZs, innovation centres, business incubators, STPs and accelerators to support start-up creation. However, the infrastructure is still at an early stage of development as service provision to start-ups is not yet fully effective, much of the physical infrastructure is missing, skill capacities are insufficient, coordination between initiatives and their mandates is weak, and resources are unavailable. Table 4.1 lists the recommendations for addressing the gaps outlined in this chapter to strengthen the innovation infrastructure in Uzbekistan.

Table 4.1 Summary of policy recommendations on innovation infrastructure

Recommendation 4.1: Create the necessary **framework conditions to strengthen the business environment**, and increase FDI in innovation projects, in order to facilitate innovative development.

Framework conditions do not adequately create a conducive environment for innovation, which include a developed market for quality standardization and certification, and protection for IP.

Actions	Priority	Time frame	Actors
4.1.1. **Strengthen the market for certification and standardization services** by supporting the emergence of private service providers or independent government agencies, with attention given to ongoing regional integration processes such as the EEU.	②	Medium-term	Uzbek Agency for Technical Regulation
Relevant UNECE EPR (2020) recommendation on **analytical laboratories**			
4.2. **Ensure the accreditation of all analytical laboratories** under concerned ministries and agencies that have responsibilities for implementation of the Programme of Environmental Monitoring.			Cabinet of Ministers
4.1.2. **Ensure enforcement of IP legislation** adequate to support the growth of innovative enterprises and attract FDI in technology-intensive sectors.	③	Short-term	Intellectual Property Agency

Recommendation 4.2: Expand the infrastructure and administrative capacities of **FEZs** to strengthen their effective support for attracting FDI and channelling it to innovation projects, as well as facilitating access by resident firms to GVCs, and strengthen governance processes to engage all relevant stakeholders in decision-making on FEZ development.

Although FEZs have flourished since 2017, insufficient support for logistics, tedious administrative procedures and underdeveloped critical infrastructure impede the integration of FEZs into regional and global value chains, and FEZ governance frameworks do not sufficiently incorporate local needs in FEZ development efforts.

Actions	Priority	Time frame	Actors
4.2.1. **Invest in the road asset management system**, including improving access to GVCs, and expanding the capacities and services of logistics centres and their connection to FEZs.	②	Medium-term	MoIFT
4.2.2. **Streamline customs and administrative procedures**, with the use of e-governance to facilitate processes, ease trade and support the development of FEZs into regional hubs, and ensure coordination between initiatives for stimulating innovation.	②	Short-term	MoIFT
4.2.3. **Develop and ensure the efficiency of critical infrastructure** at FEZs, to reduce electricity losses and energy intensity, including by introducing renewable energy sources and energy efficiency measures in transmission and distribution networks. This includes building staff capacity in sustainable energy efficiency.	③	Medium-term	MoIFT
4.2.4. **Establish a mechanism of regular performance evaluation**, including a monitoring and evaluation system, especially for FEZs with significant amounts of public investment. Develop a financial plan and further support the provision of financial resources to cover initial investment costs.	①	Short-term	MoIFT
4.2.5. **Introduce mechanisms for participatory governance**, and integrate local governance levels into decision-making processes to provide opportunities for feedback and local knowledge in FEZ governance.	②	Medium-term	MoIFT
4.2.6. **Build more linkages with international innovation projects** and with existing and emerging strategic efforts on industrial policy, and foster cross-border cooperation with FEZs in other countries – especially on renewable energy sources and energy efficiency, as well as the digital economy, to create synergies and provide additional benefits such as improving the critical infrastructure of FEZs. Conduct a review of projects to identify compatibility between international projects and the work conducted at FEZs.	②	Medium-term	MoIFT

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Table 4.1 Summary of policy recommendations on innovation infrastructure (Continued)

4.2.7. **Facilitate the creation of clusters with various companies inside and outside FEZs** to leverage the potential for collaboration through knowledge and resource sharing.	②	Medium-term	MoIFT

Recommendation 4.3: Increase the effectiveness of **innovation centres**[a] **and incubators**[b] by clarifying strategic frameworks, providing support in developing sustainable capacities for providing services to start-ups and further facilitating access to finance.

The number of innovation centres and incubators has increased in recent years, but many of them lack clear development frameworks, and often both necessary skills capacities and physical infrastructure as well, negatively affecting the quality of services provided to start-ups.

Actions	Priority	Time frame	Actors
4.3.1. **Clarify definitions and the strategic frameworks of innovation centres and incubators**, and provide them with the necessary infrastructure to accommodate start-ups.	①	Short-term	MoID, HEIs
4.3.2. **Set up a clear and transparent system of criteria for evaluating requests** for support from start-ups, and streamline the financing process by reducing administrative steps and complicated reporting procedures.	②	Medium-term	MoID, HEIs
4.3.3. **Introduce incentives for specialists in innovation management and strengthen the capacity of staff at innovation centres and incubators** to effectively manage and implement innovations and technologies.	②	Medium-term	MoID, HEIs

Recommendation 4.4: Enhance the functioning of **STPs**[c] by improving and expanding regulatory frameworks to benefit from ongoing efforts towards digitalization and IT innovations.

The benefits of the recently established STPs are not yet fully exploited as regulatory frameworks for digital technologies are underdeveloped and personnel at STPs do not have sufficient expertise in providing support services or in mitigating risks in digitalization processes.

Actions	Priority	Time frame	Actors
4.4.1. **Support the further development of regulatory frameworks for STPs, and encourage the absorption of ideas and technologies**, including digital technologies and trade in e-commerce, 3D printing, artificial intelligence, big data and the Internet of Things. Leverage international best practices and international regulations for the digital economy.	②	Short-term	IP Park, MoDICT, MoID
4.4.2. **Ensure the provision of high value added services through STPs** – for example in incubation, training, networking, consultation activities and services – to ensure a sustainable and inclusive digital transformation and foster technology transfer.	②	Medium-term	IP Park, MoDICT, MoID
4.4.3. **Address emerging digital barriers to business development**, including the fragmentation of the digital market and the risk of cybercrime. Create capacities for Internet use, especially in the regions, raising awareness and strengthening digital education.	③	Short-term	IP Park, MoDICT, MoID

Recommendation 4.5: Adequately equip **accelerators** with the resources necessary to provide comprehensive and effective support to foster start-up creation.

Despite the growing number of accelerators – an essential part of the start-up ecosystem – they do not yet provide a full range of services, specifically for emerging sectors, or sufficiently facilitate knowledge exchange with other actors within the NIS.

Actions	Priority	Time frame	Actors
4.5.1. **Conduct feasibility studies on barriers and drivers of start-ups in the regions.** On the basis of identified gaps, introduce further start-up support measures in the regions and encourage large corporations to support efforts through fundraising and networking, establishing partnerships or providing corporate venture capital.	①	Short-term	MoID, HEIs, research institutes

/...

Table 4.1 Summary of policy recommendations on innovation infrastructure (Concluded)

4.5.2. **Expand consultation services at accelerators** to include information and training on financing available for innovation, and introduce mechanisms for matching with international donors and private investors.	②	Short-term	MoID, HEIs, research institutes
4.5.3. **Create targeted start-up accelerators in emerging and promising fields** such as green technologies, renewable energy and energy efficiency, agriculture, medicine, biology and the like.	②	Medium-term	MoID, HEIs, research institutes
4.5.4. **Create platforms to facilitate the exchange of information and enable networking between investors and start-ups**, including start-ups in the regions. Create university alumni networks, and attract entrepreneurs who can provide expertise and mentoring support to new start-ups.	③	Short-term	MoID, HEIs, research institutes

Source: UNECE.

HEI = higher education institution, IP = intellectual property, MoID = Ministry of Innovative Development, MoIFT = Ministry of Investments and Foreign Trade.

[a] Innovation development centres are seen as the bridges between science, academia and production that facilitate the implementation of scientific and innovative solutions in various economic sectors.

[b] In Uzbekistan there are two kinds of incubators: business incubators and technological incubators. Business incubators are considered to be a promising policy mechanism for supporting entrepreneurship throughout the initial steps of the innovation development life cycle. Technological incubators support the development of new technologies such as digital technologies.

[c] STPs have a broader mission than, for example, innovation centres. STPs are organizations managed by professionals with the aim to increase the wealth of the community, promote a culture of innovation and make knowledge-based institutions more competitive.

Notes

1 SEZs, such as FEZs, which are developed on the basis of the overall business environment, are an important mechanism to attract FDI for innovation and to support integration into GVCs so as to diversify and upgrade industries, which is essential for innovation-led sustainable development. The main objectives and functions of SEZs depend on the stage of economic development of a country. In middle-income countries, the objectives are to support industrial upgrading, promote GVC integration and upgrading, and encourage technology dissemination and spillovers, with existing zones predominantly focusing on GVC-intensive industries, e.g. automotive, and services, e.g., business process outsourcing. SEZs in more developed economies typically focus on upgrading innovative capabilities and attracting high-tech industries, as the prevalent zones in such economies are typically technology-based and focused on higher value added industries and value chain activities and services (UNCTAD, 2019).

2 Considering the importance of FEZs for Uzbek stakeholders, as highlighted during several interviews, the majority of recommendations target FEZs as vehicles to promote innovation.

3 Uzbekistan, On radical improvement of public administration in the field of technical regulation, Presidential Decree No. PF-6240 of 2 June 2021, https://lex.uz/docs/-5443205#-5449406; https://www.standart.uz/page/view?id=5.

4 The Association of Exporters has created a dedicated department and is working with representatives from the European Union on easing the export process. The Association also works closely with the EXPORT PROMOTION AGENCY, which provides financial assistance.

5 Uzbekistan, On measures to improve the system of protection of intellectual property objects, Presidential Resolution No. PP-4965 of 28 January 2021, https://lex.uz/ru/docs/5248265.

6 Ibid.

7 The first phase (2021–2022) introduces such courses at HEIs in production, technology, agriculture and water management.

8 Uzbekistan, On the introduction of a mandatory digital labeling system for certain types of goods, Resolution of the Cabinet of Ministers No. 737 of 20 November 2020, https://lex.uz/docs/5118476#5131920.

9 Uzbekistan, On special economic zones, Law No. LRU-604 of 17 February 2020, https://lex.uz/docs/4821319.

10 Uzbekistan, On additional measures of activating and expanding activities of free economic zones, Presidential Decree No. DP-4853 of 26 October 2016, https://lex.uz/docs/3056981.

