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Innovation Performance Review

KAZAKHSTAN

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INNOVATION PERFORMANCE REVIEW OF KAZAKHSTAN

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NOTE

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FOREWORD

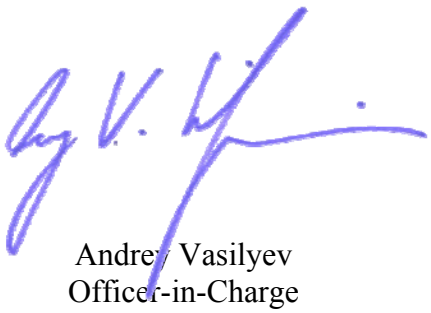
The *Innovation Performance Review of Kazakhstan* continues the series of national assessments of innovation policies initiated by the pilot *Innovation Performance Review of Belarus*. These policy advisory exercises draw on the experience accumulated by the UNECE in the identification of good practices and policy lessons in the area of knowledge-based development, with particular reference to the problems of countries with economies in transition.

Interventions by the public sector play a pivotal role in fostering innovation, including a wide range of policies and instruments that seek to correct market failures, provide guidance to the private sector and facilitate the coordination of the efforts of different stakeholders. The design and implementation of these interventions should be informed by an assessment of the national innovation system that provides an appropriate diagnosis of the existing situation and offers guidance on how to improve innovation performance, taking into account national characteristics and the lessons that can be drawn from the international experience.

This *Review* presents the outcomes of an advisory project undertaken at the request of the Government of the Republic of Kazakhstan. It aims to provide a set of recommendations and policy options to stimulate innovation activity in the country, enhance its innovation capacity and improve the overall efficiency of the national innovation system. Close collaboration with the national authorities and other experts from Kazakhstan throughout the project has helped in identifying issues of practical importance and in ensuring the relevance of the *Review* conclusions and recommendations to national circumstances.

The *Review* will contribute to increase our knowledge of the impact of policies promoting innovative development and to the identification of good practices in this area that could be useful for other countries with economies in transition. The assessments and recommendations presented in the *Review* will also provide a solid basis for capacity-building activities that could be implemented to facilitate the implementation of the proposed recommendations.

I would like to thank the Government of the Republic of Kazakhstan for its support in the implementation of this joint project. I hope that the recommendations of the *Review* will be useful to policymakers in their efforts to promote innovation.



Andrey Vasilyev
Officer-in-Charge
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PREFACE

The practical work on the *Innovation Performance Review of Kazakhstan* began in April 2011 with a preparatory mission by representatives of the UNECE Secretariat to establish contacts and discuss the structure and content of the *Review* with the national authorities and other stakeholders. The main project mission took place from 20 to 30 June 2011 with the participation of a team, including representatives of the UNECE Secretariat, international and national experts.

The *Review* reflects the outcomes of a series of consultations and discussions between the *Review* team and policymakers, government officials, representatives of academic institutions and the business community and other innovation stakeholders of the Republic of Kazakhstan.

The draft text of the *Review* was submitted for comments to the authorities of Kazakhstan and to a group of independent international experts who had not participated in the field mission. The main outcomes of the project, including its main conclusions and recommendations were presented and discussed during the Substantive Segment of the sixth session of the Committee on Economic Cooperation and Integration on 30 November 2011 with the participation of the *Review* team, the external reviewers, the members of a high-level delegation from Kazakhstan and delegates from other UNECE Member States.

The final text of the *Review* was prepared for publication by the UNECE Secretariat reflecting the outcome of these discussions as well as other comments and suggestions by different stakeholders.

ACKNOWLEDGEMENTS

The *Innovation Performance Review of Kazakhstan* was prepared by a group of international and national experts as well as staff of the UNECE Secretariat. The *Review* was the result of a collective effort in which the lead authors for each chapter were: Sailau Baizakov (Chapter 1), Aigul Toxanova (Chapter 1), Hans Wissema (Chapter 2), George Strogylopoulos (Chapter 3), Nina Bohdan (Chapter 4), Anna Kaderabkova (Chapter 5), Malcolm Parry (Chapter 6), Mathias Rauch (Chapters 3 and 8), Hannes Leo (Chapter 7), Janne Peltola (Chapter 8) and Christopher Athey (Annex). Marina Ranga, Slavo Radosevic and Rafis Abazov reviewed the first draft of the *Review* and provided useful comments. During the discussion at the Substantive Segment of the sixth session of the Committee on Economic Cooperation and Integration, Muslim Bektep, Baurzhan Aitielu and Zhumatay Salimov presented comments and suggestions on behalf of the delegation of the Republic of Kazakhstan. Rumen Dobrinsky and José Palacín contributed to the overall editing of the publication.

UNECE would like to express its deep appreciation to the Eurasian Development Bank for its generous financial contribution which made possible the implementation of the project *Innovation Performance Review of Kazakhstan*.

The smooth work throughout the project was greatly facilitated by the helpful support and cooperative attitude of the National Innovation Fund of the Republic of Kazakhstan which was the UNECE's leading partner in Kazakhstan in implementing this project.

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ABBREVIATIONS

ADB	Asian Development Bank
BSC	Business Support Centre
BEEPS	Business Environment and Enterprise Performance Survey
CCS	Carbon Capture and Storage
CCT	Clean Coal Technologies
CCTCS	Centre for the Coordination of Technology Commercialization System
CETT	Centre for Engineering and Technology Transfer
CIP	Centre for International Programmes
CIS	Commonwealth of Independent States
CSESCE	Centre for the Study of Social and Economic Change in Europe
DAAD	Deutscher Akademischer Austauschdienst / German Academic Exchange Service
DAMU	The Entrepreneurship Development Fund (Kazakhstan)
DBK	Development Bank of Kazakhstan
DIN	Deutsches Institut für Normung / German Institute for Standardization
EAPATIS	Eurasian Patent Information System
EBRD	European Bank for Reconstruction and Development
EPA	Environmental Performance Analysis
EPO	European Patent Office
EurAsEC	Eurasian Economic Community
FDI	Foreign Direct Investment
FEZ	Free Economic Zones
GDP	Gross Domestic Product
GERD	Gross Expenditure on Research and Development
GIZ	German Society for International Cooperation (formerly GTZ)
HSTC	Higher Scientific and Technical Committee
ICSTI	International Centre for Scientific and Technology Information
IE	Innovation Executive
IFK	Investment Fund of Kazakhstan
IFRS	International Financial Reporting Standards
ILAC	International Laboratory Accreditation Cooperation
INS	Information with Norms and Standards
INOGATE	International Energy Co-operation Programme between the EU, Turkey and countries of the NIS (with the exception of the Baltic States and the Russian Federation)
INSEAD	European Institute of Business Administration
INTAS	International Association for the promotion of cooperation with scientists from the independent states of the former Soviet Union
IPR	Intellectual Property Rights
ISL	Industry-Science Linkages
ISTC	International Science and Technology Centre
IT	Information Technology
KABIC	Kazakhstan Association of Business Incubators
KAI	KazAgroInnovation

KBTU	Kazakh-British Technical University
KDS	Korean Institute for Development Strategies
KEI	Knowledge Economy Index
KIDI	Kazakhstan Institute for the Development of Industry
KING	Kazakh Institute of Oil & Gas
KOF	Swiss Economic Institute
KSTU	Karaganda State Technical University
MEDT	Ministry of Economic Development and Trade
MES	Ministry of Education and Science
MF	Ministry of Finance
MINT	Ministry of Industry and New Technologies (Kazakhstan)
MNC	Multinational Corporation
NADLoC	National Agency for the Development of Local Content
NATD	National Agency for Technology Development
NCB	National Coordination Board
NCC	National Commercialization Centre
NC STI	National Centre for Scientific and Technical Information
NIC	National Innovation Capacity or National Innovation Council
NIF	National Innovation Fund
NIIP	National Institute for Intellectual Property
NIS	National Innovation System
NTBF	New Technology-Based Firms
OECD	Organisation for Economic Co-operation and Development
OTC	Office of Technology Commercialization
Parasat	The National Science-Technology Holding of Kazakhstan
PDISTM	Programme for the Development of Innovation and Support for Technological Modernization
PISA	Programme for International Student Assessment
PPP	Public-Private Partnership or Purchasing Power Parity
R&D	Research and Development
RCC	Regional Commercialization Centre
RIS	Regional Innovation System
RTDI	Research, Technological Development and Innovation
RTTN	Russian Technology Transfer Network
S&T	Science & Technology
SBIR	Small Business Innovation Research program (US)
SCO	Shanghai Cooperation Organization
SCST	Supreme Council on Science & Technology
SEC	Socio-Entrepreneurial Companies
SEMISE	Support to Energy Market Integration and Sustainable Energy (within the National Innovation System)
SEZ	Special Economic Zone
SEZ PIT	Special Economic Zone - Park of Innovative Technologies
SIS	Sector Innovation System
SPAIID	State Programme for Accelerated Industrial Innovative Development of the Republic of Kazakhstan

SME	Small and Medium-sized Enterprise
STI	Science, Technology and Innovation
TACIS	Technical Assistance to the Commonwealth of Independent States
TEMPUS	Trans-European Mobility Programme for University Studies
UNCTAD	United Nations Conference on Trade and Development
UTT	United Tax Tariffs
USAID	United States Agency for International Development
USPTO	United States Patent and Trademark Office
VET	Vocational Education and Training
VT	Vocational Training
WEF	World Economic Forum
WIF	World Innovation Foundation
WTO	World Trade Organization
Zerde	The National Info-communication Holding of Kazakhstan
3GU	3rd Generation University

EXECUTIVE SUMMARY

The *Innovation Performance Review of Kazakhstan* provides a critical examination of the national innovation system, the institutional framework of innovation policy and the various mechanisms and instruments of public support for innovation in the country. On the basis of this broad assessment, a number of policy options and recommendations are offered to improve the innovation performance of the country and enhance the innovation capacities of stakeholders.

Assessment

National innovation system and innovation governance

Kazakhstan has put a growing emphasis on the promotion of innovation as a driver of economic development and diversification. These initiatives have targeted the improvement of some components of the National Innovation System (NIS), in particular, the creation of public innovation-support institutions. Increasingly, other policy targets have received attention, including improvement in performance by firms, regional aspects or the demand for innovation. However, despite the awareness expressed in some policy documents, public interventions have been focused mainly on the institutional build-up, while issues regarding linkages and the connectivity between various components of the NIS are still relatively neglected. The new Law on State Support to Industrial Innovative Activity, adopted in early 2012, opens new policy possibilities and reflects an increased understanding of the need to encourage the demand for innovation. However, the effectiveness of public intervention is also often limited by the underdevelopment of innovation services and market infrastructure. There is a need to develop further the systemic view of the NIS emphasizing linkages and going beyond the primary focus on technological forms of innovation.

A mature and thriving domestic private sector is a necessary condition for an innovative economy. Facilitating market entry by innovative entrepreneurs and simplifying their relations with the state is one of the key factors in this area. Entrepreneurs in Kazakhstan, as in many other countries, are often confronted with a large body of legislation and regulation that severely hampers their innovation efforts. Significant progress has been achieved in recent years in improving the regulatory environment for private business, as reflected in improved international ratings. Administrative barriers have received particular policy attention and this has been translated into monitoring mechanisms. However, continued progress in reducing the regulatory burden and improving the market environment in which SMEs operate would increase the number of SMEs and facilitate the growth of existing ones.

Kazakhstan's science and technology (S&T) sector offers a scattered landscape dominated by research institutes which are mainly inherited from the past and still mostly funded by the state. At the same time, universities in general have not yet become the leading generators of knowledge resulting in innovation as is typical in mature industrialized countries. Technoparks and business incubators do not always benefit from close association with universities. Increased exposure to market demands and competition and enhanced linkages with other innovation stakeholders would improve the efficiency of all S&T and academic organizations. Focused policies could develop the potential of the top universities to become

hubs of innovation, resulting in closer links with new and existing enterprises, better know-how exchange with international enterprises and improved international projection.

Kazakhstan has set up different institutions and developed many programmes aimed at encouraging innovation and modernization. While these are valuable initiatives, their proliferation has stressed the need for coordination across policy actions and institutions. The complexity of innovation also requires the involvement of different innovation stakeholders, including those in the private sector, to develop a vision of future developments. Kazakhstan is organized along vertical (state enterprises report to ministries that also fund R&D, design bureaux and intermediaries), horizontal (organizations like the National Innovation Fund and DAMU that support enterprises of all sectors), and regional axes. A systemic view of innovation that considers the interaction between various components of the NIS should lead to a reinforcement of horizontal mechanisms of coordination, which remain relatively weak. The new Law on State Support to Industrial Innovative Activity, adopted in early 2012, envisages new mechanisms of coordination that should be used fully.

Framework conditions, innovation policies and instruments

There has been a significant improvement in the business environment of Kazakhstan in recent years, including not only regulatory and tax aspects but also the quality of infrastructure and other factors influencing economic activity. However, there is still room for further progress in creating better conditions for private initiative and thriving entrepreneurial activity. The impact of measures promoting innovation or fostering entrepreneurship is highly dependent on the overall framework conditions, which need to be a continued object of policy attention.

The authorities have put in place an ambitious strategy to foster economic diversification, including the encouragement of innovation. While initially much effort was devoted to set up new supporting organizations, the emphasis is now on creating plans for action. Multiple innovation initiatives have been introduced and new instruments, including tax incentives and grants, are being used. Programmes reflect an increased concern about the capabilities of firms to innovate and the regional dimensions of the innovation process. While there is consistency at the level of the overall programme goals, mechanisms for the coordination of development initiatives and implementation are weaker. Recent legal changes enshrine the importance of foresight mechanisms to identify priorities and provide a firmer basis for policy interventions.

Recent state programmes have correctly identified weak demand as a major constraint to advance innovation in the country. This is a significant obstacle to innovative development, given the existing productive specialization. The instruments deployed so far to address this situation rely heavily on the control over state enterprises, although there are also initiatives envisaging tax incentives, the use of state procurement and coordination schemes. Public initiatives should emphasize further decentralized market-based mechanisms to encourage the demand for innovation, including through the improvement of framework conditions.

Kazakhstan has developed many innovation initiatives, including the creation of an innovation support infrastructure. However, these efforts have not yet resulted in a significant number of new technology-based firms. SMEs play a limited role in economic activity and are mainly involved in traditional sectors. Entrepreneurship and entrepreneurial culture remain

inadequately developed. Despite some attempts to use public procurement to promote innovation, there is limited participation of SMEs in these initiatives.

Regional issues have become increasingly important in Kazakhstan's innovation policy agenda. Initial efforts have focused on institution-building, ensuring that the activities of innovation institutions are well known at the regional level and creating new regional infrastructures of support. These are important elements that should be developed further.

The State Programme for Accelerated Industrial Innovative Development (SPAIID) has created a comprehensive framework for the modernization of the country, including through improved innovation performance. Kazakhstan has been very open to the use of foreign experiences in designing policy initiatives. However, the success of these initiatives depends on the ability to draw lessons from their outcomes, so that future policy adjustments reflect the knowledge acquired in the course of implementation, including adaptation to local circumstances. This stresses the importance of monitoring and evaluation mechanisms. Existing programmes of state support include control mechanisms over their implementation and assessments of their results. Evaluation mechanisms should reflect the distinctive features of innovation policies; focussing on effective impact and not only on the consistency with declared goals, and taking into account the interrelation between different programmes.

The economy of Kazakhstan is driven by some dynamic sectors, which are linked to external demand, FDI and the large domestic corporations. Under current policy initiatives, these sectors have the potential to play an important role in technology transfer and in raising the demand for innovation. However, there is so far little evidence of economic or technological spillovers to the rest of the economy, in particular regarding the creation of new firms. There are a number of ongoing initiatives to encourage linkages between SMEs and larger public and private companies and these would be reinforced with the new Law on State Support to Industrial Innovative Activity. However, connectivity among innovation stakeholders in the national innovation system in general remains weak and should be the object of continued attention. Forthcoming initiatives such as the introduction of technology programmes to develop these linkages should be exploited fully.

Knowledge generation and innovation support institutions

Companies still play a limited role in the generation of knowledge in Kazakhstan. The structure of R&D, which reflects the legacy of the former planned economy, with the still prominent role of sectoral research institutes, is not conducive to commercial success, given the detachment from the market. Market-driven demand for technology is also low, reflecting the pattern of productive specialization.

Largely due to the legacies of the past, the knowledge-generation capacity of the country is relatively limited, reflecting overall low levels of spending on R&D, both in the public and, particularly, in the private sector. The authorities have set ambitious targets in this area but implementation lags behind. Despite marked progress, the existing infrastructure does not yet support easy access to and dissemination of knowledge. There is space for enhancing the knowledge-generation capacity of the economy through targeted policy intervention.

Kazakhstan clearly recognizes the importance of human capital development to enhance the growth potential of the country and create a conducive environment for innovation. However,

despite progress, lack of qualified personnel constrains the growth of the private sector, while careers in R&D do not seem to be attractive to the brightest university graduates. Reforms in this area are critical but it will take time to reap the full benefits of current investment, so continued commitment and work in multiple directions is necessary.

Structural changes in the economy, and the need to increase the national absorption capacity while facilitating technology transfer, both of which are critical for Kazakhstan, stress the importance of education to meet the increased demand for skills. While it is important to aim for academic excellence at the top universities, it is also essential that skills are improved more widely, addressing the need for different types of workers.

Kazakhstan is making an increased emphasis on the science base of the tertiary education system. International links have been actively developed. However, it is also important to cultivate linkages among domestic institutions, in order to facilitate the diffusion of knowledge and the exchange of experiences. Closer relations between university and industry would also increase the scope for learning. Robust monitoring mechanisms would contribute to better assess the outcomes of existing initiatives.

Industry-science linkages and collaboration in the innovation process

Improving the innovation impact of industry-science linkages (ISL) will require coordinated policy actions at all levels of the innovation system, employing a wide range of policy instruments as part of a systemic, comprehensive approach. ISL policy must reflect the specific characteristics of innovation agents on both the supply and demand sides of knowledge production and use. Policy support must be tailored to the specific context of Kazakhstan. Improved needs assessment would provide the basis for informed policy decisions.

The promotion of ISL requires a good understanding of the capabilities of innovation stakeholders and the impact of policies. Support measures should take as a departure point existing capacities and needs, attempting to accommodate the support provided to the requirements of their beneficiaries. Areas with a particularly large impact potential or those that are considered as critical barriers impeding progress should be specifically targeted. This defines a complex agenda of intervention that should be founded on a thorough analysis of the existing situation and requires specific instruments. The design and implementation of effective interventions targeting ISL requires a good knowledge of the potential of the existing system, the driving forces of interactions among innovation stakeholders and focused policy actions.

Intellectual property rights (IPR) create basic incentives for the commercialization of research outputs and the development of ISL. The importance of these incentives is particularly high given the underdevelopment of knowledge entrepreneurship in the country. Despite some positive steps in this direction, there is still considerable potential to enhance the role of IPRs in Kazakhstan's innovative development. In particular, the low capacity of knowledge institutions to deal with IPR issues is a barrier to innovation.

Public education and research institutions in contemporary national innovation systems are asked to perform a variety of roles. Although these may be all-important for the performance of the national innovation system, there may be conflicts between different goals that need to

be managed. Public education and research institutions in Kazakhstan are still not well equipped to meet so many different expectations.

Innovation support institutions

The commercialization of technology presents significant challenges and the likelihood of success is often overestimated by those engaged in research with little commercial experience. In Kazakhstan and other countries with economies in transition, this is a particularly serious problem, given the share of research carried out in public institutions. Increasing awareness of pitfalls and the involvement of partners with a commercial understanding in research decisions is important to assess and respond to market needs.

The relatively weak support to technology businesses, especially newly emerging ones, limits the effectiveness of support measures targeting later stages in the development of a company. Early intervention is therefore necessary to explore and generate new projects that could grow further while ensuring that resources are not wasted in those that do not show sufficient commercial potential. Support to the creation of companies, even those where technological innovation is not a major driver, contributes to increase management capacity, which is essential to encourage the growth of clusters. In order to create a flow of potential opportunities, it is important that support measures target the very early stages in the development of a company.

Technology parks in Kazakhstan tend to be based on the assumption that the mere presence of resident technology-based companies staffed by skilled personnel will automatically lead to spillover effects resulting in the creation and development of innovative SMEs. However, this is insufficient. Successful technology parks are those that become focal points in a chain of linkages that can effectively support the development of companies.

Kazakhstan has made a significant effort in improving educational standards and providing opportunities to study abroad. However, the range of skills required to support innovation is very varied, and must be developed in close cooperation with the private sector. Some recent policy initiatives, such as the provision of management courses in the "Business Roadmap 2020" or the financing of practices in foreign companies within the Bolashak programme, recognize the importance of developing the necessary skills. However, the shortage relevant managerial skills continues to constrain the success of innovation initiatives.

The technology park and business incubator programmes in Kazakhstan have relatively low national and international visibility. This is a major obstacle to the formation of linkages with other innovation partners, and to integration with the national and global chains through which knowledge diffusion occurs. Ongoing efforts to improve the situation through roadshows and mechanisms to request the feedback of potential users on the services provided should be continued and strengthened.

Financing innovative entrepreneurs

The development of SMEs is critical not only for innovation but also to foster the modernization and diversification of the economy, which are major objectives of Kazakhstan's industrial policy. SMEs can also contribute to economic dynamism but so far they have not been among the key drivers of innovative development in the country. Access

to finance remains a key constraining factor with banks reluctant to finance risky and innovative projects, particularly those of SMEs, which can in many cases offer only limited collateral. Public support is also weak with DAMU (the Entrepreneurship Development Fund) having at present no initiatives targeting the innovative activities of SMEs. The NIF provides R&D grants to SMEs on an individual basis as part of the Productivity 2020 programme. A conducive environment is necessary to allow SMEs to expand and develop beyond the traditional sectors where they are currently concentrated.

The financial system in Kazakhstan is bank-based, as the capital market plays a minor role in providing finance to companies. A bank-based system favours industries which rely on incremental innovations as banks are usually not prepared to accept the risk involved in (radical) innovation projects - and SMEs, especially start-ups and service sector companies, are not in a position to collateralize investments. However, the financing of radical innovation is strongly linked to the development of equity instruments and, in particular, those concerning early-stage financing. The focus on equity financing is likely to increase in the medium to long term as the economy develops and becomes more sophisticated. This requires the creation of the necessary infrastructure.

Financial support for innovation is currently divided between equity finance that produces a small number of highly supported projects, and R&D grants that distribute relatively small sums over a larger number of firms. Most of the beneficiary projects and activities are investment projects with limited "pure" innovation content. This reflects the capabilities of successful applicants rather than a bias from funding agencies, strongly suggesting a shortage of genuine innovative projects seeking finance. If Kazakhstan is to continue to modernize the economy and gradually increases the innovation content in this process (i.e. some incremental product and process innovation), the number of firms engaging actively in innovative activities should increase substantially in a medium-term perspective.

Kazakhstan has carried out initiatives to develop a venture capital industry, investing along private funds. This is a valuable experience that will contribute to create domestic expertise in venture investing and exploit some existing opportunities. However, this is a slow organic process which can only yield limited results, being constrained by the existing deal flow and the amounts of financing available from these emerging specialized intermediaries. Established companies can be a complementary source of financing and knowledge.

Because of the inherent risk of innovation support and the unpredictability of outcomes, policy learning depends on regular evaluation of the rationale, procedures and impact of support programmes. However, until now public innovation support programmes have only been subject to limited evaluation. Without the insights drawn from evaluation, policymakers are likely to have difficulties designing policy instruments in an effective and efficient way. However, it is important that evaluation and control mechanisms reflect appropriately the characteristics of innovation processes. Existing evaluation procedures require that each and every investment project is successful, rather than the portfolio of supported projects, and disregards the positive indirect effects of innovative activities, resulting in excessive risk aversion.