11 Including enterprises in electrical and mechanical engineering, chemicals and petrochemicals, pharmaceuticals, food processing and deep processing of fruits and vegetables, production of modern construction materials, leather and so on.

12 FEZs provide residents with these benefits for between 3 and 10 years depending on the volume of investment (ranging between $300,000 and $10 million).

[13] Examples of newly constructed infrastructure include a 100 MW grid-connected solar photovoltaic power project in Navoi Region. This public-private partnership project, implemented on a build-operate-transfer basis, is expected to be a landmark transaction with significant demonstration effects for private sector participation in the energy sector. The feasibility of such projects for other regions should also be studied.

[14] Innovation centres support innovative solutions that target the following purposes: optimizing production processes by enhancing effectiveness and efficiency, improving quality, automating processes, promoting import substitution, producing export-oriented products and improving competitiveness.

[15] With loan rates of 7 per cent.

[16] Up to 10 years.

[17] This association also helps start-ups during the first phases of their activity with support in legal matters, employee recruitment and establishment of financial and economic activities.

[18] By 2020, the Technopark Yashnabad had 21 resident companies. Overall, it has supported more than 35 resident firms, which resulted in the creation of about 340 jobs and production of innovative products worth SUM 147.6 billion (about $14.6 million).

[19] Kun.uz, "New Uzbekistan University established", 24 June 2021, https://kun.uz/en/news/2021/06/24/new-uzbekistan-university-established.

[20] UzDaily, "Hi-Tech City renamed to Delta City", 5 July 2018, https://www.uzdaily.uz/en/post/44675.

Annex

Table A4.1 Innovation centres in various regions

Innovation centre	Activity	Financing
Youth Innovation Centre in Ferghana Region	Financing processes for implementation of innovative projects and start-ups such as purchasing of equipment, materials and components. There are 30 innovative start-up projects in the areas of robotics, smart city and agriculture.	In 2019 about $500,000 was allocated. A further $500,000 is expected from the local government budget. There are 10 workers in the centre.
Innovation Technopark under Urgench State University in Khorezm Region	The main aim is to provide laboratories for students and exhibition space for demonstration of innovation to entrepreneurs.	$200,000 from the local budget. The Technopark is located at Urgench Industrial College. It has five workers, and five residents are involved.
Innovation centre in Namangan Region	The centre has a "bank of innovation ideas" which collected more than 30 innovative start-up ideas in the region.	The centre was created by a local entrepreneur to implement innovative ideas. A further $10,000 was received from the government budget to support maintenance of the centre and to provide wages. The centre has five workers.
Innovation centre in Nukus, Karakalpakstan Region	One project has been developed with the main aim to increase digital literacy. Two other projects are in planning: preparation courses for robotics and a database for collecting innovative ideas and information on start-ups.	Created by a local entrepreneur with support from the local administration.
International innovation centre in the Aral region	A demonstration and experimentation platform has been established to conduct scientific and innovation research on the soil of the Aral Sea. An awareness-raising project on environmental protection was implemented, addressing the local population. Another 24 project ideas are in the phase of funder identification.	$200,000 from the Islamic Development Bank for KPMG to prepare the centre's development strategy and to support the development of innovations addressing environmental challenges.
Innovation centre in Surkhandarya region	The aim is to transfer knowledge on developing, scaling up and promoting innovative projects to local entrepreneurs.	Established by a local entrepreneur with support from the local administration

Source: UNECE.
Note: There are also various innovation centres at universities, industrial enterprises and State companies.

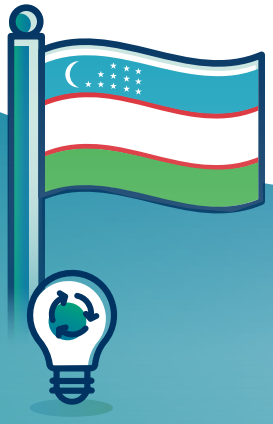
Table A4.2 Accelerators in Uzbekistan

Name of accelerator	Institution	Support services
Start-up Initiatives	Joint programme between UNDP, the MoEDPR, and the Russian Federation, in collaboration with the MoID, the MoDICT, the Agency for Youth Affairs and the IT Park	Acceleration programme; workshops and consulting; marketing and customer studies; partnerships; public relations and financial support
Centre for Advanced Technologies science accelerator	Established by the Centre under the MoID	Training; paid access to laboratories
Start-up Factory	Brand.uz; StartupFactory	Infrastructure for work (an office in the centre of Tashkent); legal, accounting and human resources support; expert advice; support in attracting investors
World Vatandosh	Ziyo Forum, World Influencers Network, Adjacent Possibilities Corp	Online platform to accumulate proposals for the development and optimization of various sectors of the economy, including tourism, ICT, industry, agriculture, high technology, banking and other areas from the Uzbek diaspora
Unicorns Accelerator	Fund "Youth Future" under the Union of Youth in cooperation with the Centre for Support of Youth Entrepreneurship	
Center for Digital Finance	Under the Tashkent Institute of Finance	Market analysis; informational and consulting services; support in attracting investment
IT Park Acceleration	-	Mentorship; legal, marketing services; access to investment area; networking

Source: UNECE.
ICT = information and communication technology, MoDICT = Ministry of Development of Information and Communication Technologies, MoEDPR = Ministry of Economic Development and Poverty Reduction, MoID = Ministry of Innovative Development, UNDP = United Nations Development Programme.

Chapter 5

ENHANCING SCIENCE-INDUSTRY LINKAGES IN UZBEKISTAN



Main messages

- In the science-industry linkages (SIL) of Uzbekistan, public applied R&D is driven by solving problems related to SOEs' activities, including adapting imported technology to local conditions.
- A central feature of the "triple helix" model of interaction between science, industry and government in Uzbekistan is that R&D activity is largely extramural: not yet fully driven by market demand and increasingly moving away from the middle stages of the innovation chain (engineering, design and prototypes), towards basic research and downstream activities, such as science and technology services.
- Although the current SIL model stimulates local production and diversification, it is not fully effective as it requires significant investment and largely misses potential in innovation, specialization, economies of scale and export competitiveness.
- As the economy liberalizes, privatizes and opens up, policy needs to enable institutional transformation to a more flexible, dynamic model of SIL, able to build on a range of opportunities such as those afforded by trade and investment openness, and thus requiring significant changes in the capabilities of firms and PROs.
- The emerging model would benefit from greater engagement of foreign technology providers and a greater intermediary role for PROs, to accelerate knowledge and technology transfer for upgrading in the private sector, a change that will require a sector-specific approach.

To enable and support SIL development in line with ongoing economic and innovative reforms, Uzbekistan should explore three fundamental routes to upgrading technology:

- R&D route: Support innovative, high-growth enterprises (IHGEs), especially with opportunities for commercializing public R&D results.
- Local innovation route: Unleash the potential for local innovation by supporting entrepreneurship in responding to local demand, by improving the quality of the middle-level skilled labour force and by enhancing production quality and innovation capabilities in firms across all sectors.
- Technology transfer route: Generate opportunities for using FDI and GVCs as levers for upgrading technology by accessing new technologies and learning from foreign users.

Recommendations at a glance: Enhancing SIL in Uzbekistan

Recommendation 5.1: R&D route to upgrading technology: Facilitate the development of IHGEs and the commercialization of public research by generating capabilities for innovation-based growth and by gradually and actively restructuring the R&D system.

Actions	Priority	Time frame	Actors
5.1.1. Improve the quality of higher education through technical assistance, by establishing a separate agency for quality in higher education or modernizing the State Inspectorate for Education.	①	Medium-term	Cabinet of Ministers, State Inspectorate for Supervision of Quality in Education, MoPE, MoHSSE
5.1.2. Increase the research activity of teachers at HEIs by integrating HEIs with PROs to inform teaching.	①	Medium-term	MoPE, HEIs
5.1.3. Restructure PROs to meet the demand for innovation-related services.	②	Medium-term	MoPE, research institutes, HEIs
5.1.4. Establish R&D commercialization grants to foster collaboration within the NIS.	①	Short-term	MoID
5.1.5. Introduce a programme of matching grants for R&D projects with the private sector.	①	Short-term	MoID

Recommendation 5.2: Local innovation route to upgrading technology: Unleash the latent potential for high-quality SME entrepreneurship by improving the quality of the middle-level skilled labour force and enhancing the production quality and innovation capabilities of firms across all sectors.

Actions	Priority	Time frame	Actors
5.2.1. Improve the quality of secondary specialized vocational education, and match it to the quality of skills needed in the labour market and specific professional standards.	①	Medium-term	MoHSSE
5.2.2. Introduce innovation vouchers to induce demand for productivity-enhancing activities in SMEs.	①	Short-term	MoID

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Recommendation 5.3: Technology transfer route to upgrading technology: Generate opportunities to use FDI and GVC integration as levers for upgrading technology and as mechanisms for accessing new technologies and learning from foreign partners.

Actions	Priority	Time frame	Actors
5.3.1. Introduce supplier development programmes to expand the access of firms to foreign buyers (clients) and to facilitate integration into GVCs.	①	Short-term	EPA (MoIFT)
5.3.2. Establish a strategic approach to FDI by creating individual investment promotion and attraction packages of measures that go beyond legal and financial incentives and link FDI to vocational training and skills improvement programmes.	①	Medium-term	MoHSSE, MoIFT Investment, Promotion Agency

Source: UNECE.
EPA = Export Promotion Agency, FDI = foreign direct investment, GVC = global value chain, HEI = higher education institution, IHGE = innovative high-growth enterprise, MoHSSE = Ministry of Higher and Specialized Secondary Education, MoIFT = Ministry of Investments and Foreign Trade, MoID = Ministry of Innovative Development, MoPE = Ministry of Public Education, PRO = public research organization.

SIL in Uzbekistan focus on solving production problems rather than innovating

SIL need to adapt to the emerging needs for upgrading technology and transferring knowledge for innovation.

SIL are among the several essential linkages within an NIS. The significant institutional transformation in Uzbekistan – from a focus on import substitution towards a liberalized economic environment (chapter 1) – has had a significant impact on the nature of SIL, which poses challenges to SIL policy. As is common in most catching-up economies, SIL in Uzbekistan are not significantly different in intensity but they are rather different in nature[1] (Albuquerque and others, 2015). Instead of being centred on commercializing R&D outputs from public research, they focus on solving technological problems of enterprises. In economies whose growth is based on R&D and where the private sector has developed in-house R&D capabilities, SIL that focus exclusively on commercialization are usually justified (box 5.1). In lower-middle-income economies such as Uzbekistan, this approach would be far too narrow and of limited relevance to policy.

Along with ongoing liberalization efforts (chapter 1), to meet new requirements for upgrading technology SIL will have to radically transform and evolve on the basis of the capabilities of firms and of universities and R&D systems. As noted earlier, SIL in Uzbekistan

Box 5.1 SIL in the NIS

Public research has always been a critical component of an NIS and a source of major scientific and technical achievement. Maximizing the advantages of research requires effective links between PROs (R&D institutes, academic institutes, universities and industrial institutes) and industry.

Businesses can use the pool of publicly available research in a variety of ways, one of which is for commercialization. Firms with science linkages, which may take many forms, also benefit from greater productivity and superior innovation performance, especially when it comes to introducing products and processes in the market. Yet the private sector also benefits from cooperation with external R&D organizations in a variety of other ways. The most important benefits are training of graduates and solving of problems through consultancies, knowledge transfer and networking.

Source: UNECE.

reflect predominantly extramural R&D,[2] rather than encouraging innovation and cooperation between R&D organizations and HEIs. To transform this model will require strengthening the capacities of R&D organizations and businesses, along with involving foreign technology providers to a greater degree, to ensure technology upgrading and knowledge transfer occur in the private sector.

This chapter begins by outlining the approach, based on the triple helix model, that was used for the analysis of SIL. It evaluates the advantages and limits of the current model. It then describes the emerging model, along with the potential of SIL to facilitate technological upgrading and economic development in the country by strengthening the capacities of both firms and PROs, as well as international linkages. Finally, it provides policy recommendations that may be instrumental in exploiting the potential of SIL to facilitate technology upgrading in Uzbekistan.

The triple helix model is mainly oriented towards solving firms' production and technology problems rather than promoting innovation

The triple helix model of innovation refers to interaction between science (through HEIs and PROs), industry (through firms) and government, an essential component of any NIS that fosters inclusive socioeconomic growth in the transition towards a knowledge-based economy (box 5.1) (Etzkowitz and Leydesdorff, 1995). It is commonly used for examining SIL for innovation. Moving away from the standard linear model of systems innovation, in which PROs define and lead R&D activities, the non-linear dynamics of the triple helix model are more demand driven, shifting the focus towards a more co-evolutional model that reflects the complexity of interactions in a broader group of innovation stakeholders.

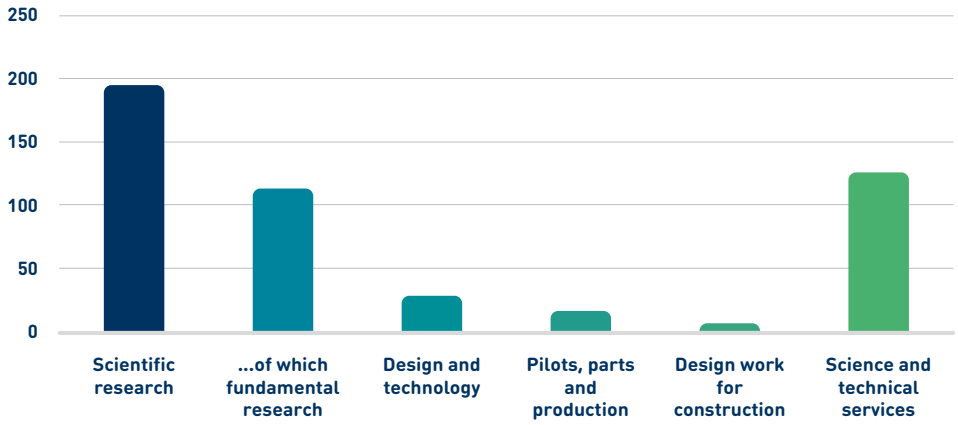
SIL are currently production-driven and mediated through the Government.

SIL in Uzbekistan are quite developed and of distinct character as they are implicitly part of technology import policy (chapter 1) and, as a result, still significantly inward-oriented. This orientation is reflected in the mixed nature of the R&D system, which conducts a combination of largely extramural[3] R&D and non-R&D activities, particularly in its role as provider of knowledge-intensive services (figures 5.1 and 5.2).

R&D activity is still heavily mediated through the ministerial structure and State ownership of firms, with SIL predominantly focused on production problems of SOE. Only recently are PROs and universities becoming more autonomous in their dealings with industrial and agricultural enterprises. Firms still predominantly compete on resource availability and costs, rather than on technology, whereas R&D institutes mainly assist in localizing production or adopting technology. Only when there is no domestic R&D expertise do decision makers import technology from abroad.

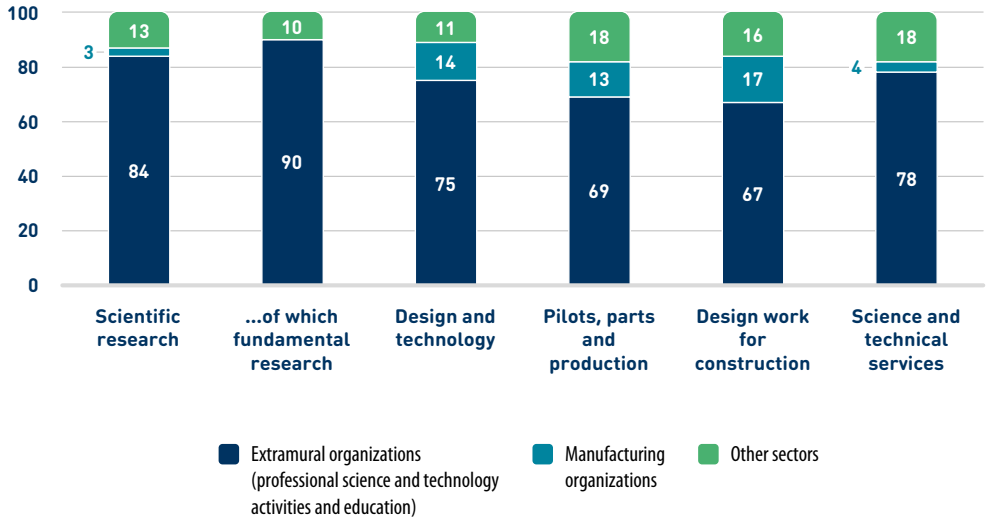
With the ongoing economic reforms and liberalization of the economy, the demand for local R&D is decreasing, along with the need for reinventing the wheel. Despite a recent acceleration, the number of R&D organizations has in fact been decreasing over the past two decades, at an average annual rate of 2.6 per cent, with a drop from 668 in 2018 to 254 in 2019 (State Statistics Committee of Uzbekistan, 2020). This decrease could reflect the growing technology gap and the difficulty of conducting import-substituting technology efforts at their previous scale in the years following independence. Furthermore, R&D activities are becoming increasingly polarized, and innovative cooperation between extramural R&D organizations (PROs and HEIs) is relatively marginal (see figure 5.2).

Figure 5.1 · Organizations that perform R&D activities, by type of work, 2019



Source: UNECE, based on State Statistics Committee (2020).
Note: The sum of organizations is not equal to the total as one organization may perform several types of work.

Figure 5.2 · Share of organizations that perform R&D activities (extra- and intramural), by sector, 2019 (Per cent)

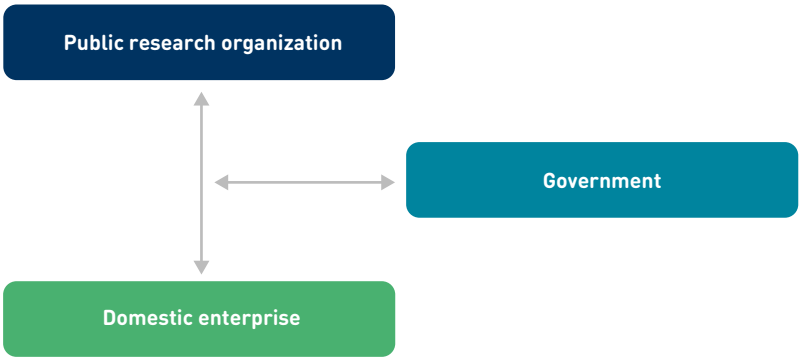


Source: UNECE, based on State Statistics Committee (2020).

The current SIL model (figure 5.3), which permeates the R&D system deeply, does not enable further technology upgrading. Whereas it stimulates local production and diversification, which is beneficial in building a variety of technological capabilities, it ignores innovation, specialization, economies of scale and export competitiveness. It requires significant investment and can be ineffective as it promotes redundant activities and is insufficiently sensitive to cost, energy and the environment.

Current SIL do not encourage systematic upgrading of technology, especially in small businesses.

Figure 5.3 · Production-driven triple helix model of science-industry linkages



Source: UNECE.

The current model still works for large companies that have developed their own cooperation mechanisms with universities and R&D institutes. Large SOEs can rely on State programmes that involve SIL through commercialization contracts, or master's degree or doctoral (MSc or PhD) projects focused on solving specific problems in an industry, for example as done by the Navoi metallurgical company. Very often, however, these linkages form closed innovation ecosystems that are predominantly oriented to production or problems. New private companies have not developed linkages and are outside the SIL networks of SOEs.

The innovation system is thus slowly acquiring features of a dual system, sometimes described as "polarization of the R&D spectrum",[4] which denotes a weakening of the the R&D sector's involvement in industrial innovation. In the last 20 years, the R&D system has evolved to be significantly less engaged in activities in the middle of the innovation value chain (engineering design and prototypes) and more engaged in upstream activities such as research and downstream activities such as science and technology services. As a result, by 2020 activities related to prototyping, producing specialized parts and even producing regular parts had almost disappeared (table 5.1). This dichotomy may grow with the arrival of FDI and foreign firms detached from local R&D organizations.