The integration of financial measures with other forms of support enhances the positive impact of interventions. A number of initiatives have sought to integrate packages of instruments into comprehensive support programmes, such as Productivity 2020 and Business

Roadmap 2020. Combined with a one-stop-shop approach, this is a very positive development that avoids system fragmentation while allowing tailor-made support packages for enterprises.

Innovation and international economic integration

Kazakhstan has embraced international cooperation to gain access to new knowledge, identify good policy practices and develop contacts that should result in improved innovation performance. Many initiatives are being carried out by different institutions. However, synergies across different actions are not being fully explored and the exploration of different options is not always accompanied by follow-up actions.

Creative and skilled workers are essential for an innovative economy. Kazakhstan has put in place programmes such as Bolashak that make an important contribution to the improvement of skills, facilitating access to international education. The potential of international cooperation to contribute to human capital development and provide the necessary skills to support innovation could be developed further, paying attention to the multiple options available, including also mobility of researchers and the use of foreign workers.

Kazakhstan has a good track record of participating in international research cooperation initiatives. However, capacity bottlenecks, concerning both intermediating organizations and researchers, constrain involvement in international projects.

The increased importance of recent regional integration initiatives, in particular those within the Commonwealth of Independent States and the Eurasian Economic Community, creates the institutional prerequisites for closer collaboration in innovation-related areas, resulting in an increase in innovation capacities. Traditional links with neighbouring countries suggest a significant potential in this area. However, in terms of implementation, there is still room for considerable improvement and the existing potential is not fully explored. There is not yet a clear national strategy that seeks to exploit the opportunities created by these integration processes. Institutions, particularly at the subnational level, are not fully equipped to facilitate linkages in this regional context.

The Customs Union increases competitive pressures, not only for firms, but also for R&D institutions. This challenge is also an opportunity, if the capabilities to meet future customer demands are improved, including through higher innovation activity. However, there is a shortage of empirical evidence on the impact of the customs unions, which would allow the development of tailored policy instruments.

Recommendations

A number of recommendations and policy advice can be derived from the assessment of the innovation performance of Kazakhstan which could contribute to increasing the efficiency of the national innovation system and enhancing the innovation capabilities of stakeholders. These recommendations, which concern a large number of innovation related issues, have different scope, including strategic considerations, changes in the allocation of resources, new policy orientations or the design of specific instruments.

Regarding the **National Innovation System** (NIS), the Review recommends further efforts to strengthen the connectivity between various components of the NIS through horizontal

instruments that facilitate linkages, including public support to coordination and risk-sharing mechanisms. In addition, it advises the use of policy instruments that can increase the demand for innovation and the development and upgrading of a market infrastructure supporting the innovation process, including appropriate services to facilitate innovation activities. Non-technological forms of innovation, in particular in the services sector, should also be considered. These initiatives should be complemented by the promotion of an innovation culture.

Further efforts should be conducted to reduce the regulatory burden on SMEs and address the challenges faced by innovative start-ups. The assessment and recommendations to reduce administrative barriers and other obstacles to business development should result from a dialogue between the government and the business community.

The role of universities and other knowledge-generating organizations in the National Innovation System should be strengthened by boosting their capacity to transform ideas into innovation projects and reinforcing links with other innovation stakeholders. The Review recommends a number of actions, including the preparation of practical plans to increase further the contribution to innovation made by top research universities, based on a detailed assessment of existing constraints and possibilities; the possible merging of some existing research institutes with universities; the introduction of targeted measures for the encouragement of entrepreneurial activity in research and education organizations or further support to the creation and strengthening of technology transfer and industrial liaison offices in research universities.

The Review also suggests further steps to strengthen the horizontal dimension of the innovation policy mix with a view to facilitating the coordination of innovation policies and ensuring their effective design and implementation. These include the creation of a National Innovation Council (NIC), where representatives of the business sector and the relevant ministries would be equally represented. The NIC could act as a central advisor to the government on innovation policy, with a wide remit that would also include non-technological aspects and the overall framework conditions for innovation. In addition, the new National Agency for Technological Development (NATD) should be empowered with the functions to act as the lead implementer of innovation policy. The Review advises a gradual shift in the innovation policy mix, which results in a widening and broadening the scope of horizontal policies and instruments while at the same time reducing the coverage of vertical ones. This shift should be accompanied by a corresponding redeployment of the public financial resources underpinning the two types of interventions.

In order to improve the **framework conditions for innovation**, it is suggested that the authorities should engage in a systematic policy course of addressing existing impediments to entrepreneurial activity and further improving the business environment to make it more conducive to innovative entrepreneurship, continuing and expanding the dialogue with entrepreneurs to identify the factors that limit their activity.

The Review also suggests a number of initiatives to improve the coherence of **innovation policies**, developing the possibilities opened by recent legal changes. In particular, it stresses the need to align strategic objectives with the results of foresight programmes and other priority-setting mechanisms and to facilitate the coordination of actions by different organizations during the design and implementation phases at different levels. At the same

time, the bottom-up flow of information and ideas and their integration into innovation initiatives, through a consultation process, should be encouraged.

The lack of sufficient demand is an important impediment for innovation and the Review proposes a number of instruments to address this situation, including aspects related to framework conditions such as the establishment of competitive domestic markets and the elimination of existing dominant positions. In addition, the Review proposes the introduction of new demand-oriented public support schemes such as a voucher system for R&D and innovation, as well as public procurement targeting chains of innovation activity. Existing demand-oriented coordinating and matching mechanisms should be extended further.

The Review emphasizes the need so support the emergence of new enterprises and especially new technology-based firms (NTBFs), suggesting measures such as support to innovation-based university start-ups and spin-offs and mechanisms to increase the participation of these companies in public procurement activities and other existing programmes like the Business Roadmap 2020. In addition, it proposes the creation of the status of "Young Innovative Enterprise", which would include tax incentives without sectoral limitation as well as other measures of support.

The Review recognizes the importance of the regional initiatives being undertaken and proposes that regional strategies should be integrated at the national level, so that the complementarities and interdependencies between regional strategies can be supported by national policies. The active participation of the main innovation stakeholders, both in the formulation and implementation of strategies, should be ensured so that potential opportunities and the necessary actions to exploit them are identified.

The Review acknowledges the ongoing efforts to develop appropriate mechanisms to monitor and evaluate the results of policy programmes and encourages the authorities to develop a common evaluation mechanism for all innovation-related programmes that takes into account the specific character of public interventions regarding innovation and prevents excessive risk-avoidance through the adoption of a portfolio approach. Building on current practices, independent external reviewers should participate in the process of evaluation.

The development of linkages, in particular between large and small domestic companies and between foreign and domestic companies, as well as the enhancement of connectivity in the national innovation system, should remain a major focus of innovation policy. The authorities should consider developing further innovation support measures which are conditional on the collaboration between several innovation stakeholders and develop further existing initiatives to increase subcontracting by large national companies to SMEs and foster international partnerships.

The Review proposes different initiatives to foster **knowledge generation and transfer**, including increased R&D expenditure in the economy. It is suggested that policy instruments should be differentiated according to the type of R&D, the level and type of risk as well as other factors affecting the innovation process. Instruments should at the same time target higher connectivity and better linkages in the national innovation system. The Review also stresses the importance of enhanced collaboration with foreign direct investors to encourage the setting up of local R&D facilities and linkages with the domestic research base. Support to

foreign investment through the tax system or other systems of incentives could be contingent on the development of these linkages.

Firms should be placed at the centre of the innovation process and instruments should be developed to strengthen linkages and foster the creation of collaborative networks. It is also advised to address financing constraints that limit the ability of the business sector, in particular SMEs, to undertake R&D projects, ensuring that existing grant schemes reach these companies. This should be combined with other instruments to facilitate the development of technology-based SMEs, including increasing the share of innovative products in public procurement.

Building on existing initiatives, the authorities are encouraged to retain a strong focus on education and training in the innovation policy mix, including through raising the profile and attractiveness of careers in science and R&D and setting up incentive schemes for students to do applied research in state enterprises and private businesses. Among the measures proposed, it is suggested that a standard training course on public administration questions related to Innovation and Technological development should be developed to facilitate the understanding of innovation issues among public officers.

The authorities should strengthen ongoing efforts to enhance human capital and increase labour force skills, so that they are appropriate to serve the needs of a diversified knowledge-based economy. The Review proposes a number of practical measures, including widening further access to higher education, disseminating good practices and lessons learned from the experience of elite national universities to other parts of the tertiary education system, increasing support to vocational training and developing a variety of life-long learning opportunities.

The Review emphasizes the importance of networking initiatives to facilitate knowledge generation and transfer and proposes measures such as the creation of networks of scientists from different institutions and disciplines, including international exchange programmes and the development of schemes for the temporary placement of young scientists and researchers in companies.

The Review proposes an **industry-science linkages** (ISL) mapping and evaluation exercise to identify bottlenecks and barriers, in particular concerning the interaction of actors from different institutional sectors and their motivations, and to raise the attractiveness to private entities of participating in government financed projects or cooperation arrangements.
It is advised that the scope of horizontal policies and instruments should be widened at the expense of the narrowing of vertical ones. This would include horizontal policy instruments that specifically target ISL, such as the planned technology platforms, and the modification of existing ones to include eligibility criteria related to ISL activities. Young knowledge-based small companies have a high potential for linking science and markets and should be specially supported. The increase of knowledge transfer capacity, in particular by promoting effective intermediating services and skills, should include both external provision of these services and initiatives to encourage their internal development.

The role of intellectual property rights (IPRs) as a driver of the country's innovative development should be strengthened by clearly defining the options for transferring of ownership of publicly funded research results from the state (government) to the (public or

private) agent performing the research, down to the level of the individual inventor. In addition, clear incentives for innovation should be established by protecting the rights of researchers and scientists while creating favourable conditions for the creation of firms based on the results of their research. The Review also suggests the elaboration of precise guidelines that would allow knowledge organizations to understand the opportunities and limitations of IPRs and would offer guidance on how to deal with the different options. Model applications and contracts covering a range of situations should be made available.

The Review also advises the authorities to develop the capacities of public education and research institutions to perform efficiently their role in the national innovation system. To this end, it is suggested that the introduction of criteria in the evaluation of knowledge producing organizations related to the measurable effects of external linkages, commercialization and technology-transfer activities, academic entrepreneurship and others. Development plans for public institutions to reinforce ISL, based on an analysis of the starting level, the identification of strengths and weaknesses of existing links and current and potential partners could be developed with the involvement of the business sector.

The Review acknowledges the initiatives developed by Kazakhstan to create a network of **innovation support institutions** and makes a number of suggestions and proposals to make these efforts more effective. In particular, the Review stresses the need to encourage the commercial orientation of publicly funded research, including through the engagement of business in decisions related to R&D through the creation of science-industry groups covering different priority areas, through the planned introduction of technology platforms and other instruments. The infrastructure necessary for the generation of scientific knowledge, the provision of training and the commercialization of technology should be developed further.

The authorities are encouraged to support the establishment of pre-incubators in research organizations and setting up funding programmes that target the early stages of development of technologies with commercial potential while extending incubation initiatives beyond the traditional focus on university and research institutes. The integration of technology parks into the national innovation system could be strengthened by establishing new linkages and facilitating connectivity with other innovation stakeholders, in particular, by establishing specialized teams tasked with such assignments. Horizontal programmes and instruments, which result in close linkages between research centres, universities and industry, should be deployed.

The Review suggests further support to the development of management skills both in the public and in the private sector, proposing measures such as short business courses, coaching programmes for managers of firms operating in technology parks and incubators and the introduction of modules on business in the curricula of all undergraduate courses to encourage technology-based entrepreneurship and develop linkages between incubators and business schools. Developing the brand image and external projection of technology parks and business incubators would help organizations to understand better the opportunities available.

The Review provides a number of recommendations to foster **financing of innovative entrepreneurs**. It encourages the authorities to take a life-cycle approach to identify and address any bottlenecks at different stages of enterprise formation while providing finance as a complement to other forms of support. The Review proposes the introduction of a special new programme to support R&D and increased micro financing and small grants provision to

encourage experimentation of potential opportunities and entrepreneurial initiative, including in universities and research organizations.

The Review acknowledges the importance of equity financing for innovation and recommends the strengthening of stock markets as an exit mechanism for equity/venture finance, paying particular attention to the needs of innovative companies with a limited track record. Business angel financing could be promoted through public initiatives aiming to overcome coordination and information problems in the private sector, including through support to the formation of networks.
The Review proposes a wider set of public innovation instruments that cater for the needs of different types of innovation projects, distinguishing between equity finance (riskier projects with promising potential, mostly start-ups), less risky incremental innovation projects and pure investment or modernization projects, which should be gradually phased out from access to public equity funds. Corporate venture capital as a source of financing for innovative companies could be facilitated by matchmaking and tax and other incentives, including risk-sharing with the use of public funds.

The Review stresses the importance of a regular evaluation of innovation support programmes and proposes the compilation of a complete database of financed projects, incorporating a selection of indicators that allows for a quantitative analysis of the effects of the promotion programmes and the characteristics of the awarding process. The need to take into account the special characteristics of innovation should be emphasized in measures of performance to prevent excessive risk avoidance. Returns from public investments in innovative projects should be assessed on a portfolio basis rather than focussing on the performance of each individual project.

The authorities should continue to develop integrated programmes that link the provision of financial resources (supply interventions) to other instruments aiming to increase the managerial and innovative capacities of beneficiaries, using the experience of existing integrated programmes to improve future policy design and involving target groups in consultations at an early stage in the design of new programmes or in the overhaul of existing ones to better understand the potential needs of beneficiaries.

International cooperation can foster innovation through multiple channels. Building on the extensive experience accumulated so far, the development of an integrated strategy for international cooperation in R&D and innovation should establish clear goals and priorities and identify cross-border linkages with interventions in other innovation-related programmes to reinforce the consistency and impact of policy actions, in particular in areas targeting an upgrade in the capabilities of firms. The Review also recommends addressing coordination and information exchange issues between different national agencies involved in promoting international cooperation in R&D and innovation.

Human capital and skills can be upgraded through international cooperation. A number of measures are proposed in this area, including further support to mobility of researchers, use of qualified foreign labour and programmes of cooperation with foreign investors to train local staff.

The participation of researchers in international innovation initiatives could be promoted through a number of measures, including the provision of appropriate support services, recognition in professional appraisals and better access to international information sources.

The Review recommends a better alignment of innovation policies with regional integration initiatives, in particular those within the Commonwealth of Independent States and the Eurasian Economic Community. It suggests the elaboration of a strategy for the promotion of innovation in a regional context, which exploits and evaluates scientific collaboration and connects it with trade patterns and increased opportunities for foreign investment. Other proposals include the promotion of joint technology-based projects with countries where strong traditional links exist, the development of regional networks of incubators and technoparks and meeting platforms for interaction, strengthening cooperation between higher educational institutions and the reciprocal opening up of national innovation support schemes. The implementation of an adequate monitoring and evaluation system would facilitate an informed and deeper analysis on the impact of the Customs Union and other integration initiatives on Kazakhstan's economy and innovation system.

Chapter 1

RECENT ECONOMIC AND INNNOVATION PERFORMANCE

Kazakhstan is an upper-middle income economy, according to the World Bank classification, with a GDP per capita of around US$11,000 in 2011 (US$13,000 on a purchasing power parity basis). Large and sparsely populated, the country is rich in natural resources, with very significant reserves of oil, gas, minerals and non-ferrous metals. There has been a strong growth in production of oil and gas condensates over the last decade, and the country could become one of the top ten exporters of hydrocarbons by 2020. Growing resource-based exports and imports of equipment associated with large foreign direct investment in extractive industries have increased the degree of openness of the economy, with the ratio of merchandise exports to GDP reaching 41% in 2010.

The break-up of the Soviet Union was accompanied by a severe contraction in output and was followed by a period of economic instability. However, over the last decade, Kazakhstan has posted an exceptional economic performance, with GDP growing by around 10% annually in 2000-2007. Although this rapid expansion suffered a sharp slowdown in 2008, as a result of the negative impact of the global economic crisis on the availability of external finance and declining commodity prices, the economy rebounded in 2010, with GDP increasing by 7%.

While the development of its natural resources has provided a major impetus to the recent expansion of Kazakhstan's economy, the authorities have stressed the need to develop other sources of growth and improve overall economic competitiveness. In order to support these aims, growing resources are being devoted to the modernization of the economy and the revamping of its infrastructure, seeking to facilitate economic diversification.

1.1 Economic structure

Economic activity is dominated by services, which account for more than half of GDP. The share of manufacturing has been stable over the last decade, while the relative importance of agriculture has declined significantly, representing in 2010 only 4.4% of GDP, against 8.7% in 2001 (Table 1). This process of structural transformation is typical of catching-up economies.

The global financial crisis initiated in 2008 constrained access to finance sharply, putting an end to the rapid growth observed in the construction sector. As a result, its share in GDP declined to 7.7% in 2010, down from a peak of 9.8% in 2006.

Over the past decade, extractive industries have grown rapidly. They represented 19.5% of GDP in 2010, against 11.4% in 2001 and accounted for 61.3% of industrial production, up from 37.3% in 2001. The main driver of this increase was the expansion of the extraction of crude oil and natural gas and associated services, which rose from 26.1% to 51.9% of industrial production over this period. Price increases have contributed to boost the importance of the extractive industries.

Table 1. Composition of GDP, shares in per cent, 2001-2010

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Manufacturing	**44.8**	**43.8**	**42.9**	**42.5**	**44.0**	**44.9**	**43.4**	**45.6**	**44.7**	**44.9**
Agriculture, hunting, forestry, and fish farming	8.7	8.0	7.8	7.1	6.4	5.5	5.7	5.3	6.2	4.4
Construction	5.5	6.3	6.0	6.1	7.8	9.8	9.4	8.1	7.9	7.7
Industry	30.6	29.5	29.1	29.3	29.8	29.6	28.3	32.2	30.6	32.8
Services	**49.4**	**50.6**	**51.8**	**53.4**	**52.0**	**51.6**	**54.3**	**52.1**	**53.9**	**51.9**
Transport and communications	11.2	11.6	12.4	11.8	11.8	11.5	11.5	11.0	11.0	11.2
Financial activities	3.4	3.5	3.2	2.9	3.0	4.7	5.9	5.3	5.0	3.9
Real estate, renting and services to consumers	12.1	12.5	14.4	15.3	15.1	14.8	14.8	14.9	15.9	8.7
Trade, repair of motor vehicles and household goods	12.1	12.2	11.6	12.3	11.8	11.4	12.4	12.3	12.1	13.1
Others	10.6	10.8	10.2	11.1	10.3	9.2	9.7	8.6	9.9	15.0
FISIM	-1.1	-1.5	-1.5	-1.9	-2.2	-3.0	-4.8	-4.7	-3.2	-2.2
Net taxes on products and imports	**6.9**	**7.1**	**6.8**	**6.0**	**6.2**	**6.5**	**7.1**	**7.0**	**4.6**	**5.4**
GDP	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Agency of Statistics of the Republic of Kazakhstan.

Kazakhstan's employment structure is broadly similar to that observed in low middle-income countries, with a large share of the workforce occupied in agriculture and services and the relatively smaller significance of employment in the industrial sector. More than half of the population is employed in the service sector. Agriculture, with a share of GDP of only 4.4% in 2010, had an employment share of 28.3%, reflecting the relatively lower labour productivity in this sector. Employment in agriculture has declined; down from 35.5% of total employment in 2001.

The bulk of small and medium-sized enterprises (SMEs) are active in the trade sector, which accounted for more than 40% of total SMEs in 2009. Agriculture is also an important sector, where 23.4% of SMEs are present. The economic crisis of 2008 appears to have had a negative impact on SMEs, but overall their relative importance in economic activity and employment has increased since 2005 (Table 2), accounting for around one fifth of GDP in 2010. However, this remains low by international standards. Individual farmers represent 23% of SME employment but only 14% of output.

Table 2. SMEs' contribution to GDP and employment, shares in per cent

	2005	2006	2007	2008	2009	2010
GDP	17.8	17.5	20.4	18.6	20.4	20.2
Employment	22.2	22.8	24.4	22.3	23.9	23.2

Source: Agency of Statistics of the Republic of Kazakhstan.

For administrative purposes, Kazakhstan is divided into 14 oblasts (regions) and two cities of republican significance, Astana and Almaty. Some oblasts are particularly dependent on the oil and gas sectors (Atyrau, Mangystau, West-Kazakhstan, Aktobe and Kyzylorda), while others may be characterized as agrarian-industrial regions (Kostanai, North-Kazakhstan and Akmola oblasts in the north, Zhambyl and South-Kazakhstan in the south and Almaty in the south east). Industrial oblasts include Pavlodar, East-Kazakhstan and Karaganda. Over the past decade, economic expansion has been particularly rapid in Atyrau, Almaty, Kyzylorda and Mangistau.

1.2 The public sector

Economic activity is largely in the hands of the private sector, which accounted for 70% of GDP and employment in 2010, according to the estimates of the European Bank for Reconstruction and Development.

However, there are a number of large enterprises that remain fully or partly in state hands. These concern mainly the energy sector, utilities, transport and communications. As a result of the financial crisis, the state also took equity stakes in a number of troubled banks. Many of the activities in which the state has significant presence have important implications for overall business conditions, as they provide inputs that are necessary for other sectors.

The sovereign wealth fund Samruk-Kazyna manages the state's interest in these industrial and financial companies. The development of the companies under its control into "national champions," contributing to the modernization and diversification of the economy, is one of the strategic aims of the holding, which has been given an important role in the initiatives to promote innovation and boost R&D spending (Chapters 2 and 3). The holding also took an active role in the stabilization of the economy during the financial crisis initiated in 2008, although there are plans to scale back this involvement.

Assets of the companies in which Samruk-Kazyna holds stakes were equivalent to 60% of GDP in 2010, a sharp increase from around 45% in 2007. However, there are varying degrees of direct or indirect private participation in many of these companies.

Kazakhstan has been saving part of the revenues obtained from the exploitation of its resources in the National Fund of Kazakhstan, with assets equivalent to around one quarter of GDP by the end of 2011. Oil and gas revenues are allocated to the National Fund of Kazakhstan, with the exception of US$8 billion annually, which is transferred to the budget and considered as fiscal revenue. The National Fund of Kazakhstan invests in foreign assets to avoid creating inflationary pressures in the domestic economy.

While the activities of Samruk-Kazyna exert a degree of direct influence over the economy, the size of the general government is relatively limited in comparison with other economies in the region. Expenditures and net lending were equivalent to 25% of GDP in 2008-2010 on average. Oil revenues accounted for around 44% of general government revenues and grants over this period.

1.3 Economic performance

Kazakhstan's economy has expanded rapidly over the last decade, posting one of the fastest paces of growth in the region. The reliance of the banking system on international capital markets made the country vulnerable to the global financial crisis initiated in 2008. However, although the economy experienced a marked slowdown in 2008-2009, this has proved short-lived and rapid growth returned in 2010 (Table 3).

Table 3. GDP and its components: annual rates of growth, per cent

	2005	2006	2007	2008	2009	2010
GDP	9.7	10.7	8.9	3.3	1.2	7.3
Consumption	10.7	11.6	11.4	4.8	0.7	10.0
Investments	35.0	31.7	23.4	-12.8	2.3	2.0
Exports	1.1	6.5	9.0	0.9	-11.6	1.9
Imports	12.5	12.2	25.8	-11.3	-16.0	0.9

Source: Agency of Statistics of the Republic of Kazakhstan.

Strong investment activity was a major driver of economic expansion in the pre-crisis period but, despite some stabilization, the recovery after the slump in 2008 remains limited. The ratio of investment to GDP averaged 33.5% in 2005-2007 but fell to 27.5% in 2008-2010.

External balances have been largely influenced by the investment effort associated with the development of the hydrocarbons sector and the dynamics of commodity prices. A sharp increase in imports led to a widening of the current account deficit to reach 8% of GDP in 2008. This gap has now been closed, with a surplus of 3% observed in 2010.

External public borrowing has been limited and the growth of external debt driven by the borrowing of banks and other private companies. The ratio of external debt to GDP reached a peak of 98.2% in 2009 but declined to 79.8% in 2010. However, part of this debt represents intra-company transactions. Excluding this component, the ratio is only 44.5%.

Inflation has declined but remains relatively elevated, down to an annual average of 7.4% in 2009-2010, from more than 12% in 2006-2008. Rapid growth, the impact of food prices and increases in utilities prices have contributed to inflationary pressures.

1.4 Labour force and education

Kazakhstan enjoys favourable demographic and labour market trends. The economically active population increased by 15% in 2001-2010, while employment rose by 21% over the same period. Job creation has continued even during the economic slowdown induced by the global financial crisis and unemployment has declined steadily, reaching 5.3% in the third quarter of 2011.

Kazakhstan has made significant efforts to increase education provision in recent years (Chapter 4). The gross enrolment rate in tertiary education increased by fifteen percentage points between 1999 and 2009, reaching 39% by the end of this period.[1] Public spending on

[1] UNESCO (2011), Global Education Digest, Paris, UNESCO.

education has increased substantially, averaging 3.5% of GDP in 2007-2010. Despite the improvement, these indicators are still relatively low in comparison with other dynamic emerging economies. The shortage of qualified personnel across a range of sectors remains a constraining factor in economic activity.

Average monthly wages reached US$530 in 2010. Despite some improvement in recent years, average wages for staff working in higher education were in 2010 only 92% of average wages for the overall economy. By contrast, workers in research and development enjoyed wages that were 33% higher.

1.5 International economic relations

Kazakhstan has become increasingly integrated in world markets. Over the period 2000-2008, there was a rapid growth in foreign trade, in terms of both volumes and values. The global crisis resulted in sharp declines in 2009 but this was followed by a recovery in 2010 (Table 4).

Table 4. External trade of Kazakhstan, US$ billion

	2005	2006	2007	2008	2009	2010
Exports	27.8	38.3	47.8	71.2	43.2	59.2
Imports	17.4	23.7	32.8	37.9	28.4	29.8
Trade balance	10.5	14.6	15	33.3	14.8	29.5
Turnover	45.2	61.9	80.5	109.1	71.6	89.0
share in GDP, %	79.2	76.5	76.8	81.8	62.1	60.6
Memorandum item: GDP	57.1	81	104.9	133.4	115.3	146.9

Source: Analysis of data from Customs Control Committee and Agency of Statistics of Kazakhstan.

The share of mineral products in Kazakhstan's total exports in 2010 amounted to 76%, compared to 54.4% in 2000. By contrast, the share of metals and their products in total exports declined from 25.8% in 2000 to 12.6% in 2010. The increase in the share of primary commodities in Kazakhstan's export structure has been largely due to rising energy prices. Most manufactured goods are exported to Russia and China (more than 40% in 2010) and other CIS countries.

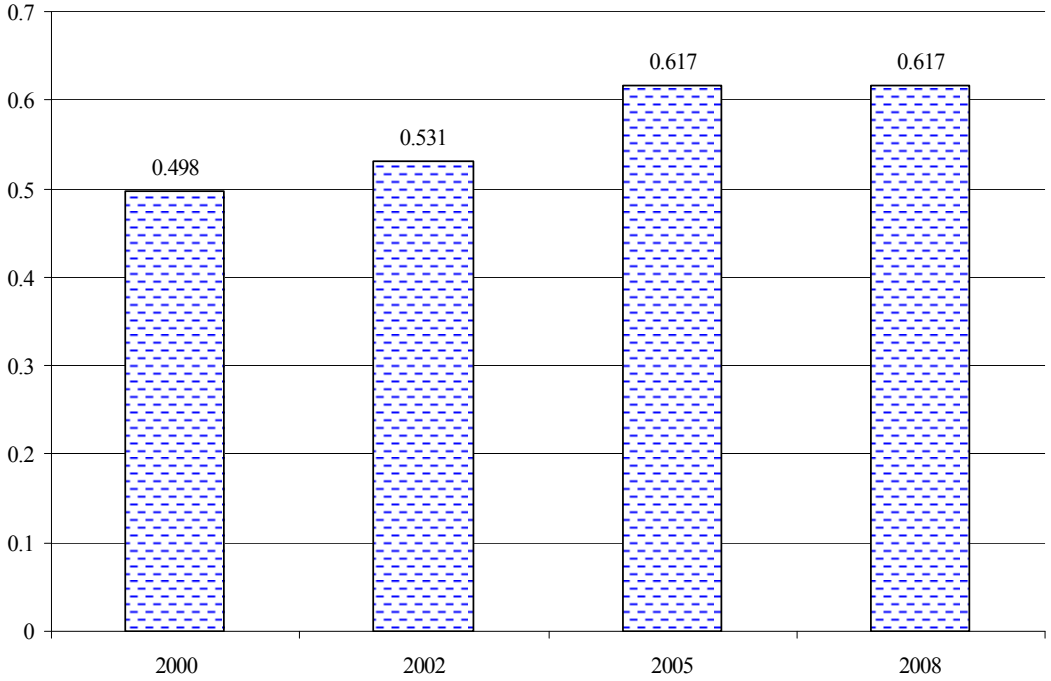
The analysis of the structure of exports shows an increased degree of concentration, as measured by the Hirschman index (Figure 1). This has been largely the result of higher oil and gas prices and a decline in the export share of processing industries.

1.6 Export performance

The technological structure of exports and imports of goods can be characterised with the share of technology-intensive goods in trade flows and an index of revealed comparative advantage[2] (Table 5).

[2] A Lafay index (LFI) was used. A positive figure indicates revealed comparative advantage, while a negative one indicates revealed comparative disadvantage.

Figure 1. Hirschman export concentration index



Source: UN Comtrade, own calculations.

Table 5. Change in technological structure of Kazakhstan's foreign trade, 2000-2010

2000	**Share in exports** %	**Share in imports** %	**Index of revealed comparative advantage**	**Exports,** US$ mln.	**Imports,** US$ mln.
Material-intensive goods	67.3	21.7	0.82	5,707	1,051
Capital-intensive goods	27.6	23.6	0.19	2,341	1,144
Labour-intensive goods	1.7	13	-0.4	140	633
High-tech goods (easily imitated)	1.4	12.3	-0.7	122	595
High-tech goods (not easily imitated)	2.0	29.5	-1.46	169	1,430
2010	**Share in exports** %	**Share in imports** %	**Index of revealed comparative advantage**	**Exports,** US$ mln.	**Imports,** US$ mln.
Material-intensive goods	81.4	19.5	1.01	45,876	4,672
Capital-intensive goods	13.1	15.5	-0.12	7,369	3,717
Labour-intensive goods	0.6	17.1	-0.53	316	4,110
High-tech goods (easily imitated)	4.4	12.4	-0.47	2,462	2,970
High-tech goods (not easily imitated)	0.6	35.5	-1.61	336	8,504

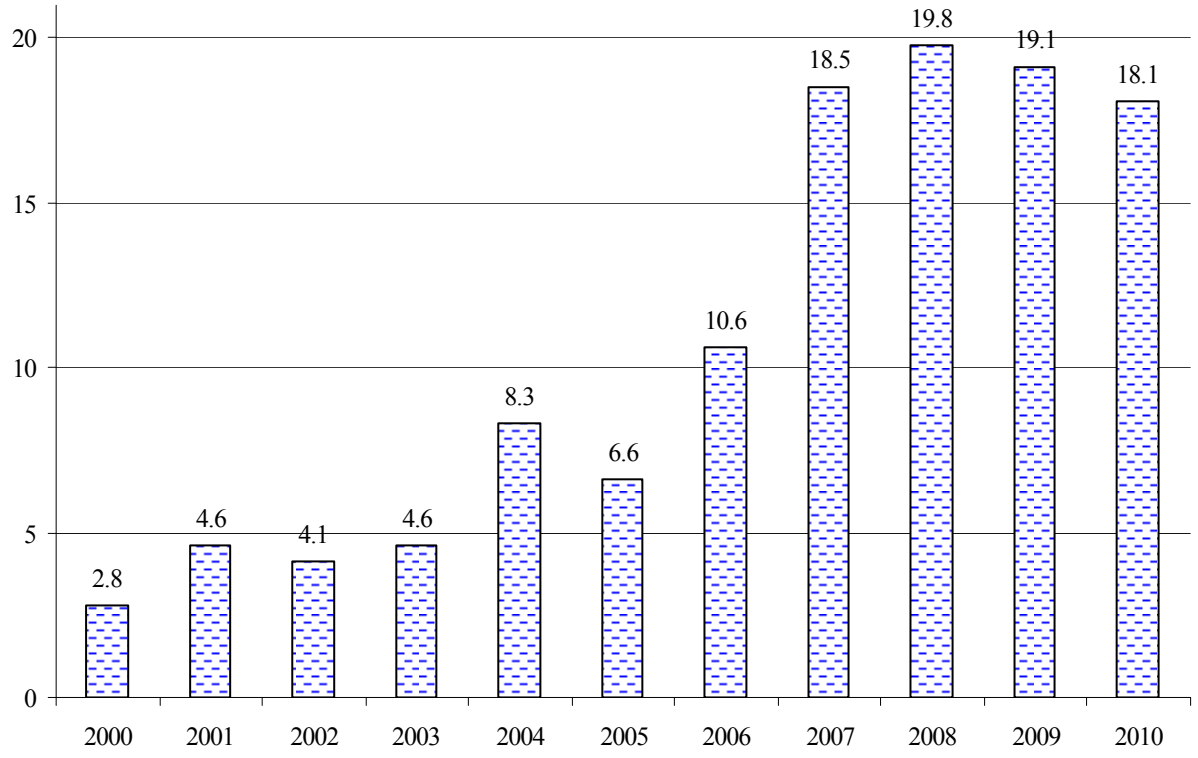
Source: UN Comtrade, own calculations.

There has been a shift in comparative advantage in the last decade from capital-intensive exports to material-intensive and high-tech goods that are easily imitated. This is reflected in the changing structure of both exports and imports. Comparative advantage is lower in relation to more complex types of goods. Since the advantage measured here has a relative character, this effect in part reflects strong export performance in material-intensive goods, driven by buoyant prices in the global commodity markets.

1.7 Foreign Direct Investment

Kazakhstan has attracted large foreign direct investment inflows, which increased markedly after 2007, accounting for 12% of GDP in 2010 (Figure 2).

Figure 2. FDI inflows, US$ billion, 2000-2010



Source: National Bank of Kazakhstan.

FDI inflows have been largely directed to resource-based activities in 2000-2010, including geological exploration and research (33% of gross FDI), the oil and gas industry (28%), metallurgy (5.5%), trade and financial activity (5%). Developed countries are the main sources of FDI inflows, including the Netherlands (23.2% of gross FDI), the US (15.7%), the UK (7.8%), France (6.3%), Virgin Islands (5.6%) and Italy (4.4%). Kazakhstan has demonstrated strong performance in attracting FDI, particularly in the extractive industry. However, this pattern of specialization does not support existing plans to diversify the economy and promote the transfer of knowledge.

1.8 Key innovation indicators

Inputs

There is an increased emphasis on innovation in Kazakhstan's policies, seeking the development of scientific and technological capacities and a closer integration between science and business activities.

However, gross domestic expenditure on R&D has not grown as fast as GDP in recent years. It declined in absolute terms in 2010, as a result of the delayed impact of the financial crisis, with the ratio to GDP falling to 0.16%, from an average of 0.22% in the three preceding years. By contrast, this figure is much higher in advanced countries. In the USA, spending on R&D as a share of GDP is 2.6%, with comparator figures being 2.4% in Germany, 3.0% in Japan, and 3.7% in Sweden. The share of investment in R&D over total investment in Kazakhstan declined from 0.47% in 2006 to 0.33% in 2009 but recovered to 0.36% in 2010.

Overall R&D has been boosted by budgetary funding, which has increased its share in total R&D financing in recent years. By contrast, private spending on internal R&D declined in 2009 and 2010 both in absolute terms and as share of GDP.

Table 6. Expenditure on R&D in Kazakhstan, KZT billion, 2007-2010

Indicator	Year			
	2007	2008	2009	2010
Gross expenditure on R&D	37.2	44.6	49.0	46.0
including:				
external	10.3	9.8	10.0	12.6
internal	26.9	34.8	39.0	33.5
Share of R&D expenditure in GDP (%)	0.21	0.22	0.23	0.16
R&D spending from the budget	13.7	15.1	21.5	20.2
The share of budgetary funds in total domestic spending,%	50.9	43.6	55.2	60.2
R&D spending per capita (KZT)	1,723.4	2,198	2,407	2,037
Memorandum item: GDP	12.850	16,053	17,008	21,514

Source: Agency of Statistics of the Republic of Kazakhstan.

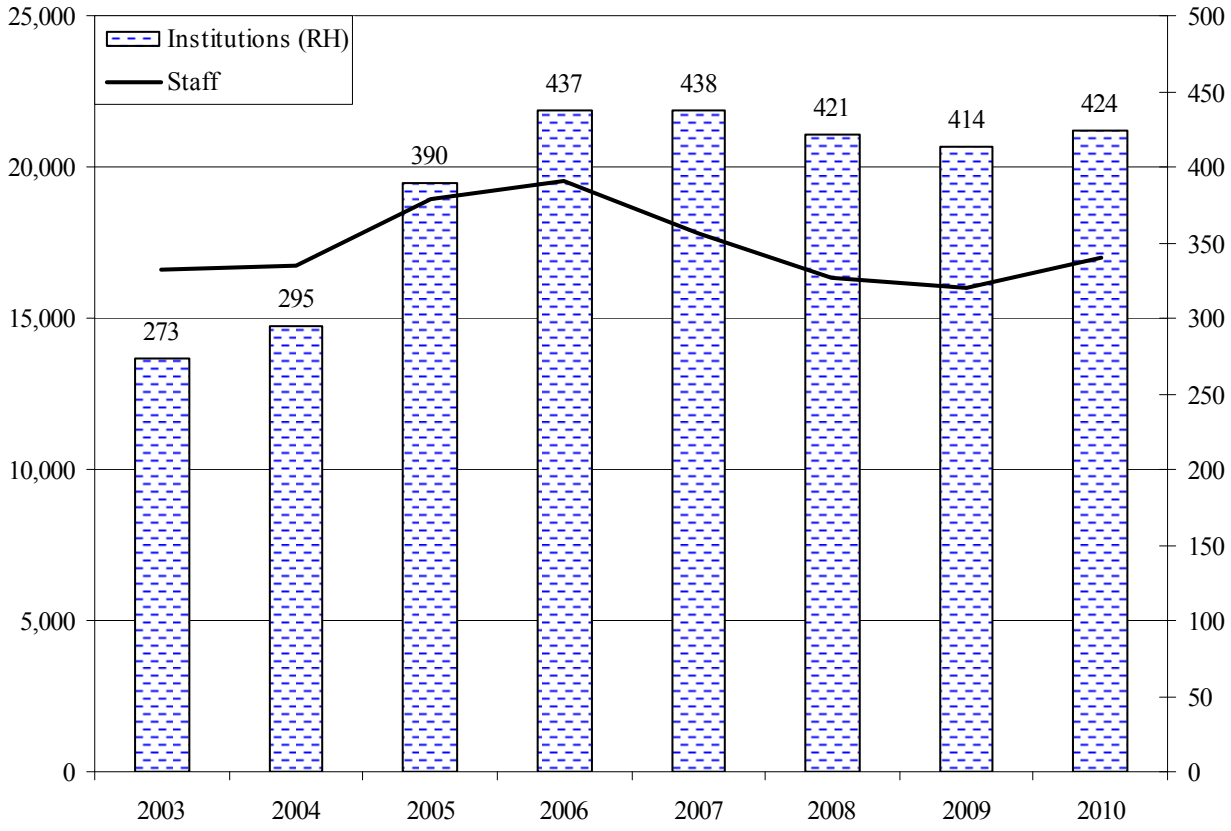
The structure of spending shows a comparatively high level of spending on applied research, with much lower levels of funding for the final stages of development. For example, in 2010, around 45% of expenditure on science and technology in Kazakhstan was on applied research, compared to the 25-30% that is much more typical in developed countries, where around 55-60% of all funding corresponds to later stage development and commercialization. Technical sciences account for the bulk of activities of research organizations, representing 50.8% of R&D spending in 2010. By comparison, the share of total expenditure on research in natural sciences was 29.9%, agricultural sciences 9.4%, medical sciences 4.4%, social sciences 2.5% and the humanities 3.0%

After increases during the early part of the decade, the number of organizations engaged in R&D in Kazakhstan has been relatively stable over the last five years (Figure 3). The number of staff working at these organizations has been declining since 2006 but recovered in 2010.

Outputs

Available indicators suggest a certain reversal in the innovation performance of companies after 2006, as both the share of innovative products in GDP and the extent of innovative activity in the enterprise sector have declined (Figure 4). The latest figures available point to some improvement in 2010, with 4.3% of enterprises engaged in innovation and innovative products accounting for 0.65% of GDP. In industry, innovative products represented 1.2% of total output that year. The number of organizations creating or using new technologies, which had fallen to a low of 140 in 2009, rose sharply to 338 in 2010.

Figure 3. Organizations engaged in R&D, 2003-2010

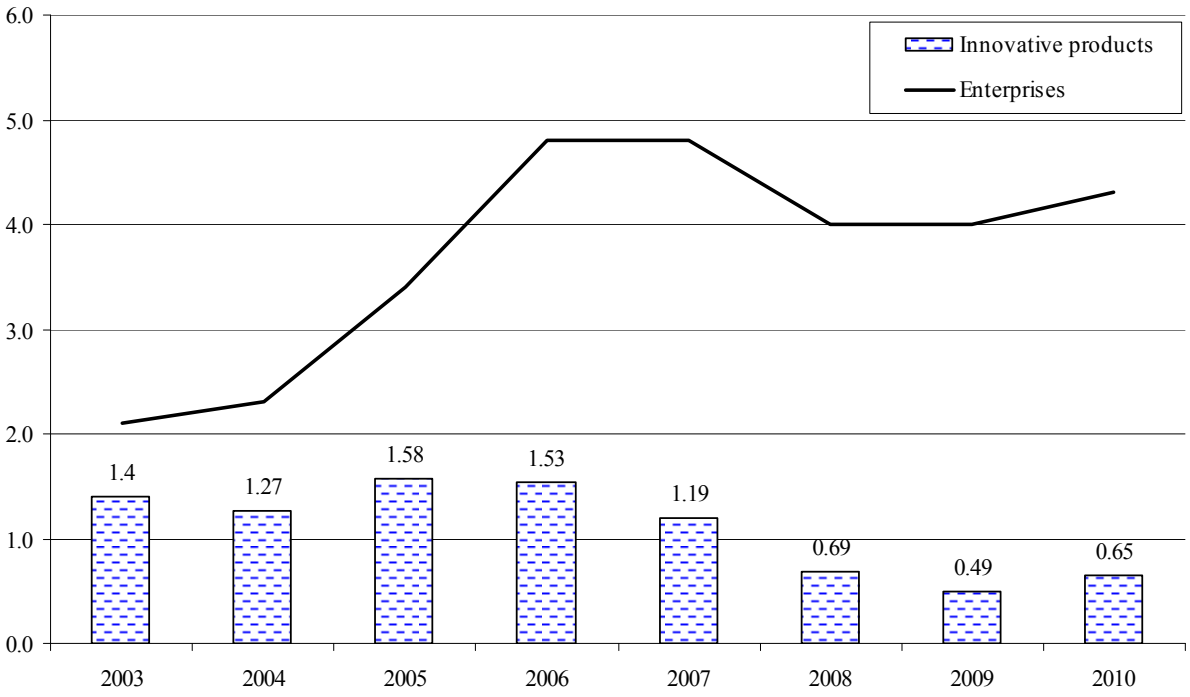


Source: Agency of Statistics of the Republic of Kazakhstan.

The sectors in which the levels of innovation activity are highest include oil products (28.6% of companies participating in the innovation survey 2010), metallurgy (23.5%), electrical equipment (22.0%) and means of transport (25%). State companies are the most innovative (9.8% of total state companies), which partly reflects the pattern of sectoral specialization.

More than half of innovative production was sold abroad, in particular beyond the CIS. Exports of innovative products to CIS countries, which accounted for an average 24% of total exports of innovative products in 2006-2009, represented only 5% in 2010.

Figure 4. Innovative activity of enterprises, shares in per cent



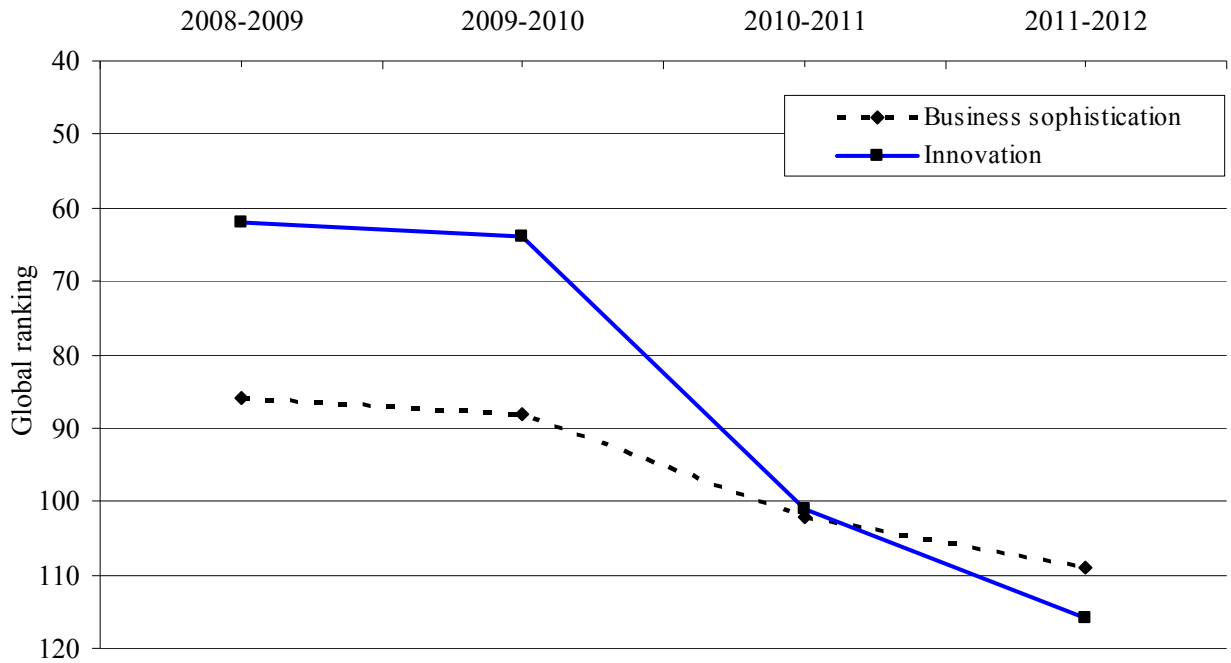
Source: Agency of Statistics of the Republic of Kazakhstan.
Note: Share of innovative products in GDP and share of innovative enterprises in total enterprises.

The level of patenting activity is another indicator of innovation performance. The number of documents issued recognizing patents and other intellectual property rights has increased in recent years, reaching 1,850 in 2010, against 1,157 in 2006 . The majority of these rights, around 85% over the period 2007-2010, are awarded to national holders. The number of patent applications per one million population is low in comparison to more developed countries (93 against 195.9 in Russia, 582.6 in Germany and 2,591.5 in Korea).

Global competitiveness and innovation indicators

The World Economic Forum's Global Competitiveness Report ranks countries according to their performance as assessed under 12 "pillars of competitiveness". Kazakhstan may be considered as a county in transition from being a largely factor-driven economy, where output is driven by increased use of labour and capital, towards an efficiency-driven economy. Progress in the two pillars of competitiveness that are key in the transition from an efficiency-driven to an innovation-driven economy (business sophistication and innovation) has been limited in recent years. The weak progress on these indicators in part reflects the fact that Kazakhstan's economy remains largely resource-driven.