Table 5.1 Volume of R&D by type of activities (Per cent)

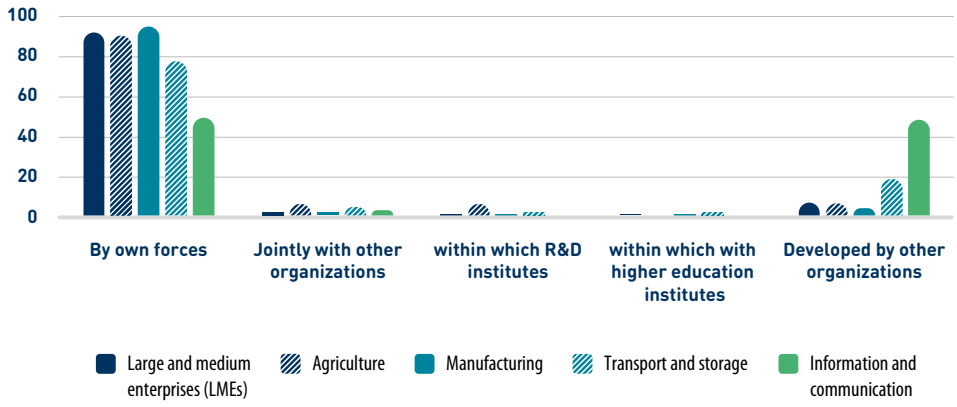
	2000	2020
Scientific research	54.3	66.8
Design and technological activities	10.5	7.5
Prototypes, parts and productions	15.1	0.4
Design work for construction	12.8	6.9
Scientific and technical services	7.2	18.4

Source: UNECE, based on State Statistics Committee (2020).

The R&D sector and businesses cooperate only marginally in developing business innovations.

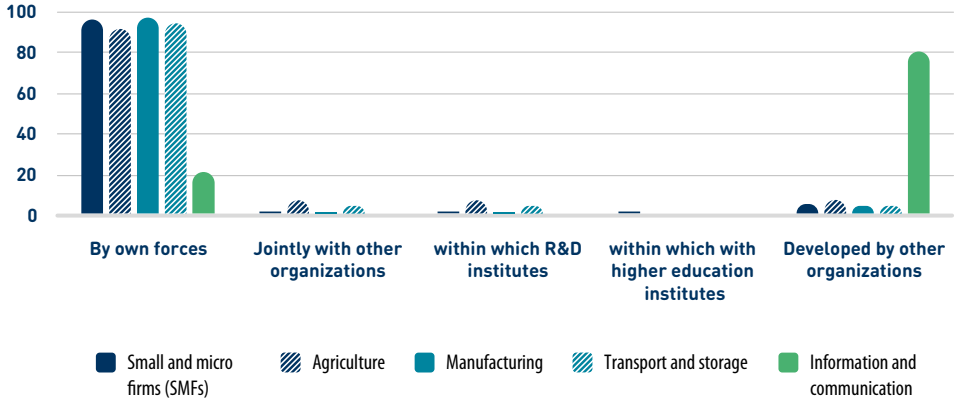
Innovation in Uzbekistan predominantly emerges from within a single organization or business or from intra-organizational cooperation (figures 5.4 and 5.5). Evidence shows that in 2019 only 1.2 per cent of innovations were introduced in cooperation with the R&D sector. Although the degree of cooperation differs in some sectors, the absence of cooperative efforts seems to be a strong general feature of the NIS. The extramural R&D systems often participate in science and technology services and engage in resolving production problems, but their involvement in developing innovations with business enterprises is only marginal. This is true for large and medium-size enterprises (LMEs) as well as for small and micro firms (SMFs).[5] The only exception is in the information and communication sector, where external organizations – for example IT service firms – develop innovations.

Figure 5.4 · Distribution of innovations introduced in 2019 based on cooperation mode: medium and large firms



Source: UNECE, based on State Statistics Committee (2020).

Figure 5.5 · Distribution of innovations introduced in 2019 based on cooperation mode: small and micro firms



Source: UNECE, based on State Statistics Committee (2020).

Table 5.2 Expenditures on innovation by sources of funding, 2019 (Per cent)

	Own funds	Foreign funds	...of which foreign banks loans	Loans of commercial banks	...of which loans under favourable conditions
Large and medium enterprises (LMEs)	50.6	**16.4**	**11.2**	16.1	0.7
Small and micro firms (SMFs)	**55.6**	9.9	5.0	**30.7**	**2.2**

Source: UNECE, based on State Statistics Committee of Uzbekistan (2020).

Public policy can foster innovation in business by supporting the expansion of external financing under favourable conditions for innovation.

Although innovation by Uzbek firms involves minimal engagement of other organizations such as suppliers, buyers or extramural R&D organizations, about half of the funding for innovation comes from firms, for both LMEs and SMFs, and the rest from various external funding sources to fund their largely in-house activities (table 5.2). For external sources of funding, LMEs rely more on foreign funds, especially foreign bank loans, whereas SMFs rely more on commercial bank loans. The share of loans under favourable conditions for both types of firms is marginal (see box 3.7 in chapter 3). The relatively high share of external funds suggests that implemented innovations are incremental and represent safe returns. Also, the low share of loans under favourable conditions indicates considerable room for an active role for innovation policy. Finally, a gradual shift from sector-specific to universal banks may change the behaviour of banks concerning innovation.

Since production has steered SIL, it is reasonable to expect that as firms upgrade technologically, in the long term R&D activities will lead the agenda of SIL – ideally supported by continued local adaptation of internationally developed technologies. Nevertheless, the transformation of the economy will induce changes in SIL, and this long-term goal may not be easily achievable. Specifically, this process will be strongly driven by the speed at which the economy shifts from a resources and production basis to an innovation and knowledge basis.

The current and future roles of PROs can be understood only in relation to firms' changing capabilities. As firms and PROs upgrade their capabilities, the nature of the linkages between them will change. Hence, an understanding of the capabilities of both is essential for shaping effective SIL policy.

Institutional transformation to the new model of SIL will require a change in firm and PRO capabilities

SIL in Uzbekistan are strongly shaped by the innovation behaviour of firms, which, in a sense, represent the demand side of SIL. In the last 10 years, there has been a significant increase in the numbers of both innovatively active enterprises and implemented innovations. Between 2010 and 2019, the number of innovation-active enterprises increased by 5.2 times, from only 304 to 1,587. This was accompanied by an even higher increase – 6.8 times – in implemented innovations, from 683 to 4,869. Unfortunately, this encouraging and steep upward trend has been interrupted by the COVID-19 pandemic, which led to decreases of innovative firms and implemented innovations – by 23 per cent and 9 per cent, respectively (State Statistics Committee of Uzbekistan, 2020).

This negative impact is expected to continue throughout 2021 and 2022, slowing the process of upgrading technology. Nevertheless, provided that the global situation recovers and considering that the pandemic has also accelerated innovation in digitalization, a stronger upward trend may materialize.

Most innovations emerge in low-tech, traditional industries and more recently in trade and ICT; they are less prominent in agriculture, leaving significant potential untapped.

The most innovative sector in the economy, with more than half of all innovative enterprises and sales, is industry (table 5.3). This is not surprising, as in most countries R&D is conducted in industry, despite its decreasing share in GDP. Within industry, the most innovative sectors are low-tech or traditional industries such as clothing, textiles, food and the like, followed by medium- and medium-low-tech sector. In relative shares, innovation activity in high-tech manufacturing is still quite marginal, reflecting the very low share of these sectors in the economy. The relatively high share in the trade sector of innovative firms reflects the emerging trend of innovation in distribution chains. Also, the high share of innovative sales in the ICT sector reflects advances in the diffusion of ICT. The high shares of agriculture in both employment and GDP (chapter 1) are not reflected in the scale of innovative activities, which indicates that technological activities in the sector are relatively limited.[6] Nonetheless, it should be noted that improved labour productivity in agriculture may be achieved by processes that are not easily detected by innovation surveys.

Table 5.3 Share of innovating enterprises and shares in innovative sales by sector, 2019 (Per cent)

	In number of innovating enterprises	In innovative sales
Manufacturing	52	54
of which		
Low-tech manufacturing	29	21
Medium-low-tech manufacturing	18	13
Medium-tech manufacturing	5	19
High-tech manufacturing	1	1
Wholesale and retail trade; repair of motor vehicles and motorcycles	16	4
Construction	6	3
Accommodation services	3	4
Professional, science and technical activities	3	0.3
Agriculture, forestry and fisheries	3	1
Transportation and storage	3	6
Information and communication	2	15
Others	12	13

Source: UNECE, based on State Statistics Committee (2020).

The process of liberalization should unleash individual entrepreneurship, which is an essential potential channel of technological diversification and higher employment in the economy. Although existing evidence does not give a clear picture, it suggest that SMFs are the primary source of innovations. Available data suggest that between 24 and 32 per cent of innovative sales are produced by SMFs, indicating that they are the main drivers of technological modernization and diversification of the economy. As would be expected, their share in sales is smaller than that of large enterprises, but they diversify the range of products and processes deployed in the economy, as seen by the high share of SMFs as product innovators (67.9 per cent of SMFs) (State Statistics Committee of Uzbekistan, 2020). The share of innovative firms is higher among SMFs in the industrial sector (69 per cent, compared with 53.7 per cent for large firms).

Technological innovations are more prominent than organizational and marketing innovations.

A significant feature of innovation activities in Uzbekistan is that they centre on the acquisition of machinery and equipment. Although the quality of data on the structure of innovation expenditure does not enable a precise picture, the available evidence shows that the share of expenditure on machinery and equipment is 55.4 per cent[7] and the share of expenditure on R&D is 39.9 per cent. A high share of innovation expenditure on tangibles (machinery and equipment) as opposed to intangibles (training, knowledge) suggests that innovations are primarily technological and much less so organizational or marketing related. This is reflected in the very high share of technological innovations[8] and the high share of expenditure for technological innovation (table 5.4) compared with organizational and marketing innovations. This is characteristic of innovation in both LMEs and SMFs.

Furthermore, in addition to the obstacles that firms face (chapter 3), various conditions in the market affect their innovative activity. Overall, four obstacles have had the greatest impact on innovation in Uzbekistan: (i) ensuring compliance with modern technical regulations, rules and standards; (ii) improving the quality of goods and services; (iii) expanding sales markets; and (iv) expanding the range of goods and services (table 5.5). As noted earlier, innovation is primarily oriented towards the local market, rather than foreign markets. For example, of all innovative enterprises, only 3 per cent (116) exported to CIS countries in 2019 (State Statistics Committee of Uzbekistan, 2020). From an innovation perspective, it will be essential to push firms to export to more demanding markets.

Innovation is very much demand led and used to sustain firms on their development trajectories and diversify their product portfolios. In that respect, these data show the diversity of benefits that accrue to the economy by incentivizing firms to innovate. Hence, it is essential to understand why innovation activities do not take place on a larger scale.

Although research is frequently evaluated on international criteria, its quality lags behind that of international research.

At the same time, the R&D sector is becoming gradually but increasingly subject to criteria for improved excellence through the introduction of criteria for international excellence and competition. In terms of scientific excellence, owing to low investment and the inward orientation, R&D in Uzbekistan lags significantly behind on a global level but is on the same level as Central Asia (figure 5.6 on page 96). For example, interviewees pointed to the Hirsch index as a significant criterion in assessing the excellence of the R&D teams and expressed satisfaction with the two-stage process of technical and scientific evaluation. Yet, they also recognized the still limited involvement in R&D projects of international peer reviewers as well as foreign participants.

Table 5.4 Expenditure by types of innovation: technological, marketing and organizational innovations, 2019 (Per cent)

	Technology innovations	Organizational innovations	Marketing innovations
Large and medium enterprises (LMEs)	85.1	**13.6**	1.2
Small and micro firms (SMFs)	**92.5**	6.9	0.6

Source: UNECE, based on State Statistics Committee (2020).

Table 5.5 Impact of innovation carried out by enterprises and organizations during the preceding three years, 2017–2019 (Per cent)

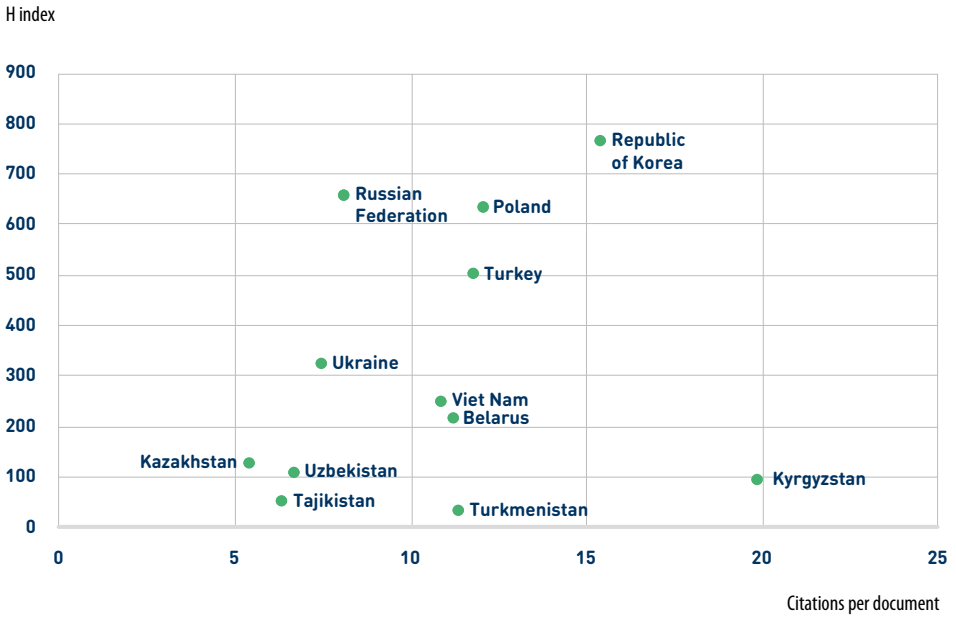
Type of impact	Low	Medium	High	Not impact	Average weighted impact[a]
Expansion of range of goods, works and services	19.6	**41.1**	19.6	19.6	148.1
Expansion of sales markets	18.7	**43.0**	16.8	21.5	146.5
in Uzbekistan	17.8	**42.1**	21.5	18.7	**150.1**
in the CIS countries	23.4	27.1	6.5	**43.0**	129.1
in other countries	27.1	21.5	5.6	**45.8**	126.1
Improving the quality of goods, works, services	12.2	**43.9**	22.4	21.5	**150.2**
Increased employment	15.9	**48.6**	7.5	28.0	140.7
Process innovation					
Increased production flexibility	15.9	**40.2**	18.7	25.2	145.7
Production capacity growth	15.0	**38.3**	20.6	26.2	146.1
Reducing material and energy costs	25.2	**35.5**	13.1	26.2	140.7
Reducing payroll costs	21.5	**35.5**	7.5	35.5	134.5
Process innovation					
Ensuring compliance with modern technical regulations, rules and standards	14.0	**37.4**	28.0	20.6	**151.8**
Reducing environmental pollution	17.8	**40.2**	12.2	29.9	140.5

Source: UNECE, based on State Statistics Committee (2020).

Note: Based on the results of a sample survey according to the Questionnaire for Survey of the Impact of the Results of Implemented Innovations (in percentage).

[a] Average weighted impact uses a weight of 1 for no impact and is calculated by weighting low impact by factor 1.3, medium by factor 1.6 and high by factor 1.9. The resulting index could take a value between 190 (all high impact) and 100 (all no impact).

Figure 5.6 · Indicators of scientific impact: citations per document and h-index, 1996–2020



Source: UNECE, based on Scimago Scopus database.
Note: The h-index, an author-level metric, measures both the productivity and the citation impact of publications, initially used for an individual scientist or scholar. It is defined as the maximum value of *h* such that the given author or journal has published at least *h* papers that have each been cited at least *h* times.

Recent reforms have led to challenges for strengthening R&D and private sector SIL

The systemic glue that so far has held Uzbek triple helix actors together may significantly change in the future. The production orientation of the R&D system will be transformed through the following processes:

- Greater privatization may lead to a more substantial role for knowledge linkages with foreign investors and much more extensive import of foreign technology, with a significantly reduced role for localization of production. Future needs for adapting imported technology will be more difficult to meet if the links between the private sector and R&D systems are weak.
- Greater autonomy of R&D organizations will shift their evaluation criteria much more towards international standards of scientific excellence, with less regard for the daily challenges of the business sector.
- The role of sectoral institutes that have operated as "industry commons" organizations may become more difficult if FDI and privatization lead to fragmentation of production chains. A strong inflow of foreign technology and greater dependence on GVCs will create significant changes in demand for research and technological development services. Without a concerted public programme (box 5.2), these institutes may not be able to meet that demand.

NIS actors in Uzbekistan are developing mechanisms that should facilitate the commercialization of R&D knowledge within the public R&D system. For example, interviews revealed that the Academy of Sciences plans to build a centre for commercialization.

The orientation of the R&D system is changing, but the impact is not yet systematic.

Research institutes are becoming increasingly aware that they need to orient themselves more proactively towards development – that is, commercialization – activities. Some research institutes are leading in this respect and have opened themselves to various opportunities; an example is the Tashkent Institute of Irrigation and Agricultural Mechanization (box 5.3). Yet agricultural research institutes can be considered exceptions. Most universities are deeply engaged in their primary function of teaching, and their function of commercializing research is still quite rudimentary, if developed at all.

Box 5.2 Challenges of privatizing sectoral R&D institutes

From the SIL perspective, the privatization of sectoral research institutes is a complex issue for several reasons. First, the activities of these organizations cross private-public boundaries and represent "industry commons". Without some such durable joint infrastructure, individual projects are insufficient for achieving further technology upgrading. Second, a fully private solution for these organizations deprives individual sectors of sector-specific infrastructure. Third, these organizations cannot keep up with the latest technological advances and are not geared to the changing needs of newly privatized firms. To be successful, they need restructuring so as to function as new types of technical infrastructure. In addition to their current forms as R&D institutes, they could be diversified in terms of organization and function into new forms such as productivity centres, innovation centres and competence centres (chapter 4). These are required forms of new public-private infrastructure that a company or a State alone usually does not fund.

In the Central and Eastern European (CEE) countries, sectoral institutes followed a variety of paths. In the dire market conditions of the early transition, enterprises – the major stakeholders in these institutes – could not fully integrate the R&D institutes into their businesses. Public funding prioritized those parts of the R&D system suffering market failure (basic research organizations), for example, but did not support organizations that produce R&D focused on firms' technology needs. As a result, these institutes were treated like other enterprises and were privatized (Czechia), closed (the Baltic countries) or gradually converted into commercial R&D organizations dependent on policy willingness for their survival (Romania, the former Soviet Union). In most of the former Soviet Union economies, these institutes have been nominally preserved, but – given the significant decline in external demand for R&D services and the lack of resources for restructuring – they have undergone substantial erosion.

The Uzbek Government has established an interministerial working group focused on the privatization of sectoral research institutes. It must draw on the experiences of the CEE economies, recognizing that the sometimes rushed moves to privatize these organizations generated more damages than benefits, but also that extending the survival of these organizations may enable their passive erosion.

Source: UNECE.

Box 5.3 Tashkent Institute of Irrigation and Agricultural Mechanization Engineers

The Tashkent Institute of Irrigation and Agricultural Mechanization Engineers is involved in R&D based on State contracts in water resource management and rural development. It also interacts with enterprises through the Ministry of Agriculture and Water Resources, the Ministry of Energy and the Committee for Environmental Protection, as well as providing services and innovative solutions for individual companies. It is also engaged in projects supported by international donors, including international education projects such as Erasmus. A significant part of its revenue comes from vocational training courses. The Institute is fully aware of the ongoing shift towards the goal of scientific excellence in the country and of the gap between international and domestic criteria for scientific excellence. It is prioritizing foreign languages courses for staff as well as seminars on how to publish in international journals.

The Institute is an excellent example of organizational transformation and response to the changing external environment, for which it had to combine R&D, education and vocational training. It is now much more upstream oriented, in GVC terms, and internationally integrated. Nonetheless, it will have to resolve the issue of how to combine international scientific excellence while retaining local relevance by maintaining its large number of vocational training courses.

Source: UNECE.

Strengthening the role of the private sector in SIL and reinforcing support by intermediary organizations will be essential.