Figure 5. Business sophistication and innovation: WEF rankings



Source: World Economic Forum, The Global Competitiveness Report, various issues.

Kazakhstan outperforms against its peer group of economies in transition in terms of its labour market efficiency, its market size, and in terms of higher education and training, with financial market development remaining a weaker area. "Technological readiness" is a measure of the economy's capacity to assimilate existing technologies (including those from abroad), in order to boost productivity and competitiveness. Kazakhstan's relative position in terms of this indicator, which is directly related to innovation, has deteriorated in recent years, as estimated by the World Economic Forum (Table 7).

Table 7. Technological readiness: WEF rankings

	2008-2009	2009-2010	2010-2011	2011-2012	Change over period
Switzerland	5	3	7	1	4
Sweden	2	1	1	2	0
Iceland	6	14	4	3	3
Denmark	3	4	6	4	-1
Netherlands	1	2	3	5	-4
Norway	4	7	9	7	-3
UK	8	8	8	8	0
Czech Republic	33	30	32	31	2
Poland	46	48	47	48	-2
Russia	67	74	69	68	-1
Ukraine	65	80	83	82	-17
Kazakhstan	***75***	***69***	***82***	***87***	***-12***

Source: World Economic Forum, The Global Competitiveness Report, various issues.

Chapter 2

NATIONAL INNOVATION SYSTEM AND INNNOVATION GOVERNANCE

Chapter 2 is structured as follows. First, it introduces the concept of a national innovation system (NIS) and its main components. Second, it describes and analyses the different elements of the NIS as applicable to Kazakhstan. It presents the main policymaking institutions and the existing coordination mechanisms. Finally, the chapter provides a number of conclusions and recommendations to improve the functioning of the NIS and its governance.

2.1 The concept of the National Innovation System

Innovation

An innovation is *something new that has successfully been put to use*. The question is: what is to be understood by 'new'? In accordance with international practice, four broad types of innovation can be distinguished: product innovation, process innovation, marketing innovation and organizational innovation.[3]

Schumpeter, the 'father' of innovation theory, considered only radical innovation to have significant importance for the economy.[4] Changes that do not affect the basic technology of a product or process can be called modifications, improvements or modernizations. While "pure" innovation means a breakthrough that is new to the world, innovations can also be understood in a more restricted national context. The diffusion of existing technologies can make an important contribution to increase the innovation capabilities of a country. This type of innovation is particularly important for countries that are not at the "technological frontier".

National Innovation System

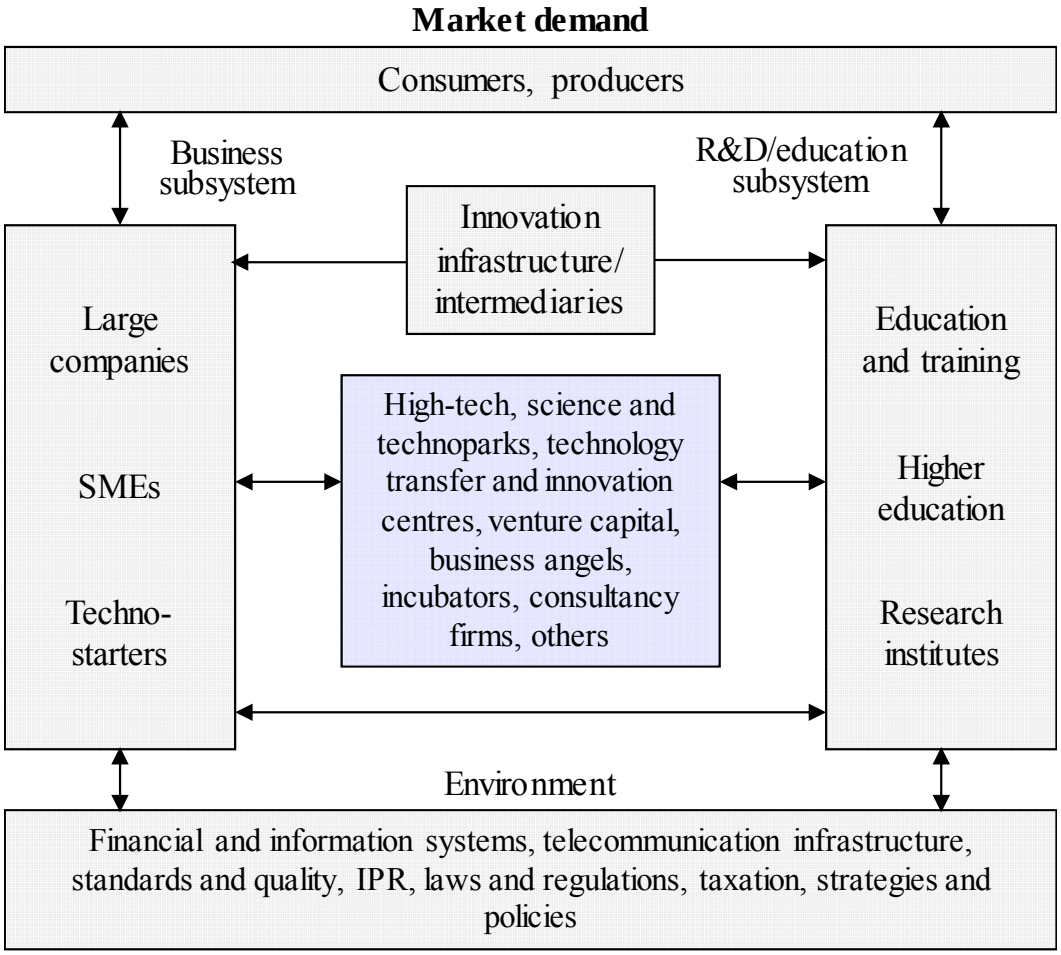
Innovation has become a complex process that requires the collaboration of many actors. This complexity is captured by the concept of the National Innovation System (NIS), proposed by Freeman[5] and now widely used. Freeman's definition of an NIS is "*the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies*".[6]

[3] OECD (2005), Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd edition, Paris, OECD.
[4] J. Schumpeter, The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle, translated from German by Redvers Opie (1961), New York, OUP.
[5] C. Freeman and L. Soete (1997), The Economics of Industrial Innovation, 3rd edition, London, Pinter.
[6] C. Freeman (1987), Technology Policy and Economic Performance – Lessons from Japan, London, Frances Pinter Publishers.

This broad framework (Figure 6) for the understanding of innovation includes three main dimensions:

- The agents of the NIS, which include knowledge institutions (universities, research institutes, technology-providing firms), firms and government bodies but also consumers, which are increasingly seen as a source of innovation;
- The interactions and linkages between the various elements of the NIS; and
- The flows of ideas and knowledge, as well as the ability to learn, are also part of the NIS.

Figure 6. Base model of the National Innovation System[7]



This NIS perspective will be used to analyse the innovation capacity of Kazakhstan, assess existing policies and provide possible policy options. The framework provided by the concept of a National Innovation System has important implications for policy analysis. The most significant one is that linkages between the various elements of the system are critical for innovation and, therefore, the awareness of this interconnection and interdependence should inform and guide policy interventions. Innovation results from simultaneous interactions of many agents interconnected in a complex system, which challenges the traditional view of the

[7] Adapted from: C. Freeman (1987), National systems of innovation: the case of Japan, in: Technology policy and Economic Performance, London, Printer Publishers.

"linear innovation model" (from research to technology to commercial product). Innovation functions are distributed among different organizations and innovative activities can occur in many different forms. However, the central actors in this system are business enterprises, which require internal R&D capacities to innovate successfully. Innovation activities go beyond R&D proper and include many other aspects, such as design, engineering and management.

From a policy perspective, it is important to retain that the innovation system is driven by both the supply of, and demand for, innovation and that innovation takes place in an international context. Overall, effective national policy results from an appropriate balance between different principles, policies, mechanisms and instruments.

The concept of the NIS remains the basis for innovation policy in many countries. The Programme for Innovative Development and Support for Technological Modernization of Kazakhstan for 2010-2014 recognized the need to develop the NIS on the basis of integrated, interrelated and systematic actions that address the different factors influencing the generation, dissemination and commercialization of knowledge.

The concept of the National Innovation System is closely related with the notion of National Innovation Capacity, which also stresses the interrelation between several different aspects. The NIC depends not only on the capacity to generate new knowledge (for example, the supply of R&D) but also on the capacity to absorb and diffuse technology and on the demand for its utilization. Innovation governance, i.e. the institutions and rules that affect the innovation process are an important component of the innovation capacity, which emphasizes the policy perspective.

Regional and sectoral innovation systems

The Regional Innovation System (RIS) concept has gained increased attention, as the recognition of the regional dimension of innovation policies and the mobilization of regional assets are seen as important contributors to overall innovation performance. The strength of the NIS is based on the existence of a dynamic RIS, which provides a foundation for the competiveness of the overall economy. Governments have increasingly intervened at the regional level to advance innovation, amid awareness that many of the factors that determine the success of the firms, including both the economic environment and the relations with other innovation stakeholders, are defined at the regional level. Cluster-building policies, which are seen as advancing national competiveness, rely on and make a contribution to the strength of regional innovation systems. In addition, support to Regional Innovation Systems is often seen as an instrument to reduce the gap between the advanced and less developed regions of a country.

National Innovation Systems include various Sector Innovation Systems, which consider the factors that influence innovation at the sectoral level, including some factors that have a national significance and specific sectoral issues such as technological trajectories and connections between upstream and downstream suppliers. Given the specialization pattern of Kazakhstan, resource-based sectors, including oil and gas, minerals, and agriculture have a particular importance as a basis on which to develop further technological competencies.

The technology modernization of resource-based industries represents a potentially promising path for improved innovation performance, involving an effort to master the necessary technologies in an evolutionary fashion. This could start with large-scale commodity-based process innovations through medium-scale specialities (chemicals, biotechnology and nanotechnology) to small-scale customized materials and special applications.

The key to a successful National Innovation System rests on the creation of synergies between the various Sector and Regional Innovation Systems. As modern science is a multidisciplinary activity, knowledge-generation institutions have a major role to play in creating such synergies, as they facilitate exchanges between scientists and engineers of different disciplines. A well-articulated and well-functioning market structure and supportive government innovation policies are also critical factors contributing to the articulation of an effective National Innovation System.

2.2 Role of the government

Governments have an important role in fostering innovation. Innovation, like all economic activity, is contingent on a number of conditions that interact with the different elements of the NIS. In particular, these framework conditions define a suitable business environment that facilitates entrepreneurship and therefore innovation. Corporate law, labour law (ease of hiring and firing), tax law, administrative burden, transport and IT infrastructures, anti-corruption measures, among others, are all elements that define these framework conditions (Chapter 3), all of which are strongly influenced by the actions of the government.

More specific interventions may address the weaknesses of different actors of the National Innovation System but also the quality of the linkages between these various actors and the obstacles to the flow of knowledge across the system. The role of the government is increasingly seen as a facilitator of the activities of the private sector, providing enabling instruments and favourable conditions rather than making specific choices. In particular, the promotion of innovation by governments often focuses on seeking changes in the behaviour of innovation stakeholders. This is closely related with the creation of appropriate incentives in the innovation-promotion instruments deployed, in particular, where the provision of financial resources is concerned.

At the same time, a systemic view of innovation leads to an emphasis on the existing or potential interrelations between them, which are often the target of specific instruments. Governments are also expected to facilitate the exchange of information, provide guidance regarding future developments and help to overcome coordination problems in the private sector. Through a different range of interventions, they address systemic failures, i.e. those that undermine the efficiency of the national innovation system as a whole, including those that concern networks, institutions, infrastructure and the capabilities of firms.

An active innovation policy, including clear goals, programmes and the provision of financial resources, is seen as making an important contribution to innovation. However, this is a complex task that requires interventions in many different areas. While most policies would have horizontal characters (i.e. being applied to different firms and sectors), there is also space for vertical policies (concerning specific sectors). Given this complexity and the importance of systemic considerations, governments may delegate the oversight of the NIS to

a specified body. This Innovation Executive would be the executor of innovation policy on behalf of the government.

2.3 The NIS of Kazakhstan

This section presents an overview of the main building blocks of the National Innovation System of Kazakhstan. The functioning of the NIS is highly influenced by the framework conditions for innovation, including the features of the business environment, which are described in chapter 3.

The subsystem of business

As discussed in chapter 1, extractive industries (oil and gas and mineral sectors), account for almost two thirds of industrial production and play a critical role in the dynamics of the economy. This specialization has not been conducive to the development of a SME sector. However, a vibrant entrepreneurial sector, in particular, SMEs, is an essential element for innovation in modern economies (Box 1), as these small innovative firms are crucial for radical innovation.

Large companies with significant state participation have an important presence in the oil, gas and mineral sectors. Ongoing policy plans (Chapter 3) give these state companies, which are integrated in the Samruk-Kazyna holding, a prominent role in advancing innovation and increasing R&D spending. These plans depend partly on the ability of the state to impose performance requirements and create the appropriate incentives and corporate governance structures to ensure that these enterprises act as drivers of innovation.

Box 1. Entrepreneurship as a driver of innovation

The entrepreneur is the driving factor behind innovation. It is the entrepreneur, whether employed in an existing firm or in his/her own company, who brings a product to market or puts a process, marketing or organizational innovation to use. Entrepreneurs are "dreamers who do".[i] They are often obsessed by their idea or invention and they are willing to take personal risks in bringing it to the market or into use. Entrepreneurship flourishes in an entrepreneurial culture, but determined entrepreneurs will also succeed in less favourable environments. Although entrepreneurship requires certain personality traits, the 'technology' of entrepreneurship can also be learned, with many more people harbouring entrepreneurial talents than would first meet the eye.[ii] Fostering entrepreneurship is a necessary complement to other policies seeking to create job opportunities and sustainable prosperity. Where there is an entrepreneurial climate, entrepreneurs will emerge. Entrepreneurial education, from high school to university, can also encourage and contribute to the development of entrepreneurial talents.

[i] G. Pinchot (1985), Intrapreneuring: Why you don't have to leave the corporation to become an entrepreneur, New York, Harper & Row.
[ii] J. Lerner (2009), Boulevard of broken dreams – Why public efforts to boost entrepreneurship and venture capital have failed, and what to do about it, Princeton University Press.

Entrepreneurial activity in the country remains limited, although is being supported by dedicated organizations such as the Damu Entrepreneurship Development Fund, which offers

both financial and non-financial support to SMEs. New programmes under the State Programme for Accelerated Industrial Innovative Development 2010-2014 (SPAIID), such as Productivity-2020, have targeted the performance of firms. These are discussed in chapter 3.

A weak entrepreneurial culture (with the exception of the agricultural sector and a tradition of small family-owned business), is one of the challenges faced to create a dynamic innovation system in Kazakhstan, which is common not only in transition economies but also in many developed European countries.

In order to address this weakness, there are a number of possible areas of intervention:

- Establishment of an innovative culture. This would require massive investment in education, from primary and secondary schools to classes in entrepreneurship at universities and other tertiary education institutes. It would also require media attention on entrepreneurship, and high-profile national competitions, possibly including President Awards for Entrepreneurship;
- Support for "start-up" entrepreneurs by making provision for services and finance; development of the SME sector is essential for innovation to flourish; and
- Encouraging competition by "spinning out" service components of large enterprises in the oil and gas and mining sectors in order to establish separate, more specialized units.

A good example of the latter approach is the way in which the state has initiated new activities in the IT sector. "Zerde" currently acts as the holding of five IT enterprises, each with a distinct services portfolio. These enterprises will be eventually brought to the market, following a period of development under a common umbrella. Likewise, service departments of large enterprises could be turned into separate companies that can, after a period of learning, operate independently.

A free market in which companies compete for their survival is a precondition for innovation. Countries – like Kazakhstan – that go through an accelerated process of modernization often create state-owned and state-controlled enterprises in order to set certain developments in motion. This is expedient, but there should be a clear exit strategy, in order that competitive forces create continued incentives for innovation and economic dynamism. This could be done by privatizing entire state companies, or by bringing components of these companies to the market (e.g. maintenance services for a refinery).

The subsystem of R&D and education

Development and access to technology is an essential component of the innovation capabilities of an economy (Box 2). However, R&D spending is low in Kazakhstan, in both absolute and relative terms. Intramural expenditures on R&D amounted to only 0.16% of GDP in 2010 (Chapter 1), well below that of other large countries in the region (1.2% in Russia, and 1.1% in Ukraine).[8] However, the country has ambitious plans to increase its capabilities in this area, through further reforms of the research sector, increased budgetary allocations and the involvement of state-owned enterprises (Chapter 3).

[8] E.Z. Suleimenov (2011), The science of Kazakhstan in the scientific and technical development of the Commonwealth of Independent States, Scientific and Technical Information Processing, vol. 38, pp.132-142, Allerton Press Inc. See also chapter 4.

The Ministry of Education and Science oversees and funds 45 R&D institutes. In addition, the Ministry is responsible for the National Scientific and Technological Holding "Parasat", a state-owned enterprise grouping together institutes that formerly belonged to the Academy of Sciences. While the Academy of Sciences still exists in Kazakhstan, it no longer performs the traditional functions entrusted to it under the planned economy, which included a significant role in producing and coordinating scientific research in the country (Chapter 4).

In Parasat, institutes are steered towards the market, so that the bulk of revenues will eventually come from commercial sources. However, as the institutes retain a focus on fundamental research, government funding will remain necessary. The Science Fund, established in 2006, also falls under Parasat holding, and is an instrument for implementation of the State Programme for Development of Science and Technology.

Box 2. Science and technology in modern economies

The science and technology sector includes public R&D institutes (e.g. universities; research institutes associated with government departments; institutes of an academy of science, others offering public research services), and private R&D facilities (enterprises, private universities, research institutes). Globalization has created an international market for know-how in which research institutes compete on a global scale. Technology has become a commodity that companies trade among themselves, as well as with research institutes.[i] The use of imported technology also requires some domestic research capacities for effective absorption. Many innovations are spin offs of publicly-financed fundamental and applied research. Science policy seeks to expand our body of knowledge without immediate applications in mind. Fundamental research is a condition for breakthrough innovation. In many countries, the government (partly) finances applied research on behalf of industry, for instance through the Fraunhofer-Gesellschaft in Germany.

[i] H.W. Chesbrough (2003), Open innovation – the new imperative for creating and profiting from technology, Harvard Business School Press.

The former centrally-planned economies often kept a relatively rigid separation between research and education. The fact that fundamental research was concentrated at the Academy of Sciences left universities with almost a purely educational function. Current initiatives seek to promote research in the top Universities, including at the newly established Nazarbayev University in Astana, designed to play a flagship role in the S&T sector.

In addition to the institutes of the Ministry of Education and Science, some R&D is performed in the large, mainly state-owned firms. However, corporations largely depend on the research performed by various research institutes, which may fall under the competencies of other branch ministries. Altogether, there are some 400 R&D institutes in the public sector, employing around 10,000 scientists and engineers. These issues are discussed in greater detail in chapter 4.

There has been an important effort to improve education in Kazakhstan in recent years, as the overall education budget increased seven-fold between 1999 and 2009, reaching the highest

level of educational spending in the Central Asian region, in absolute terms.[9] A new Law on Education has been adopted, with implementation plans being drafted. This law envisages that all children will be taught Kazakh, Russian and English languages from the age of six.

Higher education institutions include universities, academies and institutes. Universities and other academic institutions can in principle define their own curricula, but this freedom is constrained by the need to seek approval and respect overall state educational standards. The number of institutions rose rapidly after non-state organizations were allowed in 1993, although it has declined since 2002, reaching around 140. Among these, nine institutions were granted the special status of "national universities" in recognition of their ability to carry out leading research and educational activities. The government aims to have at least two universities in the Shanghai list of 100 top universities and ensure the international accreditation of all universities.

Educational reforms have resulted in a reduction in the number of specialities being taught (more than 300), into a smaller number of broader programmes. Kazakhstan has also joined the EU's Bologna Process for harmonising university education. In line with this process, there will be bachelors and masters degrees and one doctorate degree (Chapter 4). Since 2011, a new major in innovation management has been available at some universities.

Some of the reforms being carried out at the top universities bring them closer to the concept of the so-called Third Generation Universities (Box 3). However, most universities in the country do not carry out significant research activities, so are not in a position to be considered 3GU.

Box 3. The Third Generation University

The concept of the Third Generation University (3GU) comprises nine characteristics:[i]

1. Fundamental research was and will be the core activity of the university;
2. Research is largely trans disciplinary or interdisciplinary, which is reflected in appropriate organizational forms;
3. 3GUs are network-based universities, collaborating with industry, private research and development (R&D), financiers, professional service providers and other universities via their knowledge-exchange systems;
4. 3GUs operate in an internationally competitive market. They actively compete for the best academics, students and research contracts from industry;
5. 3GUs are two-track universities. While they generally retain their functions as large scale universities, they create special facilities for the best and brightest students and academics;
6. 3GUs embrace the concepts of consilience and creativity as a driving force of similar importance to the rational scientific method;
7. 3GUs are cosmopolitan; they operate in an international setting with a wide and diverse range of staff and students. They employ the English language for all courses as the new *lingua franca*;

[9] R. Abazov and G. Ibrayeva (2009), Can Kazakhstan's education dodge reforms in face of the global economic meltdown?, January 2009 issue of the Central Asia – Caucasus Institute Analyst, John Hopkins University.

Box 3. The Third Generation University *(continued)*

8. Exploitation of know-how becomes the third university objective, with universities viewed as the cradle of new entrepreneurial activity in addition to their traditional tasks of research and education; and
9. 3GUs will be financed by output as opposed to input financing. Input financing concerns the creation of capacity, which is then combined with an appropriate inspection mechanism. Output financing means that research grants are tendered; any university can participate and only the best tenders will succeed. State financing will no longer be direct, with state funds transferred through independent institutions that finance research and education on the basis of competitive tendering.

[1] J.G. Wissema (2009), Towards the Third Generation University, Edward Elgar Publishers, London.

The Nazarbayev University is an impressive project with significant potential implications for the development of the country. This is a brand new facility built on 100 hectares of land just outside the city of Astana on the left bank; with an initial investment of US$2 billion.[10] The university was founded in 2010, and there are currently 970 students. All teaching and communication is in English. The special status of this university is recognized by the law. The Nazarbayev Foundation (an endowment) has been set up to ensure the financing of the university. The Nazarbayev Intellectual Schools are 20 English-language, elite secondary schools that are to feed into the university. Entry to the schools as well as to the university is by selection, with students being selected by University College London. Tuition will be provided free of charge, at least for the first five to six years. The intention is to eventually have a partly international student body of 5,000 students.

The university has three teaching faculties: the Engineering School (with University College London), the School for Science and Technology (with Columbia University), and the Humanitarian School (with Wisconsin-Madison University). In 2012, it will open a joint business school with Duke University. There will be four centres for research: Energy, Life Sciences, (including a Medical School), an Interdisciplinary Instrumental centre and Education.

Equally international is the Kazakhstan-British Technical University (KBTU) in Almaty. Established in 2001, the university now has 2,000 undergraduate, 170 graduate and 27 doctoral students. It has full-scale science faculties and its International School of Economics and Political Science, established in 2005, is linked to the London School of Economics and Political Science. The university works in close cooperation with enterprises. For the educational programmes there is much cooperation with foreign universities. All teaching is in English. While it will take some time to create universities of high international standards, the scale of initial investment and policy commitment is promising.

Other high-level universities are Al Farabi Kazakh National University, Gumilev Eurasian National University, Karaganda State University and the Kazakhstan National Technological University.

[10] R. Abazov (2011), Kazakhstan takes universities global, April 2011 issue of the Central Asia – Caucasus Institute Analyst, John Hopkins University.

Connectivity between the various elements of the NIS is one of its weaknesses and this is an area where universities could make an important contribution. However, most technology parks and incubators in Kazakhstan are not located in close proximity to the top universities, reducing the potential for synergies (Chapter 6). The reforms of the Science Law have also created more clear foundations for output as opposed to input financing, although it is not yet clear how this would translate in practice (Chapter 4). Any rapid changes in this regard could be counterproductive, given the pace of transformations in higher education policy.