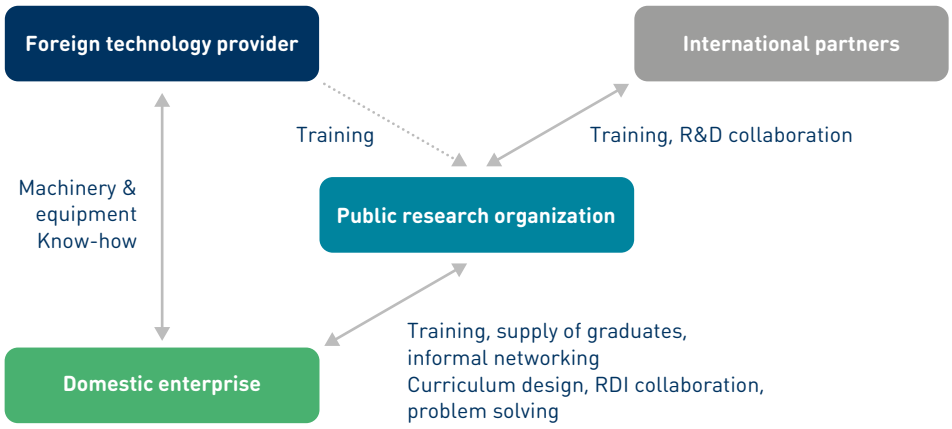
SIL are strongly conditioned by the degree of self-organization of the private sector and its capacity to cooperate with the R&D system. Until now, SIL were mediated entirely through ministerial structures; however, under the new conditions with the growing role of the private sector and small firms, this may not be feasible anymore. Instead, SIL will require much better self-organization of the private sector, and ministries will need to learn to facilitate rather than direct SIL. In this new context, organizations such as the Chamber of Commerce and Industry as well as industrial and business development associations will be as important as government in articulating industry and business interests. This shift requires strengthening intermediary business organizations, which should serve as the conduit between independent firms and government and as a mechanism to facilitate the self-organization of private industry actors. At the moment, these intermediary organizations are weak in articulating the interests of private firms.

Interviews indicated that the textile and clothing industry is the most self-organized, with accumulated experience in and a good understanding of local and international markets. In agriculture, the horticulture value chain is also well organized, unlike the livestock sector, which is dominated by small households and quite fragmented. In agriculture, improvements also appear in sectors that are organized through cooperatives. These differences will affect the nature of the links that the sector has with external knowledge sources, be they domestic knowledge organizations or foreign technology providers. The regionalization of industrial and innovation policy will also affect further development of SIL.

The emerging triple helix model includes foreign technology providers and a greater intermediary role for PROs

The emerging model of SIL will be shaped by much closer links between foreign sources of technology and domestic enterprises and thus brings a new actor into the triple helix, namely foreign technology providers (figure 5.7). Moreover, autonomous enterprises will engage in various relationships with foreign partners, ranging from 100 per cent FDI to

Figure 5.7 · The emerging generic model of SIL



Source: UNECE.

joint ventures, from subcontracting to supply and distribution agreements and alliances. Foreign firms are most likely to be the primary source of technological knowledge and technology upgrading for domestic firms, leading to highly productive firms and limited additional functional upgrading (UNCTAD, 2021d). In some cases foreign partners, especially international donors, may cooperate with local universities to offer training in technology implementation and knowledge assimilation. If not supported domestically, however, firms may risk becoming too dependent on GVCs and foreign technology providers.

This presents a significant challenge for innovation policy: how to manage the process of upgrading technology. To mitigate the risk of dependency, the new role for PROs should be to facilitate the absorption of foreign technology and subsequent innovation. This requires PROs to have the necessary international level of excellence and possess knowledge that is relevant to local firms. Achieving this calls for an innovation policy that can integrate FDI and GVC policy with R&D policy in a coordinated cross-sectoral policy for upgrading technology.

The new situation will also undoubtedly call for a new role of government in SIL. In this review, government has been intentionally omitted from the emerging model as it is still uncertain whether its role will continue to be directing SIL or change to moderating them or only facilitating them. In different sectors the government role may be different or may be a combination of several roles. The emerging SIL model is also intentionally defined as generic, as it does not capture the variety of sector-specific situations and variations of SIL.[9] In different sectors, different nodes of SIL may play quite different roles.[10] Uzbekistan is still in the early transformation stages, with patterns of technology upgrading emerging only slowly.

Adapting to internationalized SIL will require private firms, PROs and HEIs to develop capabilities for absorbing external knowledge and technology.

As pointed out earlier, the intensity and nature of SIL will evolve as firms' capabilities and capabilities of PROs evolve. Technology upgrading of firms will depend on the nature of their relationship with foreign technology providers and partners, and their links with local PROs, which should be instrumental in assisting them in adopting and adapting technology. PROs should be able to follow and participate in international R&D and technology-frontier activities. Like local firms, they will also have to establish relationships with international partners and improve the quality of their R&D and, even more importantly, the quality of education.

The internationalization of the higher education system is a precondition for improving the quality of R&D and achieving world-class teaching. This represents a significant structural challenge for the educational system, which has started the process of internationalization. Out of 33 non-public universities, 23 are foreign franchises. If well integrated, the higher education system should enable better knowledge inflows to domestic enterprises and should connect the domestic and international science bases, with positive effects on technology upgrading of domestic firms. Internationalization requires greater autonomy for R&D institutes and universities and the freedom to engage in contracts with business stakeholders. The focus should be internal and external: there is a need for a significant increase in the number of Uzbek students who study abroad. The Uzbek version of the Kazakh Bolashak programme is much smaller and much less effective (UNECE, 2012). The Government, therefore, should take a much more strategic approach that includes programmes for sending university teachers abroad for training.

The emerging goal of universities is to improve their international ranking in terms of quality (chapter 3); however, there still seems to be a lack of clarity on how to achieve this goal. Each university has its own view and has planned its own efforts.

Significantly, the Government has signed a contract with Elsevier to help universities enter the international rankings. More importantly, some universities are hiring foreign professors to improve quality and to internationalize teaching.

Support for technology upgrading will be vital in shaping future SIL in the country

SIL support should be sector-specific and an integral part of sector-specific industrial and innovation policy. This section looks at the role, relevance and nature of SIL in three areas and their potential paths to upgrading technology.[11] First is the sector of new IHGEs. This is the R&D innovation-based route, as it is "technology push" driven and focused on commercializing technological knowledge within the R&D system. Second is traditional labour-intensive industries (clothing, food), including consumer durables. Their growth path is driven by local innovation in response to local, demand-led technology upgrading, which gradually evolves from local to export markets. Third is technology transfer, which tries to use FDI, especially joint ventures and subcontracting arrangements, as levers for gradual upgrading. An example of this path can be seen in the Uzbek automotive sector (box 1.2).

For industrial and innovation policy to effectively support the generation of R&D capacities and reinforce SIL, adequate framework conditions need to be established (UNCTAD, 2020b). Although Uzbekistan has made efforts towards creating these conditions through significant structural reforms, several constraints remain. They include the early stage of liberalization, a weak and undeveloped competition policy (chapter 3) and a weak IPR regime, as well as underdeveloped IT and e-infrastructure, and an underdeveloped market for certification services (chapter 4).

The success of individual policy measures recommended for the three routes to upgrading technology also crucially depends on governmental implementation capacities and how well government cooperates with stakeholders or organizations engaged as beneficiaries. Hence, policy coordination capabilities are as crucial as in-house government capacities. The capacity to coordinate actions across public sector agencies and effectively collaborate with private sector actors is essential to successful industrial and innovation policy (chapter 3).

Uzbekistan has three routes to upgrading technology and reinforcing SIL

The focus on commercializing R&D results from the public sector, while essential for upgrading technology, does not capture the full range of SIL in Uzbekistan and will remain economically marginal for the foreseeable future. Instead, IHGEs will become increasingly more important as specialized and knowledge-intensive suppliers for the economy's traditional and capital-intensive sectors. The development of IHGEs will depend on the capabilities of both firms and PROs, and will complement their activities as specialized suppliers.

The R&D route – generating capabilities for innovation-based growth through IHGEs

From the perspective of SIL, the R&D innovation route to growth is through supporting the development of IHGEs and commercializing public R&D results. Owing to the nascent NIS (chapter 3), start-up activity in the country is still limited, consisting mostly of digital high-tech start-ups concentrated in Tashkent and disconnected from local scientific research.

IHGEs in Uzbekistan are an important potential source for economic diversification, shifting the focus from agriculture and commodities towards knowledge-based growth. Most start-ups are digital high-tech firms, as opposed to digital deep-tech firms, although many of the IT start-ups are involved in much simpler IT applications for local businesses and cannot be considered digital high-tech firms.

IHGEs such as digital high-tech start-ups are an important potential source of knowledge-based growth and innovation.

Supporting digital high-tech start-ups, rather than deep-tech start-ups, will be important in the medium term for three reasons: they face much lower barriers to entry into the global economy, they draw on a large pool of talented programmers and they support the country in becoming a global IT services hub. The Government has implemented several policy mechanisms, such as the One Million Uzbek Coders initiative, for which 300,000 people have already completed online IT education, as well as the establishment of the ICT Development Fund, which operates on the basis of public procurement criteria. However, these efforts are early steps as the country's ICT service exports are still low (chapter 2) and digital IT start-ups are constrained by the low number and quality of skilled graduates.

Development of a large pool of programmers will require a significant restructuring of the higher education system and closer integration of it with local and foreign IT companies. To complement existing activities along this path, it will be essential for Uzbekistan to increase the rate of tertiary enrolment and to improve the quality of higher education (chapter 2; chapter 3). Uzbekistan has an outstanding ratio of students to academic staff (about 13:1 in 2017), but only about half of academic staff at universities have scientific qualifications. In 2017, only 10 per cent of teaching staff in Uzbek universities had a doctoral or Candidate of Science degree, whereas 61 per cent of researchers had a Master of Science degree or the equivalent, leaving fewer than a third of researchers with a doctoral degree. This points to the poor quality of education and inefficient use of l imited funds (World Bank, 2018b). To address this issue, the Government should seek technical assistance in improving the quality of higher education. It should consider establishing a separate agency for quality in higher education or modernizing the State Inspectorate for Supervision of Quality in Education to meet the requirements of an independent public agency for quality assurance in higher education and research *(recommendation 5.1.1)*.

To support human capital development, Uzbeksitan needs to improve the quality of both education and research.

Furthermore, the quality of teaching at tertiary levels cannot be separated from the quality of research, as high-quality teaching is either research-led or research-based and most university teachers should be active in research. Uzbek universities are falling significantly behind in international comparisons of research and teaching excellence. Only the National University of Uzbekistan ranks in the world's top 5,000 universities (Ranking Web of Universities, 2021), and no Uzbek university appears in the recognized international rankings (Times Higher Education and the Quacquarelli Symonds World University Ranking). In the medium term, Uzbekistan should strive towards close integration of universities and R&D institutes as the most effective way to inform teaching on the latest advances in R&D. The funding for this should be part of the overall gradual increases of share of R&D in GDP (chapter 3) *(recommendation 5.1.2)*.

Uzbekistan's efforts to increase R&D funding will be effective only if accompanied by a gradual and active restructuring of the R&D funding system and R&D institutes, including universities' R&D activities. As part of realizing the Strategy for Innovative

Development 2019–2021, the MoID has begun reforming the science funding system by introducing competitive selection of R&D proposals and an increased average size of grants, which now also cover the purchase of R&D equipment. However, changing funding rules alone will not lead to optimal organization of the R&D system as that requires active restructuring of the profile of R&D organizations to meet new demand for innovation-related services. Some of them should be transformed into public-private institutes predominantly oriented towards the private sector. Others should be incorporated into universities, while others could be transformed into "commercial" public R&D companies. The Modernizing Uzbekistan National Innovation System (MUNIS) Project (box 5.4) and its subcomponent 1.3, Public Research Institutes Modernization, could be used as the first learning exercise towards planning and designing this step *(recommendation 5.1.3)*.

Incentives to commercialize research need to be established in the form of grants for both early- and later-stage funding.

Start-up promotion programmes are not yet effectively exploring synergies to jointly support the growth of the start-up ecosystem (Enpact Data Lab, 2019), owing to the lack of incentives to collaborate. Although the Government has introduced legislation outlining measures for strengthening commercialization,[12] these efforts need to be complemented by increasing the share of innovation grants, which according to the World Bank (2020), represent only about 2 per cent of the total amount of publicly funded grants. Next to ensuring adequate IP enforcement (chapter 4), the country could significantly benefit from introducing commercialization grants *(recommendation 5.1.4)*. The activities planned by the World Bank within the MUNIS project (subcomponent 1.2, Research Commercialization) represent the right steps in this direction.

Box 5.4 The World Bank–funded "Modernizing the National Innovation System" (MUNIS) project

In 2021, the MoID launched the "Modernizing the National Innovation System" (MUNIS) project, funded by the World Bank. The objective is to enable the development of a market-oriented NIS in Uzbekistan. Running until 2026, the project will be financed through a $50 million loan and consists of four components.

The first component aims to develop the basics for a science foundation, focusing on improving the quality of research in the country. The support, targeted at researchers in HEIs and PROs, introduces a research excellence and commercialization programme to provide researchers with grant financing to implement R&D commercialization projects. This component also finances a public research modernization programme that the MoID will develop and implement.

The second component of the project will focus on private sector innovation through matching grants and supplier development programmes, with the aim of building and strengthening SIL and a corporate innovation culture. Support will be targeted at enabling SMEs to develop new or improved products and to expand their businesses for domestic and regional development through a specifically designed innovation matching-grant programme, as well as by implementing a supplier development programme with large companies, which will be supplemented by the improvement of the national quality infrastructure in selected value chains.

The third component of the MUNIS project, which aims to improve overall innovation governance, will provide advisory support for STI policymaking and reforms in the form of studies, draft regulations and policies, and several targeted capacity-building activities based on the outcome of the previous two components. The ultimate goal of this component is to help integrate the pilot programmes of the first two components into a standard innovation policy tool set. Successful implementation and adoption of the pilots will lay the foundations for a science and innovation agency, equivalents of which are found in many developed countries.

The fourth component finances daily operational support as well as monitoring and evaluation of all project activities. It also finances the establishment and operation of the International Expert Board, which is responsible for selecting projects using rigorous criteria and monitoring them closely, and serves as an advisory body to the MoID on science development and innovation policy issues.

Source: UNECE and World Bank.

The planned funds of $4 million for (i) research commercialization subprojects related to developing proof-of-concept and small-scale prototyping and (ii) mentorship to subprojects with commercialization potential will be valuable learning exercises for scaling up these activities in later stages.

A crucial stage in developing the local start-up ecosystem is the introduction of later-stage funding for projects to be co-funded by the private sector, for example through R&D matching grants *(recommendation 5.1.5)*. Such later stages of R&D commercialization include small-scale production and large-scale prototyping. The Government has already undertaken the first step in this direction through subcomponent 2.2, Business Investments in R&D, of the World Bank's MUNIS project.

The local innovation route – improving the quality of the mid-level skilled labour force and enhancing production quality and innovation capabilities of firms in all sectors

An alternative and complementary route to the R&D innovation route is based on local entrepreneurship responding to local demand. Unlike IHGEs, which are supply- or R&D-driven, this route will gain prominence as the economy liberalizes (chapter 1), which should unleash latent entrepreneurial potential. This route relies on local entrepreneurship and potentially fast-growing local companies. A good example of this type of firm is the Artel Group (box 5.5).

Policy needs to support firms in responding to local demand for innovation across sectors.

A variant of the local innovation route to technology upgrading is the use of local IT service firms to meet the digital needs of domestic SMEs, including accounting, payment systems, marketing and the like; this shows strong growth potential. An example is a venture capital fund based in the United Kingdom, which employs 25 people and supports this type of company.

Another example of the local innovation route to growth, but in the knowledge-intensive industry, are Uzbek pharmaceutical companies. This industry has emerged in response to local demand and the absence of local suppliers. For example, Jurabek is the first pharmaceutical company to establish a marketing department in Uzbekistan. As the company is driven by local demand, it is a good example of the local innovation route. Like Artel, Jurabek may gradually become a significant exporter in generic segments. Its future growth will depend on its cooperation with the R&D sector, and it may increasingly face problems typical of the R&D route to innovation.

Box 5.5 Artel Group

Artel has grown into a leading home appliances supplier in Uzbekistan. Established in 2011, today the company employs 10,000 people. It started in the construction business and diversified into a holding company. In this period, it grew into the major domestic company in home appliances, with 80 per cent of its sales being original brand manufacturing products, of which 20 per cent are for export. The company used the original equipment manufacturer agreement with Samsung as a lever for its development and has established an R&D department with 80 people. Also, recently it started cooperating with a Korean university. In 2021, Artel became the first private Uzbek manufacturing company to obtain an international credit rating.[a]

Source: UNECE.

[a] GlobalNewswire, "Artel becomes first private Uzbek manufacturing company to obtain credit rating", 13 July 2021, https://www.globenewswire.com/news-release/2021/07/13/2262237/0/en/Artel-becomes-first-private-Uzbek-manufacturing-company-to-obtain-credit-rating.html.

A good and – macroeconomically speaking – increasingly important industry is textiles and clothing (see box 4.4), which has emerged because of its local resource base and the availability of low-cost labour, coupled with foreign investors and distributors. In this regard, this industry tilts towards the third route to technology upgrading – technology transfer through FDI and GVCs. It does not yet have any significant links with the local R&D system. This issue may be relevant only in the stages when industries shift from original equipment manufacturing to original design manufacturing, which may take some time depending on the sectoral ecosystem.

Within agriculture, the horticulture sector is an example of where R&D institutes have retained their knowledge base, which is still relevant to local producers. They can conduct soil analysis and have been able to provide fee-based services to local farmers. These SIL have been instrumental in the process of successfully restructuring and increasing exports of horticulture products.

The local innovation route to technology upgrading is still far from exploited. This route rests on local entrepreneurship, and the Government has been increasingly active in incentivizing people to develop their businesses. The advantage of this route is that it represents a local response to emerging local demand and is thus an important source of employment. These firms are expanding their range of products and are improving their product quality. In that respect, their innovations are new to the firm or new to the market. So, although they are not technology leaders, they are essential drivers of the diffusion of new technologies and services. Thus, they are probably the most important segment of firms for advancing innovation.

This route requires close links between high-quality vocational training and local markets. A feature of the Uzbek NIS is the very developed system of secondary specialization in vocational education, which has significant potential for upgrading technology in the country. As a result, the level of spending on specialized vocational education (1.2 per cent of GDP in 2017)[13] and the number of students attending it (about 1.2 million students) are both high, and the average student-teacher ratio in vocational colleges is low (approximately 10:1). However, the programme is of poor quality, is far too rigid and is not aligned with labour-market needs. In recognition of these challenges, the Government has drastically reduced the number of both training centres and teachers; however, the lack of relevance and the poor quality of skills development persist (ADB, 2020). Therefore, it is important for Uzbekistan to improve the quality of secondary specialized vocational education and match it to the professional standards needed in the labour market, and to specific professional standards *(recommendation 5.2.1)*. This issue requires innovative solutions, including blended learning and massive open online courses, for an adequate response to specific local challenges.

Innovation vouchers advisory services and quality management support services are useful tools to incentivize greater productivity of firms.

In many sectors, technology upgrading challenges do not require R&D but the diffusion of new, proven technology solutions and the introduction of new management practices and quality improvements. For example, in cotton production, the focus is on digital methods to improve irrigation systems, conduct soil and field analysis, monitor pests, simplify fieldwork, protect the environment and improve fibre quality (GIZ, 2020). These activities are being supported by international donors and are valuable forms of assistance. However, Uzbekistan needs to complement these efforts with its own support system for SMEs facing challenges related to productivity, quality and certification.

Innovation vouchers are a practical and cost-effective mechanism to enhance demand for these types of services, focused on supporting downstream services[14] *(recommendation 5.2.2)*. They aim to financially incentivize SMEs to collaborate with R&D and productivity-enhancing institutions such as productivity centres, certified laboratories, or industry technology and innovation centres. This instrument would make it possible to establish a network of organizations that could offer such services.

The technology transfer route – generating opportunities for using FDI and GVC as levers for upgrading technology

Exports and FDI (box 5.6) are crucial sources of capital and access to the market, but equally, they are essential sources of access to new technologies and learning from foreign users. Very often, new sectors can emerge only in cooperation with foreign investors. Yet technology gaps and market barriers are often too high, and in some cases, the technology transfer route may not be the route to exports. The Uzbek automotive sector is an example of one that has emerged with the assistance of FDI (chapter 1). This kind of opportunity for fast closure of the technology gap and entry into new activities is often quite complex, as it involves engaging in a relationship with foreign partners whose objectives often may not complement but instead contradict national objectives. Here, the role of policy is to provide incentives to ensure that objectives are aligned and that such engagements are facilitated.

Supporting local supply chains through supplier development is key to greater export competitiveness and to greater – and effective – integration into GVCs.

The economy's integration into GVCs is limited, as reflected in the detachment of Uzbek firms from international quality and export requirement standards. Export promotion faces numerous challenges and high barriers, especially for industrial products. Entering a foreign market as a foreign company supplier is the route that seems more feasible and requires lower fixed costs. Enhancing domestic supply chains and local firms' involvement in foreign supply chains is one of the most effective ways to assist firms in upgrading technology and ensure market access.