Research remains largely based in traditional faculties with limited inter-disciplinary activities. There is not yet a fully developed "two-track" university that retains the functions of a large university while also catering for the brightest and best.

The efforts to develop domestic educational capabilities and meet high international standards have been accompanied by initiatives relying on international exchanges to support the upgrade of skills. The Bolashak programme finances studies abroad of potentially successful students. The programme was created in 1993 and has awarded more than 3,500 scholarships to date. Students are sent to top universities in 25 countries in Europe, North America and Asia. Virtually all graduates of the programme stay in Kazakhstan. The Bolashak programme is making an important contribution to the upgrading of skills and insertion in global networks of knowledge.

The innovation infrastructure: the subsystem of intermediaries

There is a wide gap between the worlds of business and science in most countries.[11] In Kazakhstan, the problem has been particularly acute given the legacy of the planned economy, where there was a rather strict separation between the research sector and companies. This legacy led to the lack of connectivity between these key building blocks of the National Innovation System, which was compounded by the lack of institutional development to facilitate these linkages.

In many countries, services have been developed to strengthen contacts between the science and technology sector and business. Such transfer agents play an essential role in the diffusion of innovation.[12] The underdevelopment of this institutional sector in Kazakhstan has been one of the factors that explain the poor connectivity between the different elements of the NIS.

The authorities initiated an early push to develop these intermediaries, setting the foundations of an innovation infrastructure. These include a number of science parks and incubators, and technology transfer centres, which have been developed under some universities and the National Innovation Fund. In agriculture, there is an extension service for the agricultural sector which advises farmers on the use of genetic material, fertilizers, pesticides, equipment and other tools. Intermediaries between the S&T sector and business include also those developed with the networks of ministries, their corresponding sector organizations and large industries.

However, this important institutional sector remains undeveloped and the functioning of innovation intermediaries has revealed so far a number of shortcomings, including little

[11] W. Molle and J. Djarova (2009), Introduction in: W. Molle and J. Djarova (eds), Enhancing the effectiveness of innovation, Edward Elgar Publishers.
[12] E. M. Rogers (2003), The diffusion of innovations, Simon & Schuster International; 5th revised edition.

visibility, lack of skilled staff and insufficient provision of resources. These problems have resulted in weak connectivity with the surrounding environment and a poor record in the generation of truly innovative companies.

Innovation is greatly enhanced by the availability of professional services, such as market research, auditing and financial services and legal advice. Sometimes, these services are provided by innovation support institutions such as incubators and technoparks and other innovation intermediaries. The lack of development of these professional services is also a reflection of the constraining effects of weak demand on innovation. Government programmes focussing on support to firms, such as Productivity-2020 or the non-financial component of the entrepreneurship programmes run by DAMU, are encouraging the development of these services, which are being offered to the firms supported in the programmes. Innovation intermediaries and services are discussed in more detail in chapters 5 and 6.

2.4 The conduct of innovation policy

Innovation policy plays an important role in Kazakhstan's economic strategy. There is a clearly stated policy objective to move from an extraction-based to a knowledge-based economy, using earnings from the oil, gas and mineral sector to facilitate diversification and modernization.

Innovation initiatives receive strong political support. Large state companies have been instructed by the highest level of government to report on their activities in this area. District governors likewise must also report on progress made in innovation activities at the regional level. This requirement reflects increased interest in the creation of Regional Innovation Systems, complementing the emphasis on sector-based innovation.

The main programmatic document is the State Programme for Accelerated Industrial Innovative Development (SPAIID) 2010-2014, part of the Development Strategy 2020 that was approved in 2010 and covers the period 2010-2020. In addition to the SPAIID, the Development Strategy 2020 includes a Health Programme, Education Programme, Language Programme and others. SPAIID has 13 sectoral programmes and ten functional programmes. It builds on earlier measures and includes regional development plans and sector plans.

The SPAIID strategic objectives are the:

- Modernization of the commodity-based industries;
- Creation of the conditions for future growth; and
- Development of labour intensive and "new high-performance" industries.

Targets include:

- GDP growth of 50% between 2008 and 2020;
- An increase in labour productivity in manufacturing of 50%, and in other sectors by 100%;
- An increase in non-oil and gas exports of 40%;
- Reduction in the energy intensity of GDP by 10%; and
- Increase in the number of innovation-active enterprises by 10%.

The SPAIID includes mechanisms for its implementation at the regional level, which are developed into the Business Roadmap 2020 programme.

In line with the SPAIID, the plan Productivity 2020 (launched in 2011) provides opportunities for long-term financing for the lease of modern equipment, innovation grants and supports the hiring of consultants to increase the capabilities of firms. The key implementation roles correspond to the Development Bank of Kazakhstan (long-term financing), and the National Innovation Fund (innovation grants and funding for necessary expertise). Kazakhstan's Institute for the Development of Industry is the operator of most components of this programme.

In accordance with the provisions of the SPAIID, the Ministry of Industry and New Technologies is in charge of elaborating the Intersectoral Plan for Scientific-Technological Development until 2020. The priorities identified in this plan are reflected in the criteria used for access to different mechanisms of support (grants, consulting services, business incubation). The State Programme for the Development of Science for 2007-2012 defines overall directions for scientific activity in the country.

2.5 The market environment for innovation policy

A major challenge for innovation policies is Kazakhstan is the weak domestic demand for innovation, which reflects the structural characteristics of the economy and the dominance of extractive industries. A relatively low degree of competition and the specialization in traditional sectors which are subject to low rates of technological change helps to explain the lack of interest of many companies in innovation.

Besides, most innovations in Kazakhstan are in machinery and other business-to-business markets while innovation in consumer products is relatively low, given the lack of sophistication of consumer demand, the limited size of the market and the reliance on imports.

This low demand is compounded by the mismatch with domestic capabilities, which are often unable to attend the needs of the export-oriented, resource-based sector. The most dynamic sectors often cover their technological needs abroad, as the underdeveloped domestic research sector is unable to meet their requirements.

The presence of these structural challenges emphasizes the relevance of the NIS concept to guide policy decisions. While in early years, innovation policies in Kazakhstan focused on the creation of different innovation-support institutions, the authorities have become increasingly aware that institution-building and supply-side interventions are insufficient and need to be complemented by demand-side instruments to create positive dynamics. Procurement policies, standards, tax incentives and coordination arrangements targeting firms can be used to encourage the demand for innovation (Chapters 3 and 5). International economic integration also provides opportunities for raising the demand for innovation, including in the context of specific international arrangements for collaboration (Chapter 8). However, these policies are still in their infancy and the development of a market for innovation is an organic process that will take time.

2.6 Coordination and governance

Innovation policies in Kazakhstan involve a large number of institutions and organizations. These include the relevant ministries, and the state-owned enterprises and institutions that are linked to them. Some of these institutions are linked through hierarchical relations, which eliminate the need for horizontal mechanisms of coordination. In some cases, the responsibility for the implementation of different components of state programmes is allocated to different organizations. This implies that, while coordination takes place at the programme design level, the mechanisms for ensuring coordination during implementation are not fully ensured.

However, there has been a growing emphasis on horizontal coordination and this is likely to become more relevant, as plans to enhance the regional scope of innovation policies materialize. The new Law on State Support to Industrial Innovative Activity, adopted in January 2012, also envisages reinforced mechanisms of coordination.

The Ministry of Industry and New Technologies (MINT) has key functional responsibilities for innovation issues in the country. It was appointed the coordinator of the State Programme for Accelerated Industrial Innovative Development of Kazakhstan for 2010-2014. The MINT functions in the area of innovation, including making proposals to the government and monitoring the enforcement of legislation on state support for innovation.

The Ministry of Education and Science has also important responsibilities in innovation-related areas, including coordination of basic and applied research, the development of the research infrastructure and expert assessment of scientific projects financed by the state budget. This dual structure calls for targeted coordination efforts in the design and implementation of state policy in the area of innovation and technological development.
Since 1999, the country's R&D efforts have been coordinated by the Higher Scientific and Technical Committee (HSTC), headed by the Prime Minister, with representatives from the Ministry of Education and Science, which also acts as the secretariat, and other relevant ministries. The role of the HSTC is limited to overall R&D priorities and it is not concerned with other aspects of innovation policies.

The Programme for Innovative Development and Support for Technological Modernization for 2010-2014 states that a Council on Technology Policy, headed by the Prime Minister will include representatives of ministries, business and high-level foreign experts. Non-governmental organizations should account for no less than two thirds of the members of the Council, which is tasked with the identification of the main directions of state policy on industrial innovation, including the updating of the Intersectoral Plan for Scientific-Technological Development of Kazakhstan until 2020 and the coordination of activities under it. A number of Technological Sector Councils will be created under this high-level structure. The Council on Technological Policy will be serviced by the MINT, with the new National Agency for Technological Development fulfilling all the related operational functions under the MINT.

A recent report on innovation policy by a team from Columbia University,[13] New York, included some interesting recommendations. One recommendation was the establishment of a *National Innovation Council* (NIC) to set priorities for funding and research, with representatives of the public and private sectors and an emphasis on the needs of SMEs. Such a Council could benefit from the ongoing work on technology foresight. Budgetary provisions should be made in accordance with the tasks allocated, in order to reduce red tape and administrative burden. These may include responsibilities for research funding but also a wider remit on defining the strategic directions for innovation in the country, including also non-technological aspects. The functions attributed to the NIC may require an adjustment of overlapping responsibilities in other institutions. The NIC could have a secretariat operating under the highest authority. This would define the orientation of innovation policy which, after approval by the relevant ministers and parliament, would be implemented by the Innovation Executive.

Within a National Innovation System, the Innovation Executive implements innovation policy, coordinates high-level strategy and periodically assesses NIS effectiveness. The role of the National Innovation Fund (NIF) (Box 4), under the MINT, comes closest to that of the Innovation Executive, although its competencies are more limited.

The National Innovation Fund has general oversight of innovation activities in Kazakhstan, but much of the coordination of the Sector Innovation Systems remain with the respective ministries and state-owned companies that implement their policies. This is to some extent unavoidable: with an economic strategy based on the development of specific sectors, the relevant responsibilities lie with respective ministries. At the same time, this approach hampers cooperation between sectors. The transformation of the NIF into the National Agency for Technological Development (NATD) could present an opportunity to make this agency the Innovation Executive, which could be explicitly charged with coordination of the Sector Innovation Systems, developing the provisions of the new Law on State Support to Industrial Innovative Activity in this area.

As the NATD will be faced with a cross-sectoral task, it is important that the Agency is granted sufficient operational independence to perform its functions and is placed in a position within the organizational structure that would enable collaboration with the secretariat of the National Innovation Council. The NATD could prepare annually, on behalf of the National Innovation Council, a survey of the 'state of national innovation'. This strategic report should contain suggested objectives, strength/weakness analysis, technology foresight, identified bottlenecks and proposed remedies. The work of the NATD could make an important contribution to overcome coordination weakness in the implementation of policy programmes, thus increasing the effectiveness of public interventions.

The Law on State Support to Industrial Innovative Activity, adopted in January 2012, incorporated a number of measures seeking to improve the coordination of interventions in the area of innovation, which are in line with the suggestions made here. It established the figure of a central executive body in the area of industrial-innovation polices, with extensive coordination powers. This body is tasked with the preparation of an annual report assessing the effectiveness of the measures of state support to innovation. The law envisages also two

[13] R. Abazov et al (2011), Stimulating Industrial Innovation in Kazakhstan, Report, prepared for the National Innovation Fund, School of International and Public Affairs, Department of Economic and Political Development, Columbia University, New York, May 2011.

coordinating bodies under the government of Kazakhstan: the Coordinating Council on Accelerated Industrial-Innovative Development and the Council on Technology Policy. The details on the composition of these structures, the rules governing their work and the interaction with other coordinating structures are being elaborated.

Box 4. The National Innovation Fund

The National Innovation Fund (NIF) was established in 2003 as a 100% state owned entity. It plays a significant role in the implementation of the national innovation policy, including both infrastructure development and initiatives under different programmes.

Currently, the NIF has three missions:

- Infrastructure support;
- Knowledge generation (financial support to promising R&D projects); and
- Financing (innovation grants, venture capital).

Tasks include:

- Public awareness programmes, targeting various constituencies. This programme includes the publication of the journal 50KZ (the title reflecting the objective to be one of the 50 most competitive countries globally) and the organization of the annual Innovation Congress;
- Attracting foreign scientists to Kazakhstan;
- Managing a centre for technology transfer and two special centres for technology transfer to and from France and Korea. The NIF will prepare a website for demand of foreign technology;
- Introducing new 'management techniques' (quality control);
- Operating incubators; and
- Technology foresight project aiming to identify priority future technologies, with reports feeding in to the Commission on Science and Technology that sets priorities for fundamental research.

The NIF is due to be transformed into a National Agency of Technology Development (NATD). It will be assigned new tasks, in particular regarding technology transfer, commercialization of science, financing of innovative projects, grant funding of industrial projects, the administration of these projects, and development of technopark policy. The transition from the NIF to NATD was still in progress at the time of writing, with the final outcome as yet unclear.

2.7 Recommendations

Kazakhstan has put a growing emphasis on the promotion of innovation as a driver of economic development and diversification. These initiatives have targeted the improvement of some components of the National Innovation System (NIS), in particular, the creation of public innovation-support institutions. Increasingly, other policy targets have received attention, including improvement in performance by firms, regional aspects or the demand for innovation. However, despite the awareness expressed in some policy documents, public interventions have been focused mainly on the institutional build-up, while issues regarding linkages and the connectivity between various components of the NIS are still relatively neglected. The new Law on State Support to Industrial Innovative Activity, adopted in early 2012, opens new policy possibilities and reflects an increased understanding of the need to encourage the demand for innovation. However, the effectiveness of public intervention is also often limited by the underdevelopment of innovation services and market infrastructure. There is a need to develop further the systemic view of the NIS emphasizing linkages and going beyond the primary focus on technological forms of innovation.

Recommendation 2.1

The authorities need to undertake concentrated further efforts to develop a fully-fledged, modern National Innovation System, on the basis of a systemic assessment of linkages and connectivity of the system and the market context in which innovation stakeholders operate. These initiatives could build on the possibilities opened by the new Law on State Support for Industrial Innovative Activity. Systemic policy efforts should pay particular attention to:

- *Strengthening the connectivity between various components of the NIS through horizontal instruments that facilitate linkages, including public support to coordination and risk-sharing mechanisms;*
- *Policy instruments that can increase the demand for innovation;*
- *The development and upgrading of a market infrastructure supporting the innovation process, including appropriate services to facilitate innovation activities;*
- *Advancing non-technological forms of innovation, in particular in the services sector, which is critical for the overall performance of the economy;*
- *Promoting an innovation culture and facilitating access to information by innovation stakeholders to support coordination and the identification of opportunities; and*
- *Wide-ranging awareness-raising in the areas of innovation and entrepreneurial investment through the facilitation of access to specialized educational opportunities.*

A mature and thriving domestic private sector is a necessary condition for an innovative economy. Facilitating market entry by innovative entrepreneurs and simplifying their relations with the state is one of the key factors in this area. Entrepreneurs in Kazakhstan, as in many other countries, are often confronted with a large body of legislation and regulation that severely hampers their innovation efforts. Significant progress has been achieved in recent years in improving the regulatory environment for private business, as reflected in improved international ratings. Administrative barriers have received particular policy attention and this has been translated into monitoring mechanisms. However, continued progress in reducing the regulatory burden and improving the market environment in which SMEs operate would increase the number of SMEs and facilitate the growth of existing ones.

Recommendation 2.2

The authorities should continue their efforts to reduce the regulatory burden on SMEs, which remain a priority policy goal. Steps to achieve this could include the following:

- *Conduct, in consultation with SMEs, annual surveys of factors that hamper innovation and entrepreneurship with a special focus on the regulatory and administrative burden and its impact on the development of SMEs;*
- *Identify twelve key recommendations for improvement based on each annual survey, to be implemented within one year (one per month);*
- *Recommendations of the annual surveys may also include the improvement of the overall market environment and the conditions for fair competition;*
- *Particular attention both in surveys and in follow-up recommendations should be paid to the challenges faced by innovative start-ups and the innovation activity of SMEs, differentiating between those challenges that have a regulatory character and others that require intervention in other areas, such as access to finance or education; and*
- *The assessment and recommendations to reduce administrative barriers and other obstacles to business development should result from a dialogue between the government and the business community, with the participation of relevant experts.*

Kazakhstan's science and technology (S&T) sector offers a scattered landscape dominated by research institutes which are mainly inherited from the past and still mostly funded by the state. At the same time, universities in general have not yet become the leading generators of knowledge resulting in innovation as is typical in mature industrialized countries. Technoparks and business incubators do not always benefit from close association with universities. Increased exposure to market demands and competition and enhanced linkages with other innovation stakeholders would improve the efficiency of all S&T and academic organizations. Focused policies could develop the potential of the top universities to become hubs of innovation, resulting in closer links with new and existing enterprises, better know-how exchange with international enterprises and improved international projection.

Recommendation 2.3

The role of universities and other knowledge-generating organizations in the National Innovation System should be strengthened by boosting their capacity to transform ideas into innovation projects and reinforcing links with other innovation stakeholders. The authorities should consider:

- *The preparation of practical plans to increase further the contribution to innovation made by top research universities, based on a detailed assessment of existing constraints and possibilities;*
- *The possible merging of some existing research institutes with universities, as a result of a rating exercise that would take into account potential and existing synergies, complementarities between research programmes and access to human and material resources;*
- *The organization of centres of scientific and educational excellence in leading research universities, which are appropriately equipped for the creation of high-level technology and encourage the involvement of students;*

- *Introducing targeted measures for the encouragement of entrepreneurial activity in research and education organizations. This could include the introduction of entrepreneurship courses in universities, support to spin-offs and other academic ventures, and, when suitable, the creation of associated technoparks;*
- *Support to the creation and strengthening of technology transfer and industrial liaison offices in research universities to sell know-how and establish joint programmes with enterprises; and*
- *Ensuring that appropriate expertise is available for the evaluation of projects and programmes on the basis of a peer review system that results in objective, qualified and transparent assessments.*

Kazakhstan has set up different institutions and has developed many programmes aimed at encouraging innovation and modernization. While these are valuable initiatives, their proliferation has stressed the need for coordination across policy actions and institutions. The complexity of innovation also requires the involvement of different innovation stakeholders, including those in the private sector, to develop a vision of future developments. Kazakhstan is organized along vertical (state enterprises report to ministries that also fund R&D, design bureaux and intermediaries), horizontal (organizations like the National Innovation Fund and DAMU that support enterprises of all sectors), and regional axes. A systemic view of innovation that considers the interaction between various components of the NIS should lead to a reinforcement of horizontal mechanisms of coordination, which remain relatively weak. The new Law on State Support to Industrial Innovative Activity, adopted in early 2012, envisages new mechanisms of coordination that should be used fully.

Recommendation 2.4

Undertake steps to strengthen the horizontal axis of the innovation policy mix with a view to facilitating the coordination of innovation policies and ensuring their effective design and implementation. To this effect the authorities could consider:

- *Creating a National Innovation Council (NIC), where representatives of the business sector and the relevant ministries would be equally represented. The NIC could act as a central advisor of the government on innovation policy, with a wide remit that would include also non-technological aspects and the overall framework conditions for innovation. The NIC should report to the highest level of government to ensure effective oversight of the NIS;*
- *Empowering the new National Agency for Technological Development (NATD) with the functions to act as the leading executor of innovation policy (the Innovation Executive). The Agency should be entrusted with the coordination of the implementation of programmes in different innovation-related areas and given sufficient operational freedom to achieve policy goals in an efficient manner; and*
- *Undertaking a gradual shift in the innovation policy mix of widening and broadening the scope of horizontal policies and instruments while at the same time reducing the coverage of vertical ones. This shift should be accompanied by a corresponding redeployment of the public financial resources underpinning the two types of interventions.*

Chapter 3

FRAMEWORK CONDITIONS, INNOVATION POLICIES AND INSTRUMENTS

This chapter provides an overview of the conditions that support innovation, including the more general features of the business environment. It introduces the strategies and programmes developed to promote innovation and the range of instruments used, including the institutions being established at the regional level. The chapter evaluates the policy initiatives undertaken in terms of their relevance and effectiveness, given the overall framework conditions for innovation in the country. On the basis of this assessment, a number of policy recommendations are formulated.

3.1 Framework conditions for innovation

The general business environment

The innovation support system should be considered in the context of the general conditions for economic activity in the country and, in particular, those factors with a special influence on innovation, such as the business environment, fair competition and entrepreneurship.

Legal and administrative reforms have improved the business environment in recent years and facilitated entrepreneurial activity. In particular, barriers to business start-ups have been reduced by lowering minimum capital requirements and other formal demands to set up a company. Investor protection has been strengthened by requiring greater corporate disclosure in companies' annual reports. There have also been reforms to modernize customs, including implementation of a risk management system and improvements in customs administration.

According to the World Bank's Ease of Doing Business Index, Kazakhstan's ranking improved 17 places in 2011 compared with 2009. It currently ranks 47th among 183 economies. Other surveys, such as the "Kazakhstan investment attractiveness survey", carried out by Ernst & Young and focusing on foreign investor perceptions, highlighted significant progress but also areas for improvement, including infrastructure, education and enhanced training to support the needs of an innovative economy, as well as taxation and financial aspects related to entrepreneurial activity.

While the level of FDI is relatively high (Chapter 1), particularly in comparison with other Central Asian countries, there is limited evidence of significant spillover effects, including knowledge transfer, training in new technologies or formation of start-ups linked to this foreign activity.

Competition and innovation

Competitive markets are an important ingredient of favourable framework conditions for innovation, creating the right set of incentives for companies to introduce new products and processes in order to retain or advance their position in the marketplace. Competition issues are particularly relevant for Kazakhstan, with state-owned companies grouped under the

Samruk-Kazyna and other large firms holding dominant positions in the economy. In contrast, the SME sector is marked by an almost atomistic market structure and more challenging operating conditions that constrain the growth of companies. Medium-sized firms are almost non-existent in Kazakhstan. Increased competition would trigger more innovative efforts in industries currently dominated by a few large enterprises. When there is a fragmented market structure, as in the SME sector, such beneficial impact of competition is unlikely.

Measures should therefore be taken to increase competition in sectors with monopolistic or oligopolistic market structures that are neither exposed to import competition nor are competitive on international markets. This could be achieved by a legal framework allowing competition authorities to deal effectively with significant market power, through measures including market surveillance, remedying unfair business practices and the break-up of anti-competitive structures, as well as by stimulating increased competition in the form of market entry by Kazakhstan's SMEs.

Entrepreneurship and innovation

Entrepreneurship is essential for economic dynamism, allowing engagement with foreign investors and partnerships that help to move up the value chain. Despite government efforts, there is not yet a vibrant entrepreneurial culture. Entrepreneurship in Kazakhstan rarely relates to new technologies and innovative companies, reflecting the structure of production and demand and the low requirement for innovation that results from the existing specialization structure.

Entrepreneurial spirit is still in an embryonic state, with economic development largely dependent on state-owned conglomerates and foreign investors as sources of wealth, employment opportunities and technology generation and demand. This results in scarce opportunities for new business creation and spillovers. Plans for increased spending on innovation by large state companies may provide new impetus, including the decision to spend 10% of Samruk-Kazyna's net profit on innovation-related projects. This would amount to a significant increase in current spending on innovation.

A major challenge faced by government innovation policies is how to encourage the demand for innovation, so that opportunities are created that can be seized by entrepreneurs. Standards can play an important role, provided they allow a degree of freedom over technological solutions and their implementation, unlike the previous GOST standards prevalent in Soviet times. Standards can also be used not only to encourage the demand for innovation but also to facilitate the commercialization of research when applied to R&D processes (Box 5).

The creation of companies through the commercialization of publicly-owned R&D results from universities or research institutes has been facilitated by the new Law on Science, which introduces some improvements regarding the ownership of research results. However, this issue remains open, in the absence of further practical guidelines, and requires clarification (Chapters 4 and 5).

Low levels of entrepreneurship contribute to explain the observed low number of innovative projects and technologies seeking finance (Chapter 7). An attempt to increase the demand for innovation would lead to a corresponding increase in the demand for qualified labour, including managerial capacities.

Box 5. The use of standardization to stimulate innovation activity: the case of Germany

Technological systems, especially in innovative sectors, are developing so rapidly that the conventional standardization process cannot keep pace with such a rapid technological evolution.

The German Institute for Standardization (DIN) introduced R&D phase standardization to be applied to the innovative sectors as a complementary instrument to the traditional standardization. R&D phase standardization activities commence early on in the process of technical development and become an integral part of technological innovation.

The new "High-Tech Strategy for Germany", approved by the government in August 2006, acknowledges the importance of giving standardization early consideration in the research process and when translating research findings into high-tech products and services. Norms and standards are used as instruments for quickly and efficiently turning research findings and innovative technical developments into products that can be placed on the market.

As part of this seamless new innovation policy, the Federal Ministry for Economics and Technology initiated in mid-2006 the long-term project Innovation with Norms and Standards (INS). This project is coordinated and conducted by the German Institute for Standardization (DIN). Since 2006, in the INS programme, studies have been carried out to identify innovative technological fields needing standardization.
The aim for this project is to promote awareness in German industry of the role played by standards and specifications as an innovation-relevant factor that is important for market success while at the same time enhancing and fortifying the transfer of know-how and technology from research into standardization.

3.2 Human capital

The supply of a highly skilled workforce and the acceptance of skilled foreign workers who can contribute to economic development and transfer skills to local personnel is an important dimension of innovative performance.

According to Ernst & Young's investor opinion survey, the workers in Kazakhstan receive a basic technical education but graduates lack practical skills and knowledge of modern technologies and equipment, which is usually gained only through vocational technical training schemes. As a result, there is a shortage of skilled labour in technical and engineering areas. Internet access is not high, with users estimated to represent only 41% of the population.

Bolashak, a state-funded scholarship programme, is an example of the state's long-term vision to improve skills and meet labour market needs. The programme supports the graduate studies of talented young nationals in top world universities. Programme graduates typically progress to high-level managerial positions in the public sector and state-owned organizations. Many of them work in the private sector (almost 60%), but the option of becoming an entrepreneur is not generally perceived as an attractive one. The educational priorities under Bolashak

could be broadened to ensure that an appropriate proportion of technical and engineering professions are included as well as scholarships for lower level management and technicians. This needs to be considered in the context of the university and educational reforms that are currently under way (Chapter 4).

Current developments point in this direction. There has been a gradual increase in the number of students of technical subjects in 2006-2010. The decline in 2011 was the result of the new focus of the programme on postgraduate education. In addition, the programme envisages also the provision of short-term courses for staff from higher education institutions.

3.3 Innovation strategy and programmes

Main programmes

The government of the Republic of Kazakhstan has ambitious programmes targeting economic diversification, including the promotion of innovation. The focus of these programmes has evolved, introducing new instruments and targets, to address the range of problems that constrain knowledge-based development in the country, including:

- The low knowledge generation capacity and the dependence on foreign technologies and know-how;
- The need to raise domestic skills to match the demands of large companies and foreign investors;
- The mismatch between technology supply and demand in the national innovation system; and
- Limited entrepreneurial activities, entrepreneurship skills and culture.

The "Strategy 2020" sets the goal for Kazakhstan to become one of the 50 most competitive economies in the world by that year. The Strategy for Industrial and Innovative Development 2003-2015 was adopted to "…ensure stable development of the country on the basis of diversification and modernization and the creation of conditions for production of competitive products and export growth…"

This Strategy targets the following:

- Average annual growth of manufacturing industries of around 8%; trebling of labour productivity between 2000 and 2015 and a twofold reduction in the energy-intensity of GDP;
- The creation of a business-friendly environment and encouragement of the private sector;
- Introduction of incentives to establish science-intensive high-tech export-oriented enterprises;
- Diversification of Kazakhstan's export capacity, with a shift towards higher value added products that meet international quality standards; and
- Increased integration into the regional and global economy, with participation in international innovation processes.

The implementation of the strategy is divided into three stages:

- *The first stage (2003-2005)* introduced changes in the legal framework and sector development programmes. A number of development institutions were established to ensure public control over programme implementation and provide the necessary resources (Chapter 7);
- *The second stage (2006-2010)* involved analysis of private sector initiatives, promotion of investment opportunities, staff training, construction and reconstruction of various facilities; and
- *The third stage (2011-2015)* will introduce further organizational measures and carry out additional activities to increase the competitiveness of manufactured products.

The total cost of the activities envisaged under the Strategy amounts to KZT 139 billion, including KZT 77 billion from the central budget and KZT 2 billion from regional budgets. Private domestic and foreign investments are expected to contribute not less than KZT 60 billion. The strategy targets an increase in the share of knowledge-intensive and high-tech manufacturing in GDP from 0.1% in 2000 to 1.4% in 2015.

State Programme for Accelerated Industrial Innovative Development 2010-2014

An ambitious new programme was introduced in 2009, the "State Programme for Accelerated Industrial Innovative Development 2010-2014" (SPAIID), which included a set of concrete tasks and provisions for the financial resources to implement them.

The programme identified a number of priority sectors for support, emphasizing the need to modernize existing enterprises and facilitate the creation of new, highly-performing firms. The development of innovative activities is expected to have a positive impact on the productivity of traditional sectors. The programme also seeks to improve the framework conditions for innovation through infrastructure investments, including telecommunications. The ultimate goal is to support the export orientation of firms and increase competitiveness through productivity growth and innovation. Around KZT 6.5 trillion (US$44 billion) will be spent to achieve these goals within the period covered by the programme, including financing from non-state sources.

The SPAIID was accompanied by a large number of subprogrammes targeting specific sectors (oil and gas, metallurgy, the chemical industry, nuclear energy, machine-building, construction, agriculture, light industry, tourism, space, transport, ICT and the extractive industries). Other subprogrammes address aspects of the wider framework conditions of relevance to the SPAIID, including labour market regulations, competition and tariff policies. Thus, both horizontal and vertical subprogrammes are being deployed to achieve the objectives of the SPAIID, namely an increase in productivity. Within the overall SPAIID, the main emphasis is not on pure innovation, understood as the exploitation of novel ideas, but on modernization. Innovation is seen as becoming more relevant at a later stage, when previous policy efforts result in improved production and technological capacities.

Programme for the Development of Innovation and Support for Technological Modernization for 2010-2014

The Programme for the Development of Innovation and Support for Technological Modernization for 2010-2014 (PDISTM) was also launched as part of the actions to support the SPAIID. The programme recognizes the need to stimulate demand for new technologies

and promote the diffusion of innovation, while building capacities for research, technological foresight and planning. It also targets better coordination of the various components of the National Innovation System, including legal reforms and the introduction of new institutions (Chapter 2). The envisaged total cost of the programme is KZT 60 billion (around US$400 billion), of which KZT 36 billion (around US$240 billion) will be directly financed from the state budget.

Table 8. Key targets of the Programme for the Development of Innovation and Support for Technological Modernization, 2010-2014

Target indicators	Unit	2011	2012	2013	2014
Number of internationally recognized patents (30 by 2015)	Units	5	5	10	10
Number of new technologies and experimental developments (R&D) in 2015 (200 and 160, respectively)	Units	20 20	50 30	60 50	70 60
Industry centres (2)	Units			1	1
Design bureaux (3)	Units	1	1	1	
Technoparks (4)	Units	1	1	1	1
Centres of commercialization (70)	Units	9	15	21	25
Innovative activity of enterprises in 2015 (10%)	%	4.8	6.8	8.8	10
High technological productions in partnership with large foreign companies	Units	-	1	-	1
Government expenditure on science and innovation as a % of GDP	%	0.4	0.6	0.8	1.0
Share of innovative products in total GDP	%	0.6	0.7	0.85	1.0
Expenditures on technological innovation in industry	Million KZT	45,000	60,000	75,000	98,000
Increasing the number of engineers and technicians per 100,000 of the population by 2011	%	Base	1.0	2.0	5.0

The PDISTM seeks, in particular, to increase demand for innovation through tax incentives (Chapter 7), state procurement and technological agreements with domestic and foreign companies. The Programme aims to reinforce the existing innovation support infrastructure, including the creation of a network of specialized design bureaux to aggregate demand and support machine-building companies in meeting this demand. An important emphasis is being placed on the development of capacities at the firm level to enhance the development and absorption of new technologies.

R&D strategy and programmes

In 2007, the Government of the Republic of Kazakhstan adopted a new State Programme on Science Development in Kazakhstan for 2007-2012. The main goals of the programme are:

Modernization of the research, technology and development (RTD) management system.

- Modernization of the RTD infrastructure;

- Training of highly qualified science and engineering staff and encouragement of research activity;
- Increasing funding of scientific research and experimental design activities, including various tools to attract private investment;
- Modernization of the legal normative base for science and technology activities; and
- Creation of an environment favourable to the development of science.

This programme includes 15 specific science and technology (S&T) subprogrammes, which rely mainly on government funding. One of the aims is to establish five national laboratories, which will be involved in complete technology cycles, from basic research to the creation of new, competitive products. Other support for the development of the science and technology infrastructure is also envisaged.

In addition, the Ministry of Education and Science has developed six programmes of fundamental research. There are also five scientific and technical programmes:[14]

- *Nanotechnologies and new materials:* This programme targets the creation of new structural materials for solid-state electronics, machine building, power-intensive industries, the space industry and medicine;
- *Biotechnology:* Foodstuff, medicines, agriculture, ecology and engineering. The programme envisages the construction of a new scientific complex in Astana, the National Centre of Biotechnology of the Republic of Kazakhstan;
- *Technologies for hydrocarbon and mining-metallurgical sectors* and their associated services. The aim is to reduce domestic fuel use and increase production and exports of petrochemical products;
- *Nuclear technologies and renewable technologies of renewed power engineering;* and
- *Information and space technologies.*

Foresight

The identification of future opportunities, the application of existing scientific and technological achievements, strategies to exploit those technologies yet to be developed, and the need to develop relevant skills, are all often addressed through foresight activities. Such activities should not be limited to technological questions, but also incorporate entrepreneurial and business aspects.

In 2010, the National Innovation Fund, under the authority of the Ministry of Industry and New Technologies of Kazakhstan, initiated a foresight activity for Kazakhstan, with the support of the Korea Institute of Science and Technology Evaluation & Planning (KISTEP). In this exercise, technology "mega trends" were identified, as well as problems and demands that will impact on the development of Kazakhstan over the next decade. Information technology, transportation and infrastructure, renewable energy, biotechnology, medicine and nanotechnology were considered the most promising sectors. The outcome of this Foresight activity influenced the Intersectoral Plan for Scientific-Technological Development of Kazakhstan until 2020 (Chapter 2). A Delphi method involving more than 1,000 national experts is the next step, and will serve to identify the products and services with which Kazakhstan can successfully enter international markets.

[14] http://www.edu.gov.kz/en

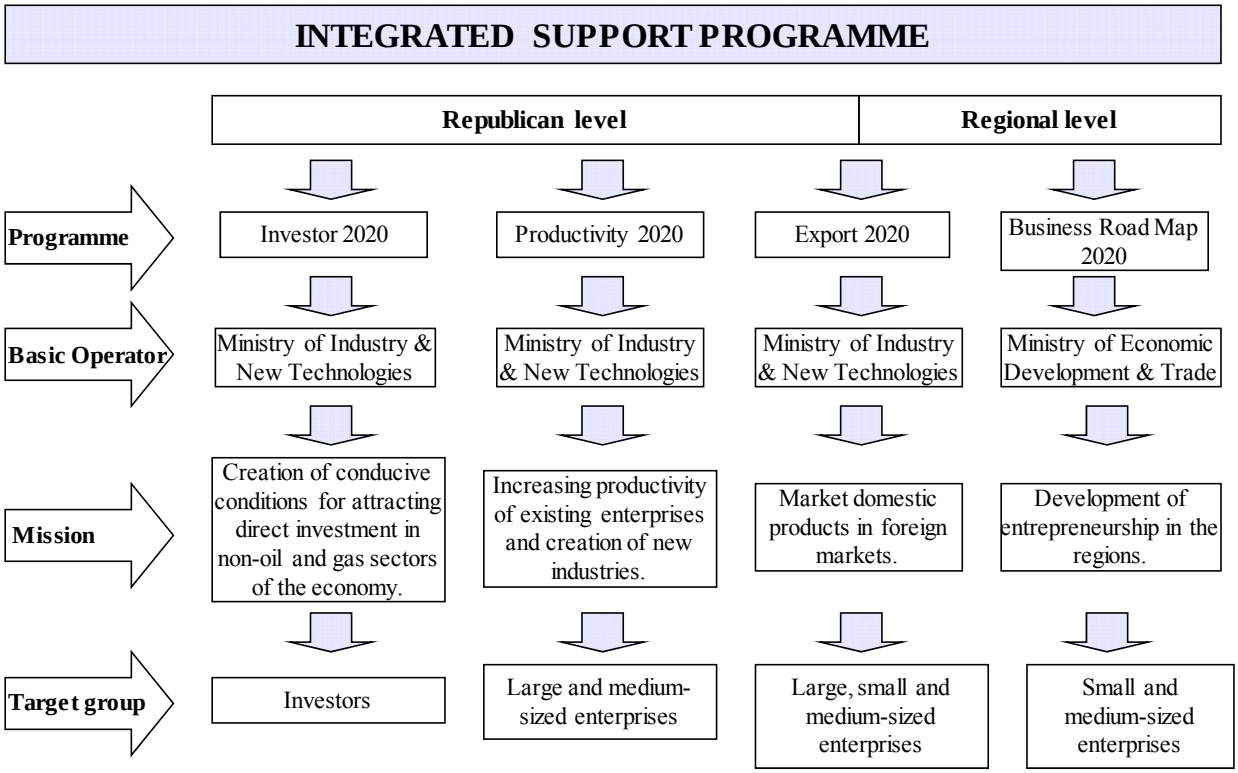
Previously, in 2006, the Ministry of Education and Science began a separate foresight initiative to identify important future priorities for research and technology. In 2010, the High Science and Technology Committee adopted five main priorities, namely: the energy sector; processing of minerals; information and space technologies; life sciences; and intellectual capacity. Closer collaboration between the teams running these two initiatives could improve outcomes, helping to identify new challenges as opposed to corroborating what is already known.

The new Law on State Support to Industrial Innovative Activity, adopted in January 2012, emphasizes the importance of technological foresight exercises to identify priority sectors and envisages that these initiatives should take place at least once every three years. The aim is to identify critical technological needs, support the design and implementation of state plans and provide criteria for granting financial support.

Integrated support programmes targeting firms

The emphasis on the firms in the PDISTM is also in line with a number of different programmes launched under the SPAIID (Figure 7), with diverse objectives and target groups, in particular the Business Roadmap 2020 and Productivity 2020 programmes. Although these initiatives do not make a primary emphasis on innovation, they aim to contribute to the development of SMEs and upgrade technological capacities and management practices in companies. The policy attention to management practices is a welcome development, as it seeks to address a weakness which was well documented in the EBRD Management, Organisation and Innovation Survey (2008-2009).

Figure 7. SPAIID: Integrated support programmes



Source: National Innovation Fund.

Productivity 2020

The Productivity 2020 business support programme was started in April 2011, with an annual allocation of KZT 19.9 billion (around US$133 million) from the state budget plus additional funds totalling KZT 15 billion (around US$100 million) in this first pilot year. The programme targets an increase in labour productivity of 50% by 2015, and its doubling by 2020. The range of instruments include innovation grants (Chapter 7), reimbursement of costs for engaging the services of highly-qualified foreign engineers and design-engineering companies, support with the purchase of licenses and long-term leasing of industrial equipment at favourable rates.

Business Roadmap 2020

"Business Roadmap 2020" is a ten year initiative targeting the diversification of Kazakhstan's economy and increased innovation in the SME sector, leading to increased economic competitiveness. The aim is to promote sustainable and balanced growth of regional entrepreneurship in the non-primary sectors of the economy, including the development of its export potential and additional job creation.

In 2010, the programme also provided assistance to enterprises to recover from the financial crisis, but since 2011, it has focused mostly on the support of business initiatives in export-oriented industries. The key targets to be achieved by 2015 are an increase in the share of the manufacturing sector to 12.5% of GDP, raising the share of non-primary exports to 40% of the total and an increase in labour productivity by 1.5 times. Box 6 presents the instruments used in this programme.

State financing of the programme amounted to around KZT 30 billion (around US$200 million) in 2010. Planned expenditure in support of new entrepreneurial initiatives totalled KZT 12 billion (around US$80 million), with KZT 16 billion (US$109 million), envisaged as expenditure on the financial recovery of the business sector and around KZT 2 billion (around US$1.3 million) as support for export-oriented industries. Financial resources were distributed between the sixteen akimats, in proportion to their populations. However, the fund allocation principle based on population size carries the risk of deepening the already significant disparities in regional development. Innovation capacities could be adopted in the future as the main criterion in distributing funds, although this may need adjustment if correcting imbalances is a policy objective.

The Business Roadmap comprehensively addresses many of the difficulties faced by SMEs. However, its effectiveness would be increased if closer links were established with other policy programmes fostering innovation and entrepreneurship, in order to exploit synergies. The connection between different programmes would help increase interaction within the National Innovation System. The new Law on State Support to Industrial Innovative Activity reinforces the scope for coordination initiatives, which would contribute to better policy outcomes. Networks and important institutional linkages between firms, research institutions, and public administration bodies are still lacking, and ought to be an important policy target (Chapter 2).

The ambitious targets of these two integrated programmes targeting companies, match well the economic challenges facing Kazakhstan. Well-developed policy evaluation criteria would

provide a valuable instrument for more effective programme implementation. The administrative bodies of Kazakhstan have the necessary means for collecting input data, and for a careful, systematic and independent monitoring of outputs and impacts of these programmes on the domestic economy. The development of a system of indicators and the introduction of evaluation mechanisms could be done at a relatively low cost and it would provide valuable insights into the economic situation of domestic firms and entrepreneurs. These mechanisms could be built on existing monitoring procedures and develop them further.

Box 6. Instruments of the "Business Roadmap 2020"

The tools employed by the "Business Roadmap 2020" to stimulate business activities are based on the German and Singapore practices of supporting the SME sector in general, and nascent entrepreneurs in particular. They include:

1. Financial tools - enhancing the accessibility of financial resources to the non-primary sector. For this purpose, the government offers subsidized credits and guarantees. In 2010, firms eligible to participate in the "Business Roadmap 2020" could request a subsidized loan under the following conditions:

- A maximum interest rate of 12%, of which 7% is paid by the entrepreneur, and 5% subsidized by state; for export-oriented businesses the shares were 4% and 8%, respectively;
- Credit period: One to three years, with an option of prolongation up to ten years; and
- Maximum amount of a credit is KZT 3 billion (approx. US$20 million), with at least 15% of financing provided by the entrepreneur.

With regard to guarantees, the state may secure up to 50% of a loan obtained within a programme.

2. Infrastructure investment – construction of roads, drainage systems, heating and water systems, establishing power supplies. Infrastructure costs cannot exceed 50% of total project costs.

3. Business support services - providing assistance with accounting, law, management and IT issues, marketing and consulting. Firms may choose among partners of the programme.

4. Labour training, allowing businesses to recruit highly-qualified local personnel.

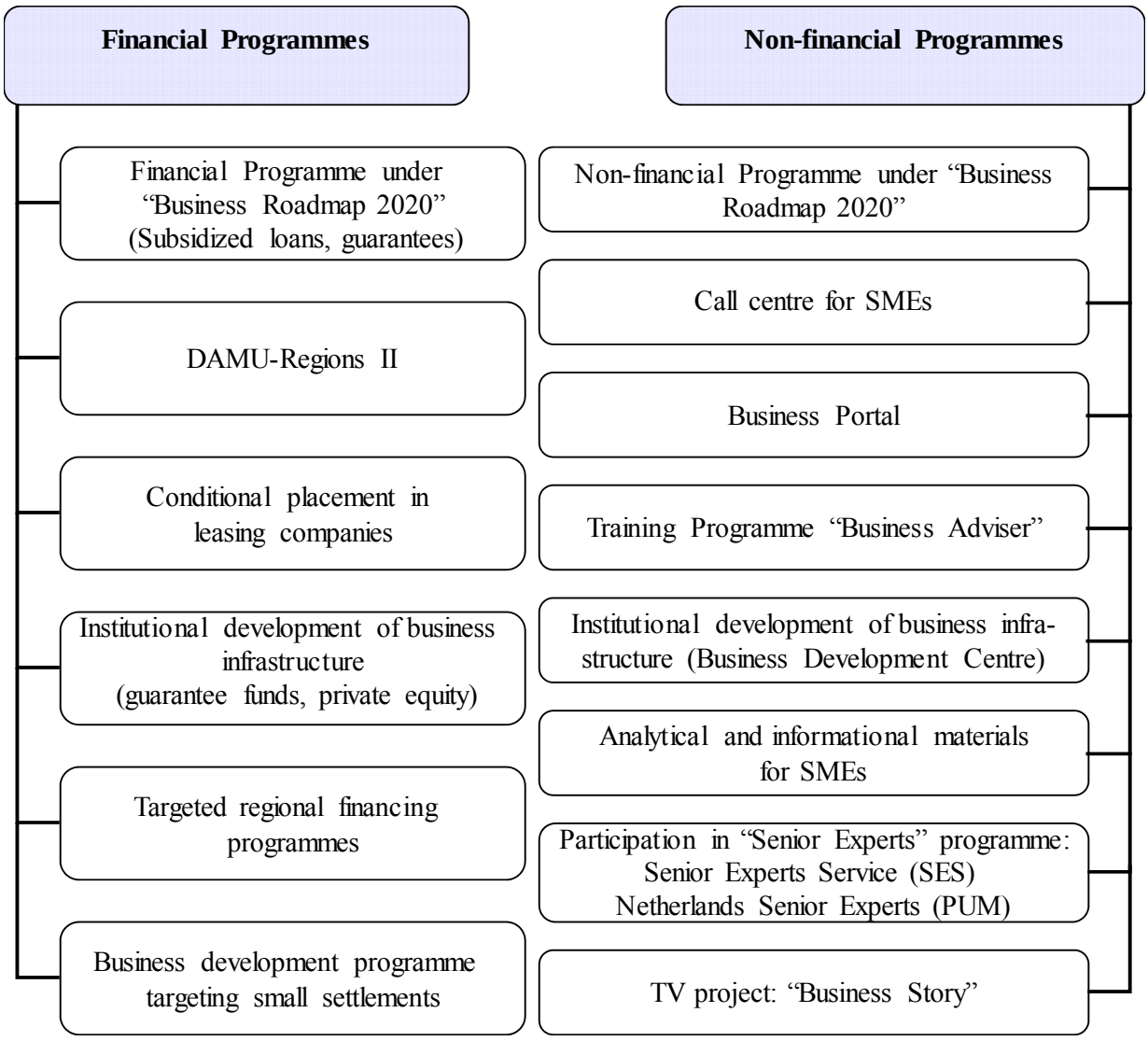
In order to facilitate the procedure of applying for state support within the programme, a "One-Stop-Shop" principle has been implemented at regional coordinators' offices.

"Business Roadmap 2020" envisages close interaction between both national and regional (*akimats*) state bodies, as well as other stakeholder institutions such as banks, the Association of Financiers of Kazakhstan and the Entrepreneurship Development Fund "DAMU".