The Government already recognized the importance of this channel of technology upgrading when it initiated component 2 of the MUNIS project, "Promoting innovation in the private sector" (with $20 million in funding). This component contains supplier

Box 5.6 Importance of FDI for innovation-led growth in Uzbekistan

Attracting FDI is an effective way to build economic competitiveness in global markets and support the integration of domestic firms into GVCs. Along with the transfer of resources, skills and tacit knowledge to local firms, it can more broadly support the diffusion of innovation through various linkages and interactions. Targeted FDI policies, in addition to improving domestic capabilities such as skills, R&D capacity and ICT infrastructure, provide significant opportunities for facilitating the technological transfer and upgrading (UNCTAD, 2003) necessary for systematic innovation.

Although Uzbekistan is making significant efforts towards promoting FDI, these do not yet allow the country to fully leverage the benefits of FDI for innovation. The UNCTAD *Report on the Implementation of the Investment Policy Review of Uzbekistan* (2021b) outlines challenges that remain in effectively attracting FDI to Uzbekistan, such as unclear FDI restrictions and requirements, lack of clarity on the investment promotion strategy, and underdeveloped business linkages and measures to support the development of local entrepreneurs' skills.

Source: UNECE.

development initiatives to stimulate linkages between local SMEs and large local and foreign companies. According to the World Bank (2020), the aim is "to support local SMEs to increase their sophistication, compete more effectively and integrate into the global and regional supply chains of the large companies". However, it may not lead to critical mass effects if projects are dispersed among individual firms. Instead, the Government may want to consider identifying several priority sectors to serve as pilot projects, where factors inhibiting supplier development can be addressed more effectively *(recommendation 5.3.1)*. Motivation for foreign partners to engage in such relationships will be much higher if there is a larger critical mass of potential local suppliers.

FDI and subcontracting represent huge opportunities as levers for domestic technology upgrading. In this route, stakes are high and thus the costs of failure are not trivial. If successful, this route requires coordination among a range of domestic stakeholders, including domestic PROs, other local suppliers and providers of both foreign technology and capital.

Support for attracting FDI needs to be closely linked to capacity development to ensure external resources and knowledge effectively support local innovation across the economy.

Attracting FDI requires identifying suitable inward investment prospects and actively serving the strategic needs of firms with foreign investment once they are established. In terms of SIL, the key to exploring the potential of the technology transfer route is in closely integrating FDI plans with vocational training policy (figure 5.7). The Government has introduced an extensive programme for attracting FDI through FEZs; however, FEZs are still predominantly oriented to the local market, and linkages with local firms are still minimal or non-existent (chapter 4). The Government must develop a more strategic approach to FDI by creating individual investment promotion and attraction packages that contain measures that go beyond legal and financial incentives and link FDI to vocational training and skills improvement programmes *(recommendation 5.3.2)*. The Government's aim should be to establish cost-sharing partnerships with subsidiaries of multinational enterprises (MNEs) to expand the scope of their training in technical skills beyond their own requirements so as to expand the pool of skills available to the whole industry. This may seem – initially – to be subsidizing MNEs, but it could be a highly effective mechanism to generate skills needed for the economy and an excellent way to speed up the emergence of a local industry, which is currently a factor limiting growth. In addition, the gradual involvement of local education institutions could generate further spillover effects on local vocational training.

Policy messages and recommendations

Policy recommendations regarding SIL assume the continuation of the current path of institutional transformation towards an open, liberalized economic environment in which the private sector plays a major role. The State-owned sector will continue to play a complementary role and be involved in areas where local entrepreneurs do not have the capital or capabilities to be agents of change. Also, in the new environment, FDI and GVCs will be much more used as levers for upgrading technology.

As outlined in the conceptual framework (see figure 5.7), the recommendations in table 5.6 depict three routes for upgrading technology in Uzbekistan, based on the evolving capacities of firms and the capabilities of universities and the R&D system in the emerging SIL model.

Table 5.6 Summary of policy recommendations on SIL

Recommendation 5.1: R&D route to upgrading technology: Facilitate the development of IHGEs and the commercialization of public research by generating **capabilities for innovation-based growth and by gradually and actively restructuring the R&D system.**

The low quality and market relevance of higher education and its weak or absent integration with PROs indicates a significant gap in the development of human capital for innovation. The R&D system does not yet meet the demand for innovative activities, especially of new private firms, and incentives for commercialization need to be further strengthened.

Actions	Priority	Time frame	Actors
5.1.1. **Improve the quality of higher education through technical assistance**, by establishing a separate agency for quality in higher education or modernizing the State Inspectorate for Education to meet the requirements of an independent public agency for quality assurance in higher education and research.	①	Medium-term	Cabinet of Ministers, State Inspectorate for Supervision of Quality in Education, MoPE, MoHSSE
5.1.2. **Increase the research activity of teachers at HEIs by integrating them with PROs** to inform teaching on the basis of the latest advances in R&D and to foster teaching and research excellence at the international level.	①	Medium-term	MoPE, HEIs
5.1.3. **Restructure PROs to meet the demand for innovation-related services,** by transforming some into public-private institutes predominantly oriented towards the private sector and others into public commercial R&D companies.	②	Medium-term	MoPE, research institutes, HEIs
5.1.4. **Establish R&D commercialization grants** to foster collaboration within the NIS.	①	Short-term	MoID
5.1.5. **Introduce a programme of matching grants** for R&D projects with the private sector.	①	Short-term	MoID

Recommendation 5.2: Local innovation route to upgrading technology: Unleash the latent potential for high-quality SME entrepreneurship by improving **the quality of the middle-level skilled labour force** and **enhancing the production quality and innovation capabilities of firms** across all sectors.

A significant factor contributing to the low productivity of firms is the insufficient quality of vocational education and its poor alignment with labour-market needs. This is further exacerbated by the weak demand for innovative development and for activities that improve productivity.

Actions	Priority	Time frame	Actors
5.2.1. **Improve the quality of secondary specialized vocational education**, and match it to the quality of skills needed in the labour market and specific professional standards. Improve the quality and relevance of education, for example through blended learning and massive open online courses.	①	Medium-term	MoHSSE
5.2.2. **Introduce innovation vouchers to induce demand for productivity-enhancing activities in SMEs.** Vouchers should cover part of the total service costs (usually 60 per cent). Service providers could be accredited public and private R&D institutions and other institutions accredited to provide quality- and productivity-enhancing services. To test such models, the Government should consider establishing a few pilot projects in several sectors, with the help of international organizations.	①	Short-term	MoID

Recommendation 5.3: Technology transfer route to upgrading technology: Generate opportunities for using **FDI and GVC integration as levers for upgrading technology** and as mechanisms to access new technologies and learn from foreign partners.

The economy is poorly integrated into GVCs, and export promotion faces numerous challenges and high barriers, especially in industrial products.

/…

Table 5.6 Summary of policy recommendations on SIL (Concluded)

Actions	Priority	Time frame	Actors
5.3.1. **Introduce supplier development programmes, to expand the access of firms to foreign buyers (clients) and facilitate integration into GVCs**. The linkages created can foster FDI, encourage the transfer of knowledge and technologies, and lead to overall upgrading of local SMEs.	①	Short-term	EPA (MoIFT)
5.3.2. **Establish a strategic approach to FDI** by creating individual investment promotion and attraction packages that contain measures that go beyond the legal and financial incentives and link FDI to vocational training and skills improvement programmes.	①	Medium-term	MoHSSE, MoIFT, Investment Promotion Agency

Source: UNECE.
EPA = Export Promotion Agency, FDI = foreign direct investment, GVC = global value chain, HEI = higher education institution, IHGE = innovative high-growth enterprise, MoHSSE = Ministry of Higher and Specialized Secondary Education, MoIFT = Ministry of Investments and Foreign Trade, MoID = Ministry of Innovative Development, MoPE = Ministry of Public Education, PRO = public research organization.

Notes

1 For indicative evidence of the similar intensity but different type of SIL in the European Union member States in the CEE, see Radosevic (2016).

2 Extramural R&D includes all R&D activity conducted outside an entity (OECD, 1993).

3 Conducted outside the private sector.

4 This polarization has taken place during the transition period in the CEE countries and reflects the reduced need for technology activities typical of closed economies. It is a sign of the gradual transformation of the R&D system and newly emerging challenges. When polarization occurs within individual R&D organizations, it raises numerous managerial challenges regarding organizational coherence and diverging criteria for assessing increasingly diverging activities. Assessment for funding basic science needs to be reconciled within the same organizations with funding consultancy services. These changes will sooner or later require active restructuring of R&D organizations to differentiate them functionally. This process may lead to innovation systems that are structurally weak, as excellent R&D groups may be locally irrelevant to the immediate needs of enterprises. Alternatively, the poor quality of local R&D organizations could make them unable to assist with technology adoption by local firms.

5 The use of LMEs and SMFs in this chapter, rather than SMEs as in other chapters, occurs because the data used for the analysis here are largely based on the statistical book provided by the State Statistics Committee of Uzbekistan, which makes this distinction.

6 Agriculture is one of the sectors in the country with the greatest need for upgrading production methods, owing to diversification away from cotton, concerns about climate change, adaptation to new standards for biodiversity and the emergence of new technologies, such as drones.

7 This is broadly in line with data for other catching-up economies and probably represents an underestimate. For example, in the CEE countries, new European Union member States' shares of expenditure on machinery and equipment and on R&D were on average 55 per cent and 39 per cent, respectively (2010–2012) (Radosevic, 2016).

8 Since 2013, between 94 and 96 per cent of implemented innovations have been technological. In 2020 the share was slightly above 94 per cent (State Statistics Committee of Uzbekistan, 2020).

9 The Republic of Moldova has a variety of sector-specific SIL models; see UNECE (2021), chapter 4.

10 The emerging model includes foreign technology providers, which are often the major source of technology. Successful adaptation of foreign technology requires that local PROs actively cooperate with foreign technology providers. However, local PROs should have the capacity to follow and actively engage in international R&D activities at the frontier of technology. This requires that they also develop knowledge transfer activities with international partners.

11 The notion of a sector here does not necessarily correspond to an industrial or economic classification but can be defined by common technology, rather than by products.

12 Uzbekistan, On additional measures to improve the efficiency of commercialization of the results of scientific and scientific and technical activities, Presidential Decree No. PP-3855 of 14 July 2018, https://lex.uz/docs/3823592.

13 This is higher than in the European Union and much higher than the OECD average.

14 These are related to advisory, testing, certification and innovation advisory services, as well as implementation of specific product-related software, productivity enhancement and introduction of quality management methods.

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