Other initiatives to support SMEs

Besides the "Business Roadmap 2020", other government initiatives have been undertaken in recent years to facilitate the development of SMEs, as part of a general strategy to promote economic diversification. DAMU, which was established by the government in 1997, plays an important role in SME development by implementing the government's credit access programmes for SMEs. Over time, DAMU's range of programmes has evolved from direct lending to indirect lending through banks. From 1997 to 2009, DAMU directly financed 2,878 small business projects, disbursing a total of KZT 33.3 billion (2% of all loans extended to small businesses in Kazakhstan). DAMU's financial programmes for SMEs are now delivered largely through subsidized loans to selected partner banks, which are used to finance SMEs on favourable terms (Chapter 7). DAMU offers also different types of non-financial support (Figure 8). However, it does not have a programme that targets specifically innovative companies.

Figure 8. DAMU programmes for 2010-2020



Source: DAMU.

Given the importance of SME finance and the challenging post-crisis market conditions, a results-based "SME Access to Finance Action Plan 2010–2015," was adopted by the Ministry of Economic Development and Trade which oversees SME development as well as the DAMU fund. The plan seeks to ensure that SMEs have access to short-term working capital and medium-term finance through a US$3 billion investment programme. It also includes a policy framework that addresses constraints to the access to finance and introduces key guiding principles to overcome them. In addition, the Asian Development Bank's (ADB) 2009 Countercyclical Support Programme helped the government to fund post-crisis SME credit support operations.

Other donors, such as the EBRD, USAID and the World Bank have provided support for the development of SMEs, including advice and capacity-building activities. EBRD has extended several credit lines to commercial banks to fund lending to SMEs.

3.4 Regional innovation programmes and structures

Kazakhstan is a vast country with geographically dispersed centres of economic activity. As a result, its innovative capacity and potential vary greatly from one region to another, necessitating regional innovation support measures. To date, there is no coherent policy framework addressing the institutional design and evolutionary development of systemic structures such as science-industry linkages from a regional perspective. Regional authorities are directly financed by the central government with key decisions taken at the national level.

Innovation-related initiatives resulting from collaboration between the regional authorities and central government were largely non-existent until 2010. In May 2011, new guidelines to the regional authorities highlighted the key role of innovation and its economic significance, foreseeing greater regional responsibilities and an evaluation of regional innovation potential. The new Law on State Support to Industrial Innovative Activity, adopted in January 2012, explicitly mentions the competencies of regional authorities in this area, which include both the coordination of state plans at the regional level and the provision of inputs for the development of national policies.

Socio-entrepreneurial corporations (SECs) (Box 7) will have an increased role. Most of them were created in 2008 but at the beginning were not tasked with functions related to innovation. In the beginning, eight SECs were founded; one for every two regions. As of end-2011, there were 16, as many as regions. Their aim was to support regional economies acting as state investment companies. However, after the transformation of NIF into a National Agency for Technological Development (NATD) (Chapter 2), SECs will probably be the host of the regional NATDs. They will provide training on innovation-related issues. The potential role of SECs as intermediaries in the commercialization of research results is also in the policy agenda.

The entrepreneurship development fund DAMU providing support to SMEs has a strong regional focus. It has 16 regional branches, and two in the main cities, Astana and Almaty. The implementation of the "DAMU-regions" programmes began in 2009. In 2011, 'DAMU' was appointed as operator of the 4th direction of the 'Business Roadmap 2020': 'Enhancing entrepreneurial capabilities', which includes measures such as the training of entrepreneurs, service support and internships abroad. DAMU has the potential to play an important role in developing a culture of entrepreneurship, given the scope of its interventions.

The establishment of two district and five regional Business Support Centres (BSCs) opens new channels for the delivery of training and consulting services at the regional level. However, in the past, most support was devoted to traditional activities in the services sector and agriculture. The participation of manufacturing firms was very limited, and high-tech companies were practically absent. This would suggest a need to offer more focused training and consulting services.

Box 7. Status and role of Socio-entrepreneurial corporations (SECs)

The creation of the Socio-entrepreneurial corporations (SECs) in 2006, in accordance with the Strategy of Spatial Development of Kazakhstan to 2015, was the first attempt to provide support for innovative entrepreneurs and coordinate their efforts at the regional level.

A Socio-Entrepreneurial Corporation has been defined as a national company that, on the basis of a public-private partnership (PPP), contributes to a deeper interaction between state and business structures. SECs seek to balance the interests of various entities: firms, regional administration, and central government. Their main task is to promote regional economic development, bringing together the public and private sectors and contributing to the creation of clusters. The corporations are supposed to reinvest all their income in the social and economic development of their regions, promoting the efficient use of public property and a more competitive economy. In partnership with local companies, SECs are expected to develop local resources, raise additional funds, attract investment to the regions and renew infrastructure.

SECs also aim to provide financial support to high-tech production and innovation projects. Thus, SECs, in cooperation with *akimats* and other regional development institutions, are expected to search continuously for potential breakthrough projects, monitoring the economic strengths of the respective region and its export potential. In addition, SECs should choose the most appropriate investment tools for project implementation and support the projects from their initial stages through to commercial viability.

SECs receive governmental funding. Each corporation received KZT 2 billion in 2007 (US$13 million at the average exchange rate of 2011), with overall funding totalling KZT 14 billion (approximately US$96 million).

Despite the funding received, there were relatively few successful projects which contributed to the development of innovative entrepreneurship in the regions. Most projects are undertaken in sectors characterized by low entrepreneurial or SME activity (mining and quarrying, agriculture, construction and infrastructure). A plant producing bio-ethanol in Yesil (Akmola region, SEC “Saryarka”), being constructed jointly with the “Korlea Invest” company (Slovakia-Switzerland) and a biopharmaceutical production plant in one the Western regions (SEC “Caspiy”) are two exceptions, and have potential to be technology-intensive production centres in their respective akimats.

Other national development institutions have organized regional open days, which are useful in showing the policy commitment to involving the regions in innovation and modernization measures and to create awareness.

Technoparks were among the first regional actions relating to innovation policy. A key difference between Kazakhstan's national innovation system and those of more advanced countries is that R&D capabilities are located mainly in public organizations rather than enterprises, resulting in weak firm-specific R&D and innovation capabilities (Chapter 4). Technoparks were seen as a solution to this problem, while contributing also to regional development. However, their impact has been limited by weak support from their operating environment, including factors such as entrepreneurship, market access and development of the knowledge base (Chapter 6).

In particular, the lack of local demand for the products and services of new-technology-based companies constrains the contribution of technoparks to innovation. The results observed to date in terms of creation of innovative companies or R&D commercialization are limited. Traditional activities dominate among the tenants of technoparks.[15]

In 1990 the Law on Free Economic Zones (FEZ) was adopted in Kazakhstan. In 1991-1996, nine free economic zones were established. However, most zones were created without clear management mechanisms or a firm legal framework. The FEZs were abolished in 1996, given dissatisfaction with their results.[16] During the same year, the presidential decree "On special economic zones" (SEZ), was issued.

A Special Economic Zone is an area with precisely defined boundaries that aims to create favourable conditions for economic activities (Chapter 6). The objective is to develop and support industries, accelerating regional development and addressing social problems through improved business efficiency and attracting investment, technology and modern management.[17] However, so far there is little evidence concerning the impact of SEZs on innovation performance.

Currently there are nine special economic zones functioning in Kazakhstan. There have been substantial changes in the operating rules and management of SEZs and, instead of the current SEZ administration, there will be joint-stock managing companies. Each zone has its own priorities and projects. A new Law on Special Economic Zones was adopted in July 2011, which widened the incentives available. The new additional incentives include a 0% VAT rate, provided that goods meet all the requirements related to the creation of the SEZ and are specified in a list defined by the government of the Republic of Kazakhstan. In addition, free land plots and simplified procedures for the employment of foreign labour are available. These new incentives have increased the interest of companies in locating to these zones.

3.5 Assessment of the innovation strategy and programmes

A high policy priority is assigned to the support of innovation and the creation of a modern infrastructure to encourage the development of internationally competitive economic activities. This has resulted in the introduction of various initiatives, programmes and legal reforms. The pace of transformation makes it difficult to assess the overall implications of the

[15] S. Radosevic and M. Myrzakhmet (2009), Between vision and reality: Promoting innovation through technoparks in an emerging economy, Technovation, 29 (10), pp. 645-656.
[16] Irina Mikhalchenko (2010), Special Economic Zones: Essences and Possibilities, University of International Business.
[17] Law of the Republic of Kazakhstan dated 06.07.2007, No. 274-3, The Special Economic Zones in the Republic of Kazakhstan.

changes being introduced. While in some cases new and ambitious frameworks have been put in place that are supported by increased spending, time is still required to enact the necessary provisions for their implementation and reap the benefits of new measures.

Enterprise creation. Under the various programmes developed to implement its industrial and innovation policies, the government of the Republic of Kazakhstan offers more than 100 business support tools. However, less than 3% of SMEs are involved in manufacturing and therefore they are unlikely to be major beneficiaries of these programmes. There is no explicit focus on the development of new-technology-based firms, which should be targeted in a more systematic way by innovation policy.

Networking. While there are a number of initiatives supporting innovation and R&D, insufficient emphasis is placed on collaboration with the knowledge base, with the exception of technoparks, which have a mixed performance record to date (Chapter 6). Liaison offices in universities and research institutes are being created. However, without the necessary support to ensure that staff with a commercial orientation runs these institutions, there is a risk of failure to connect with other innovation stakeholders and international innovation chains. The availability of appropriate skills is a critical factor to facilitate the collaboration between firms and research institutions. It is important that international support schemes to train local experts in innovation management and innovation policy are continued and expanded (Chapter 5).

Validation. Given a variety of challenges and the likely rate of change ahead, there is a need for a thorough analysis of the relation between the content and purpose of the programmes and their impact. A policy evaluation generally requires a lag of around three years following project finalization, which is not yet possible given the recent pace at which policies have been reformed. The transfer of foreign experiences has been an important driver of the policy changes observed but the impacts of these experiences in the context of Kazakhstan are yet to be assessed. Frequent staff changes emphasize the need for thorough evaluation and monitoring of outcomes.

3.6 Recommendations

There has been a significant improvement in the business environment in recent years, including not only regulatory and tax aspects but also the quality of infrastructure and other factors influencing economic activity. However, there is still room for further progress in creating better conditions for private initiative and thriving entrepreneurial activity. The impact of measures promoting innovation or fostering entrepreneurship is highly dependent on the overall framework conditions, which need to be a continued object of policy attention. The acceleration and intensification of innovation activity in Kazakhstan is crucially dependent on further progress in establishing a business environment conducive to innovative entrepreneurship.

Recommendation 3.1

The authorities should engage in a systematic policy course of addressing existing impediments to entrepreneurial activity and further improvement in the business environment aimed at making it more conducive to innovative entrepreneurship, continuing and expanding

the dialogue with entrepreneurs to identify the factors that limit their activity (see recommendation 2.2).

Kazakhstan has put in place an ambitious strategy to foster economic diversification, including the encouragement of innovation. While initially much effort was devoted to set up new supporting organizations, the emphasis is now on creating plans for action. Multiple innovation initiatives have been introduced and new instruments, including tax incentives and grants, are being used. Programmes reflect an increased concern about the capabilities of firms to innovate and the regional dimensions of the innovation process. While there is consistency at the level of the overall programme goals, mechanisms for the coordination of development initiatives and implementation are weaker. Recent legal changes enshrine the importance of foresight mechanisms to identify priorities and provide a firmer basis for policy interventions.

Recommendation 3.2

Building on previous efforts, the authorities should strengthen the coherence of innovation initiatives by putting in place mechanisms that:

- *Ensure that innovation initiatives are aligned with strategic objectives and with the results of foresight programmes and other priority-setting mechanisms, developing the possibilities opened by recent legal changes;*
- *Facilitate the coordination of actions by different organizations during the design and implementation phases at different levels; and*
- *Encourage a bottom-up flow of information and ideas and their integration into innovation initiatives, through a consultation process.*

Recent state programmes have correctly identified weak demand as a major constraint to advance innovation in the country. This is a significant obstacle to innovative development, given the existing productive specialization. The instruments deployed so far to address this situation rely heavily on the control over state enterprises, although there are also initiatives envisaging tax incentives, the use of state procurement and coordination schemes. Public initiatives should emphasize further decentralized market-based mechanisms to encourage the demand for innovation, including through the improvement of framework conditions.

Recommendation 3.3

The authorities could complement existing actions to increase the demand for innovation through:

- *Measures to stimulate market-driven demand for innovation, including establishing competitive domestic markets and eliminating existing dominant positions, and enhancing linkages and connectivity among innovation stakeholders;*
- *The introduction of new demand-oriented public support schemes such as a voucher system for R&D and innovation, as well as public procurement targeting chains of innovation activity;*
- *The extension to other sectors of existing demand-oriented coordinating and matching mechanisms such as those used in the machine-building industry;*
- *Further use of targeted tax incentives to enterprises engaged in R&D; and*

- *Co-financing of research projects with joint participation of representatives from science and business, leading to the commercialization of inventions.*

Kazakhstan has developed many innovation initiatives, including the creation of an innovation support infrastructure. However, these efforts have not yet resulted in a significant number of new technology-based firms. SMEs play a limited role in economic activity and are mainly involved in traditional sectors. Entrepreneurship and entrepreneurial culture are underdeveloped. Despite some attempts to use public procurement to promote innovation, there is limited participation of SMEs in these initiatives.

Recommendation 3.4

Public support programmes should place a special emphasis on the establishment of a conducive environment for the emergence of new enterprises and especially new technology-based firms (NTBFs). Measures could include:

- *Putting in place a system of measures encouraging the establishment of innovation-based university start-ups and spin-offs and supporting them through their early stages;*
- *Mechanisms to increase the participation of new and existing NTBFs in public procurement activities and other existing programmes like the Business Roadmap 2020, including easier and more favourable bidding procedures; and*
- *Creation of the status of "Young Innovative Enterprise", which would include tax incentives without sectoral limitation as well as other measures of support.*

Regional issues have become increasingly important in Kazakhstan's innovation policy agenda. Initial efforts have focused on institution building, ensuring that the activities of innovation institutions are well known at the regional level and creating new regional infrastructures of support. These are important elements that should be developed further. These institutions should operate under well-defined policies that reflect both the needs and capabilities of the regions.

Recommendation 3.5

The authorities should continue their efforts to reach the regions in their innovation-support initiatives and the implementation of regional innovation strategies. These strategies should:

- *Ensure consistency with national objectives and programmes;*
- *Be integrated at the national level, so that the complementarities and interdependencies between regional strategies can be supported by national policies;*
- *Be based on a deep analysis of the potential of each region, in order to develop existing strengths and establish priorities; and*
- *Rely on the active participation of main innovation stakeholders, both in the formulation and implementation of strategies, so that potential opportunities and the necessary actions to exploit them are identified.*

The State Programme for Accelerated Industrial Innovative Development (SPAIID) has created a comprehensive framework for the modernization of the country, including through improved innovation performance. Kazakhstan has been very open to the use of foreign

experiences in designing policy initiatives. However, the success of these initiatives depends on the ability to draw lessons from their outcomes, so that future policy adjustments reflect the knowledge acquired in the course of implementation, including adaptation to local circumstances. This stresses the importance of monitoring and evaluation mechanisms. Existing programmes of state support include control mechanisms over their implementation and assessments of their results. Evaluation mechanisms should reflect the distinctive features of innovation policies; focussing on effective impact and not only on the consistency with declared goals, and taking into account the interrelation between different programmes.

Recommendation 3.6

The authorities should continue ongoing efforts to develop appropriate mechanisms to monitor and evaluate the results of policy programmes and feedback the evaluation outcomes into the design of new initiatives. This could include:

- *A monitoring system that includes both output and impact indicators, which are assessed under appropriate time horizons;*
- *A common evaluation mechanism for all innovation-related programmes that takes into account the specific character of public intervention regarding innovation and prevents excessive risk-avoidance through the adoption of a portfolio approach;*
- *The participation of independent external reviewers in the process of evaluation, building on current practices; and*
- *The integration of regional information to provide a comprehensive picture and facilitate comparisons.*

The economy of Kazakhstan is driven by some dynamic sectors, which are linked to external demand, FDI and the large domestic corporations. Under current policy initiatives, these sectors have the potential to play an important role in technology transfer and in raising the demand for innovation. The diffusion of innovation is a very important factor contributing to enhanced innovation performance, in particular, at the current level of technological development. However, there is little evidence of economic or technological spillovers to the wider economy, in particular regarding the creation of new firms. There are a number of ongoing initiatives to encourage linkages between SMEs and larger public and private companies, and these would be reinforced with the new Law on State Support to Industrial Innovative Activity. However, connectivity among innovation stakeholders in the national innovation system in general remains weak and should be the object of continued attention. Forthcoming initiatives such as the introduction of technology programmes to develop these linkages should be exploited fully.

Recommendation 3.7

The development of linkages, in particular between large and small domestic companies and between foreign and domestic companies, as well as the enhancement of connectivity in the national innovation system, are the two elements that should remain the major focus of innovation policy. The authorities should consider:

- *Developing further innovation support measures which are conditional on the collaboration between several innovation stakeholders. These may include programmes of industrial collaboration for innovation between research or academic*

organizations and the business sector or programmes targeting the involvement of foreign expertise;

- *Introducing further measures to increase subcontracting by large national companies to SMEs, as a method to foster clustering activities. These efforts could build on existing initiatives to develop long-term supply links between SMEs and large companies and may include increased access to information on opportunities and support to overcome coordination problems and upgrade capabilities; and*
- *Encouraging further the development of links with high-tech SMEs and foreign technology-based firms through international partnerships, including through a targeted upgrading of the technological capabilities of SMEs and the creation of a patent regime that creates suitable incentives and addresses any conflicts of interests.*

Chapter 4

KNOWLEDGE GENERATION

This chapter provides an overview of the process of knowledge generation in Kazakhstan, including the legal, policy and institutional framework. It discusses the different roles of the public and business sectors, and analyses the existing situation regarding education and skills. Finally, a number of policy recommendations are formulated.

4.1 Institutional framework of the knowledge generation system

The National Innovation System of centrally planned economies had a number of unique characteristics. New knowledge generated by basic research was transferred in a planned manner to applied research institutes, design offices, pilot factories, and, in the end, to final production. The main producers of knowledge, i.e., R&D organizations, were isolated from both education and industry. State resources were allocated in a centralized manner to achieve specific goals, but the role of bottom-up initiatives was virtually non-existent. By contrast, in a market economy, consumer needs, economic incentives and private ownership play a central role in encouraging innovation.

The transition to a market economy and the break-up of the former Soviet Union resulted in distinct changes in the generation of knowledge in Kazakhstan. The country created the basis for an independent system of science and research management, starting with the Law on Science and Public Science and Technology Policy of the Republic of Kazakhstan, adopted in January 1992, and embarked on a process of gradual restructuring of the system.

In 2003, the National Academy of Sciences of the Republic of Kazakhstan was re-established by presidential decree as a public association and was deprived of its traditional role as manager of research institutes and provider of resources to them. As part of this reform, there was a complete overhaul in the organization and management of R&D institutes. While some research institutes, such as the Kazakh Institute of Oil and Gas, are now within the structures of large enterprises, many others are directly under the Ministry of Education and Science. The Ministry of Education and Science is also the main funding agency for fundamental and applied research in Kazakhstan. By contrast, higher education institutions play a relatively limited role in contributing to R&D efforts (Chapters 2 and 5).

Those research institutes that were closer to the market (i.e. performing more applied research and development work), were placed under the umbrella of the National Scientific and Technological Holding “Parasat", which has adopted a more commercial attitude and seeks external financing to carry out innovative projects (Annex). Parasat targets a progressive decline of the share of resources accruing from the budget, which currently represent around 70% of revenues. According to the strategic plan adopted in August 2011, this share should decline to no more than 50% by 2020. The Science Fund, which was created in 2006 to support the implementation of the State Programme on Science Development for 2007-2012 through the provision of funding for risk-taking scientific projects, has been part of “Parasat" since July 2008.

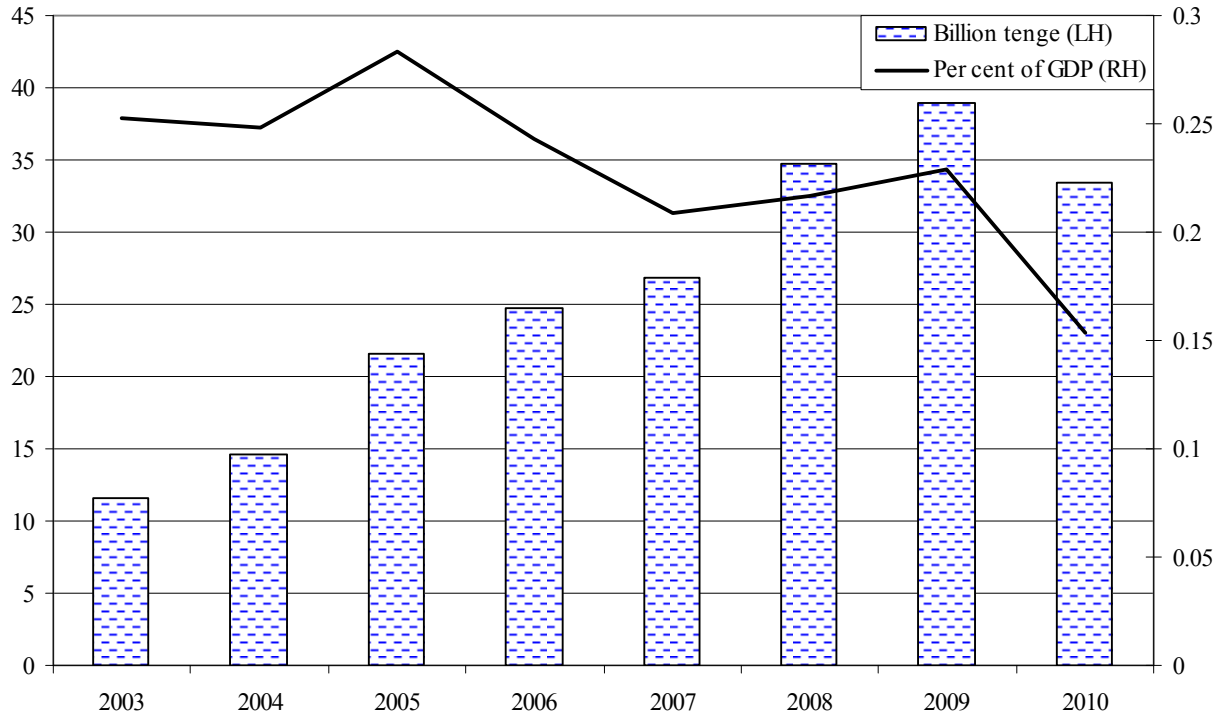
4.2 The level and structure of R&D

The economic crisis and accompanying decline in funding from the state budget during the 1990s led to a sharp fall in R&D, as well as in scientific and technical employment. By 1996, the number of R&D personnel had decreased to around 20,000, from around 50,000 in 1990; by 2010, the number of R&D personnel stood at 17,000.

Despite legal and institutional reforms, indicators of innovative activity show limited progress. R&D intensity remains very low, with intramural expenditure on R&D standing at 0.16% of GDP in 2010 (Figure 9). Gross expenditure on research and development (GERD) per capita in purchasing power parity (PPP) terms in Kazakhstan (US$22.9) is lower than in Russia (US$165.4) and Belarus (US$105.3).[18]

Such a low level of expenditure constitutes a significant barrier to upgrading the quality of research equipment, and compensating for previous under-investment. This reality contrasts with the target expressed in the SPAIID which envisages an increase in state expenditures on science and innovation to 1% by 2015.

Figure 9. Intramural expenditure on research and development



Source: Agency of Statistics of the Republic of Kazakhstan.

The low level of innovation activity and R&D spending in Kazakhstan results partly from the structure of industrial production, which is heavily skewed towards resources, where most

[18] UNESCO Science Report 2010: The Current Status of Science around the World, Paris. Data sources: for GERD: UNESCO Institute for Statistics estimates, June 2010; For GDP and PPP conversion factor: World Bank, World Development Indicators, May 2010, and UNESCO Institute for Statistics estimates; for population: United Nations Department of Economic and Social Affairs (2009) World Population Prospects: 2008 Revision, and UNESCO Institute for Statistics estimates.

FDI is concentrated. While the oil and gas sectors have driven the expansion of economic activity in recent years, the demand by enterprises for R&D has not increased in line with the growth of output. Large enterprises in the extractive sector often rely on imported technology that cannot be produced by the domestic R&D base. Extramural (to the country) R&D expenditures accounted for 38% of total R&D expenditures in 2010.

As in other countries with economies in transition, the business enterprise sector plays a relatively limited role in performing R&D (Table 9). This is a departure from the pattern observed in more advanced countries. Moreover, the relative weight of the government sector, which includes the different research institutes under the control of the Ministry of Education and Science, is very high even in comparison to Russia, where the business sector performed around 62% of R&D in 2009. Enterprises are not the main drivers of the innovation process and the business sector depends on the R&D system to solve major technological problems, and on the funding provided by ministries and development institutions.

Table 9. Structure of gross domestic expenditure on research and development (GERD) by sector, per cent of total

	2005	2006	2007	2008	2009	2010
Government	45.7	51.6	38.9	32.2	38.5	37.0
Business enterprise	39.3	35.3	44.6	50.8	32.7	36.6
Higher education	13.7	12.1	15.5	14.9	15.2	17.2
Private non-profit	1.3	1.1	1.1	2.2	13.5	9.2

Source: Agency of Statistics of the Republic of Kazakhstan.

Current government initiatives (Chapter 3) target both higher budgetary financing for R&D and the introduction of financial and tax incentives to encourage R&D spending by the private sector (Box 8). Recent reforms envisage a tax deduction amounting to 150% of R&D expenditures. Natural-resource-based companies will be obliged to spend 1% of their revenues on R&D. In addition, all the subsidiary companies of Samruk-Kazyna will be asked to spend 10% of their net profit on innovation, in accordance with the new chapter on innovation which is now part of its corporate strategy. In addition, the new Law on State Support to Industrial Innovative Activity increased the possibilities for grant financing, while widening the scope for co-financing.

Box 8. Increasing R&D in the private sector: What can policy achieve?

The main financial and fiscal instruments used either in isolation or in combination to stimulate business R&D investment are direct measures, typically involving the direct transfer of financial support from the public to the private sector, and indirect fiscal measures, whereby the public sector forsakes tax income from the private sector in exchange for approved investment behaviour. In addition, catalytic measures such as risk capital measures and loan and equity guarantees can be used to improve access to external private sources of finance and stimulate the flow of investment funds, both for innovation in general and for R&D.

Fiscal measures have relatively low administrative costs compared to direct financial

Box 8. Increasing R&D in the private sector: What can policy achieve?
(continued)

incentives. The private sector can decide how to invest most productively, there is less risk of government failure, and fiscal measures are usually characterized by easy accessibility.

An important issue regarding the use of tax incentives is the identification of eligible expenditures. The Scientific Research and Experimental Development Programme is an indirect federal government support programme for business R&D in which tax credits reduce the user cost of R&D for businesses in Canada. In this programme, capital expenditures for the acquisition of land or buildings and current expenditures for related rental or leasehold payments are not considered R&D expenditures. Also excluded are expenditures made to acquire rights in, or arising out of, R&D.

Direct measures can be subdivided into supply and demand side considerations. In recent years OECD countries and emerging economies have used more targeted demand-side innovation policies such as public procurement, regulation, standards, consumer policies and user-led innovation initiatives, as well as lead market initiatives, to address market and system failures in areas in which social needs are pressing.

The United States Small Business Innovation Research programme (SBIR) is an example of a successful initiative to promote innovation and R&D, which has inspired similar programmes in countries like Australia, the United Kingdom and the Netherlands. The SBIR offers competition-based awards to small innovative firms in three phases: feasibility of R&D, full R&D efforts and commercialization. SBIR funds are designed as a first step on the procurement ladder. Awards are linked to public-sector customer requirements and details are published on the Internet.

4.3 Innovation expenditures

Activities that support innovation are much broader than just R&D. Firms can acquire innovative products and processes that require little or no further work from external sources. Modifications can be made to both purchased products and processes or to technologies previously developed by the firm itself. Such activities are particularly strong drivers of process innovation.

Innovation expenditures in 2010 reached KZT 235 billion or around 1.1% of GDP, more than twice the level observed in the preceding year. Around 11% of the total was spent on R&D. This share is similar to that which can be seen in Belarus, but is only around half the amount observed in Russia (Table 10). In advanced countries, R&D expenditures typically account for 40-70% of innovation expenditures.[19] Traditionally, the bulk of expenditures in Kazakhstan corresponded to the acquisition of machinery and equipment but in 2010 there was a sharp increase in transfer expenditures related to production design, other pre-

[19] Eurostat (2008), Science, technology and innovation in Europe: 2008 edition, Luxembourg, Office for Official Publications of the European Communities.

production activities and the introduction of new services or productions methods. This explains the overall increase observed in innovation expenditures that year.

Table 10. Innovation expenditures, Customs Union countries, by category, per cent, 2010

	Kazakhstan	Belarus	Russia (2009)
Research and development	10.9	21.3	27.3
Acquisition of machinery and equipment	26.6	65.1	52.5
Acquisition of new technologies	6.9	0.4	1.5
Other expenditures	64.6	13.2	18.7
Total	**100**	**100**	**100**

Source: Agency of Statistics of the Republic of Kazakhstan; SCST (2010), Science, innovation and technology in Belarus 2009, Minsk; Higher School of Economics (2010), Indicators of Innovation Activity: 2010, Moscow.

Table 11 shows the relative importance of different types of innovation activity undertaken by innovative industrial enterprises in the countries of the Customs Union. The importance of the acquisition of machinery and equipment, involving between a half and two-thirds of innovating firms, is similar to that of EU countries.

Table 11. Innovative industrial enterprises engaged in selected types of innovation-supporting activity in the Customs Union, shares in per cent

Type of innovation activity	Kazakhstan (2010)	Belarus (2009)	Russia (2008)
Acquisition of machinery and equipment	51.5	57.8	66.7
Research and development	19.9	66.8	33.2
Acquisition of patent rights and patent licenses	0.9	2.4	7.3

Source: Higher School of Economics (2010), Indicators of Innovation Activity: 2010, Moscow; SCST (2010), Science, innovation and technology in Belarus 2009, Minsk.

Skills are important for using and developing technologies, with poor skills often being a particularly important bottleneck at low levels of technological development. However, the share of training costs in total innovation expenditure in Kazakhstan is only 2%, which is much lower than that observed in developed countries.

Given the existing situation, innovation policies in Kazakhstan should target an increase in overall R&D spending, which remains low but also a change in its structure, resulting in an increased role for firms in performing R&D, as this is a pattern that is more conducive to ensure the commercial orientation of research and its adequacy to the strategic needs of companies. Domestic R&D is also important to facilitate the absorption of foreign

technologies and encourage spillovers.[20] The development of absorptive capacity would require more attention to training than can be currently seen in the pattern of innovation expenditures.

Kazakhstan has received large FDI inflows, but most of these have been concentrated in the extractive industries, with only 11.8% of FDI in 2010 in the manufacturing sector. This high degree of concentration limits spillover effects, including direct learning by the employees working in foreign-owned firms and also by domestic suppliers and buyers as a result of interactions with foreign firms (Chapters 2 and 8). Subcontracting represents an alternative channel of access to technology that also remains underdeveloped whilst receiving increased attention in policy initiatives (Chapter 3).

4.4 Funding

Public funding accounted for 81% of research and development expenditures in 2010.[21] (Table 12). The persistently large share of public financing of R&D reflects the relative weakness of other sources of funding. To a large extent, R&D capacity in Kazakhstan's business sector is supported by direct government funding, reflecting public ownership of R&D institutes and the legacy of the Soviet system, with the usual separation between productive facilities and R&D. Weak demand for innovation also contributes to explain the low levels of business spending.

Table 12. Distribution of R&D expenditures by source of funding in Customs Union countries, shares in per cent, 2009

Country	Budgetary sources	Extra-budgetary funds	Own funds of research institutes	Customer funds	Foreign investment
Kazakhstan (2010)	81	1	17	-	1
Belarus	62	1	13	16	8.2
Russia	55	2	7	29	7

Source: Agency of Statistics of the Republic of Kazakhstan (2011), Science and innovation activity in Kazakhstan, Astana.

In recent years, the public R&D system has shifted somewhat towards funding applied research, while support for fundamental research has declined (Table 13). As in other transition countries, there have been strong commercialization pressures, which have led to changes in the structure of R&D. This may seem appropriate over a short-term time horizon, but there is a balance that needs to be observed between the different types of research to avoid undermining fundamental research capabilities.[22] The share of development (engineering design and technological work, prototyping, batch production), is around half the

[20] D. Foray (2010), Knowledge Policy for Development, Chapter 5 of Innovation and the Development Agenda, Paris, OECD, August 2010.
[21] Agency of Statistics of the Republic of Kazakhstan (2011), Science and innovation activity in Kazakhstan, Astana.
[22] S. Radosevic (2011), Chapter in Innovation Performance Review of Belarus (UNECE), New York and Geneva, United Nations, p.64.

levels observed in Belarus and Russia. This low level is one of the obstacles to the commercialization of research.

Table 13. Types of activities in Kazakhstan's R&D system, shares in per cent

	Year			
	2007	**2008**	**2009**	**2010**
Basic research	19	16	15	14
Applied research	52	56	63	56.4
Development	29	28	22	29.6

Source: Agency of Statistics of the Republic of Kazakhstan (2011), Science and innovation activity in Kazakhstan 2006-2010, Astana.

The separation between different types of research has been reinforced by the distribution of competencies among different organizations, with the Ministry of Education and Science having a major responsibility for fundamental research while the Ministry of Industry and New Technologies was more involved on issues concerning applied research. This rigid separation will be softened with the introduction of new mechanisms of coordination (Chapter 2).

There are a number of public organizations involved in the financing of R&D and other innovation expenditures, in accordance with government priorities. The Higher Scientific and Technology Committee (HSTC) was established in 1999 as an advisory body defining national priorities for the development of fundamental and applied science, preparing recommendations for the formation and improvement of scientific, technical and innovation policy of the state. The HSTC, headed by the Prime Minister, acts as the primary coordinator of R&D work at the national level. It includes representatives from all relevant ministries, with the Ministry of Education and Science providing secretariat support (Chapter 2).

The Ministry of Education and Science provides financing for both fundamental and applied research, while the Science Fund considers requests for the financing of more risk-orientated scientific applied research, in line with the priorities identified by the HSTC. The financing provided is open to private companies who may co-finance scientific and technological projects and chose the scientific organization who will carry out the research on the basis of public financing. Funding is provided on a competitive basis and may take different forms, including both grants and loans.

The State Programme on Development of Science for 2007-2012 envisaged that the main task of the Science Fund would be the financing of development work and collaboration with investors. The programme also stipulated that the Science Fund should channel 25% of state spending on science by 2010. This shift in financing was seen as a way to increase the share of applied research and development expenditures in total R&D and, more generally, the commercial relevance of research through closer relations with private investors. The Programme also indicated the importance of collaboration with financial development institutions. This is an area where there is room for improvement and where further progress could be made with the help of the new coordinating institutions that are being put in place. The beneficiaries of the funding are mostly research institutes, which account for around 80% of the resources disbursed. The Science Fund also conducts market research and provides advisory services on legal, financial and economic aspects related to its activities and

organizes seminars, workshops and conferences on R&D projects, their funding and commercialization.

The public financial development institutions have a limited role in funding for science and innovation. The share of these new development institutions in total innovation expenditures in Kazakhstan was 1.3% in 2010.[23] However, innovation grants have significantly increased their share in the financing provided by these institutions, accounting for 27% of the total in 2010 against only 2.7% in 2008.

There is a pattern of strong regional concentration in the allocation of resources by development institutions, with 66% of the resources provided remaining in the capital; although the scientific potential of Astana is weaker than that of Almaty (52% of the R&D personnel of Kazakhstan are located in Almaty and 7.2% in Astana).

The new Law on Science, adopted in 2011 (18 February 2011, Law No. 407-IV), introduced important changes to research financing arrangements, with funding now awarded via three types of mechanisms: grants, base funding and programme funding. The introduction of the grant system is in line with international practices. There is an important innovation in the new provisions: grants will be awarded not only to scientific organizations and universities, as before, but also to individual scientists or their teams. A National Centre for State Scientific and Technological Expertise has been established, which will provide its results directly to the National Research Council. The new control system will make the review of scientific projects and programmes more straightforward. Scientific matters are now outside the scope of the Law on Public Procurement.

Base funding serves to provide public research organizations and universities with core funds for infrastructure, utilities, administrative and staff costs and other elements necessary for the survival of the organization. The aim of programme funding is to support strategically important public policy objectives enshrined in government programmes and other high-level policy documents. The provisions of the new science law widen the scope for more competition among applicants for funding, resulting in better alignment with policy priorities and increasing the potential for the commercial orientation of research. The Law on State Support to Innovative Industrial Activities, adopted in early 2012, and related legal amendments, should also facilitate the financing of science and innovation. However, plans for the implementation of these laws are still being developed and the evidence of their practical impact is still limited.

4.5 Main trends in the process of knowledge generation

Employment

The existing policy focus on knowledge-based development has not led to an increase in employment in the science and technology sectors of the economy. On the contrary, the last decade has seen a decrease in the level of employment in these sectors. In 2010, employees engaged in research and development comprised 0.21% of the economically active population, compared to 0.26 % in 2006. Currently, there are 13.3 researchers per 10,000 of the economically active population; six to seven times fewer than in developed countries. The

[23] Agency of Statistics of the Republic of Kazakhstan (2011), Science and innovation activity in Kazakhstan 2006-2010, Astana.

number of researchers in Kazakhstan was 671 per million people in 2010, which is significantly lower than comparable figures for Russia (2,602 per million people in 2009), and for Belarus (2,164 per million people in 2009).[24]

Most of the employees engaged in R&D are still based in research institutions, organizations and universities (82.6% in 2010, compared to 94% in 2000). Over the same period, there was a marked increase in the number of R&D personnel employed in other organizations - their share increased from 0.3% in 2000 to 10% in 2010.

Publications

Trends in Kazakhstan's publication record provide an additional indication of the country's knowledge-generation capabilities. The research activity of local scientists in international publications has increased but it is significantly lower than in Belarus and Russia (Table 14). Citations per documents for 1996-2010 were 4.1 in Kazakhstan, against 5.21 in Russia and 4.61 in Belarus.

Table 14. Trends in academic publications in Customs Union countries (Scopus database)

	Publications				
	2006	**2007**	**2008**	**2009**	**2010**
Kazakhstan	300	316	313	374	377
Belarus	1,406	1,453	1,356	1,442	1,403
Russia	31,127	32,165	33,170	34,309	35,352

Source: Agency of Statistics of the Republic of Kazakhstan (2011), Science and innovation activity in Kazakhstan 2006-2010 Astana.

International co-authorship is more widespread in Kazakhstan than in Belarus or Russia. The main partner countries of Kazakhstan in the scientific sphere are Russia, the USA, Germany, Japan and the United Kingdom, together accounting for around half of all publications with foreign participation. The most quoted scientific works are in physics, biology, space technology and ecology.

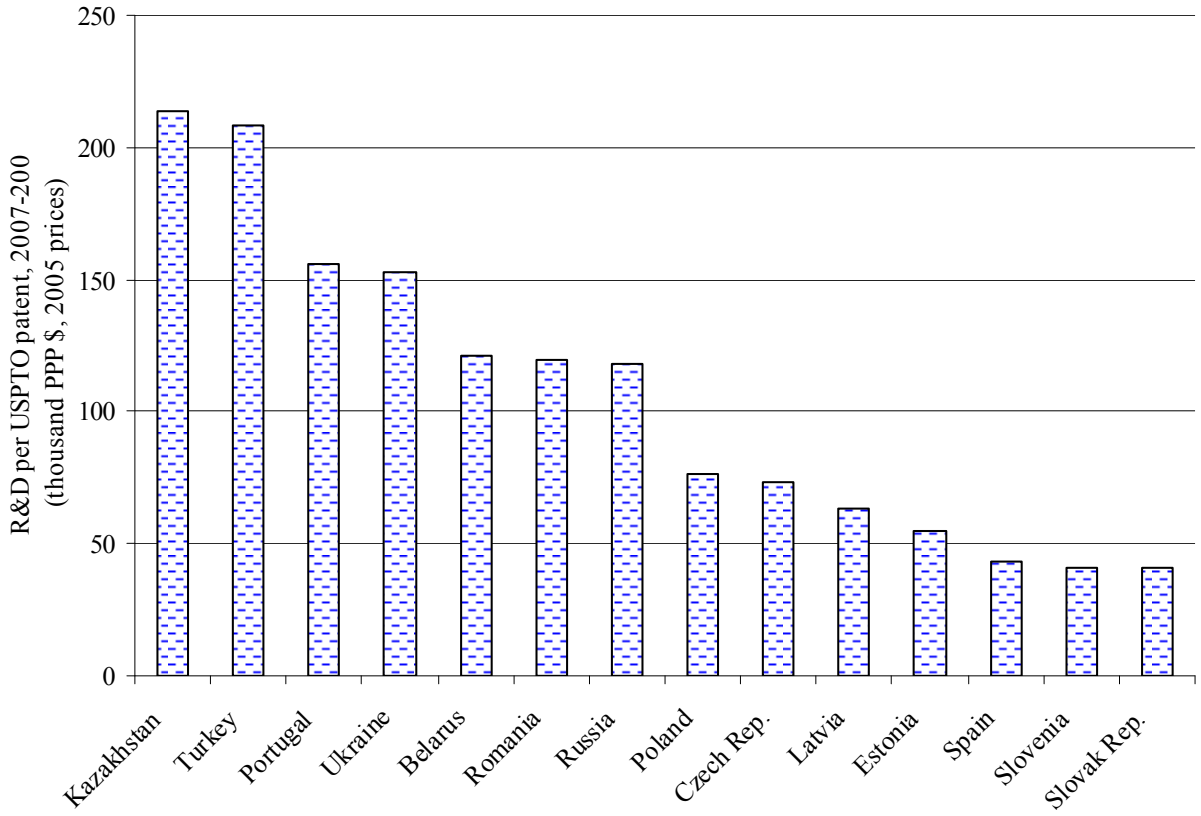
Patents

Patenting activity is one of the key performance indicators of scientific research. In 2010, the total number of national patents granted was 1,868 (88% of which were granted to national applicants, and 12% to foreign applicants), an increase of 6.4% on 2008 levels. In 2009, Almaty was the region accounting for the highest proportion of applicants (48.9%), followed by Astana (9.9%) and the East-Kazakhstan region (8.7%). These figures reflect the distribution of research institutions and universities.

[24] Own calculation on the basis of Rosstat (2010), Belarus and Russia; Agency of Statistics of the Republic of Kazakhstan (2011), Science and innovation activity in Kazakhstan 2006-2010, Astana.

The relation between innovation outputs (patents) and inputs (R&D spending) shows a still low degree of efficiency of the national innovation system (Figure 10).

Figure 10. International comparison of R&D efficiency (R&D spend per patent)



Source: UNESCO (GERD) and USPTO (all patent types) data, based on World Bank analysis ("Igniting Innovation: Rethinking the Role of Government in Emerging Europe and Central Asia, World Bank, 2011).

ICT infrastructure

An adequate, modern information infrastructure facilitates effective communication, dissemination, and processing of information and knowledge, thereby contributing to innovation activity. Kazakhstan continues to lag behind other upper-middle income economies in terms of most measures of ICT infrastructure. The latest World Bank data available from 2007 indicated a higher cost of Internet, a lower number of Internet users per 1,000 population and significantly lower international Internet bandwidth per capita than in Belarus and Russia, for example, although availability of e-Government services is an area of relative strength.[25] However, national statistics show marked progress in recent years in these relatively weak areas of information infrastructure connectivity (Table 15).

IT expenditure in Kazakhstan was 0.67 % of GDP in 2010. The proportion of enterprises with websites in 2010 was 24.9%, 3.2 times the level observed in 2009, while 52.9% had access to

[25] Knowledge Assessment Methodology (www.worlbank.org/kam).

the Internet. [26] Internet penetration (the share of Internet users among the adult population), reached 31.3% in 2010. However, the use of broadband Internet is much more limited, with an average rate of penetration of only 10.2%. This overall figure masks very wide regional divergences. The expansion of Internet access would facilitate improved logistics and business services, thus contributing to innovation.

Table 15. Mobile and Internet penetration rates in Kazakhstan, per cent of population

	2005	2006	2007	2008	2009	2010
Mobile telephone	35.6	51.2	81.3	102.6	106	118.9
Internet	2	2	2.5	3.8	4.8	6
Broadband Internet	-	-	-	2.2	3.6	5.3

Source: Agency of Statistics of the Republic of Kazakhstan (2011), Information Society in Kazakhstan 2006-2010, Astana.

Knowledge Economy Index

The Knowledge Economy Index (KEI), developed by the World Bank Institute under its Knowledge Assessment Methodology, provides an indicator of the degree to which the national environment is conducive for knowledge-based development. The KEI summarizes a country's performance across four pillars: the economic incentive and institutional regime; innovation system; education and human resources; and development of ICT infrastructure (Table 16).

Table 16. Knowledge Economy Index for Customs Union countries

Country(rank)	KEI	Economic incentives	Innovation	Education	ICT
Kazakhstan (72)	**5.2**	4.7	3.68	7.07	4.96
Belarus (73)	**4.92**	1.15	5.79	8.02	4.74
Russia (60)	**5.55**	1.76	6.88	7.19	6,38
Europe and Central Asia	**6.45**	5.71	6.99	6.62	6.46

Source: World Bank Institute, Knowledge for Development (K4D) Programme (www.worldbank.org/kam)
Note: Ranking of 145 countries.

Kazakhstan is relatively strongly positioned in terms of economic incentives, measured on the basis of expert assessments of regulatory quality, barriers to economic activity and the rule of law. However, it scores poorly on the innovation component, which includes indicators such as the volume of scientific articles produced, and international patents per million population, lagging behind the countries of Europe and Central Asia, as well as its Customs Union partner Belarus.

[26] International Telecommunications Union, World Telecommunications/ICT indicators database, June 2010, and UNESCO Institute for Statistics estimates; United Nations Department of Economic and Social Affairs (2009) World Population Prospects: the 2008 Revision, and UNESCO Institute for Statistics estimates.

4.6 Human resources, education and skills

Education is a key priority for the government of the Republic of Kazakhstan, as recognized in the "Kazakhstan 2030" strategy, and this is reflected in a number of different programmes. The overall goal of education reforms in Kazakhstan is to adapt the educational system to a new socio-economic environment, helping to achieve the target of placing the country among the 50 most competitive economies in the world.

The "Intellectual Nation 2020" programme, launched in 2009, plans to develop a network of schools for gifted students in the scientific and technical disciplines. Another major initiative is the State Programme of Development of Education of the Republic of Kazakhstan for 2011-2020, approved by Presidential Decree No.1118 on 7 December 2010. The objective of this programme is to contribute to Kazakhstan's competitiveness and sustainable economic growth through human capital development and improved access to education.

We see that Kazakhstan compares relatively favourably in terms of the percentage of firms rating an inadequately educated workforce as their top concern, in part reflecting ongoing efforts with respect to human resources, education and skills. However, the current situation remains sub-optimal, with an inadequately trained workforce rated by companies as one of the five main factors constraining their development (Figure 11). Appropriate skills are also critical for the absorption of foreign technologies. This concerns not only general education, but also the presence of enterprise-level capacity to provide technical training and on-the-job learning.

Expenditure on tertiary education has decreased over the past decade in the emerging market economies in the region. Countries enjoying sharp increases in revenues from exploiting natural resources have not generally channeled these flows towards increasing funding for education.[27] As a share of GDP, Kazakhstan spends less on education than Russia or Belarus, with expenditure per student less than half as high in PPP terms (Table 17). Although overall spending on education remains relatively low, there has been a marked increase in recent years (Chapters 1 and 2).

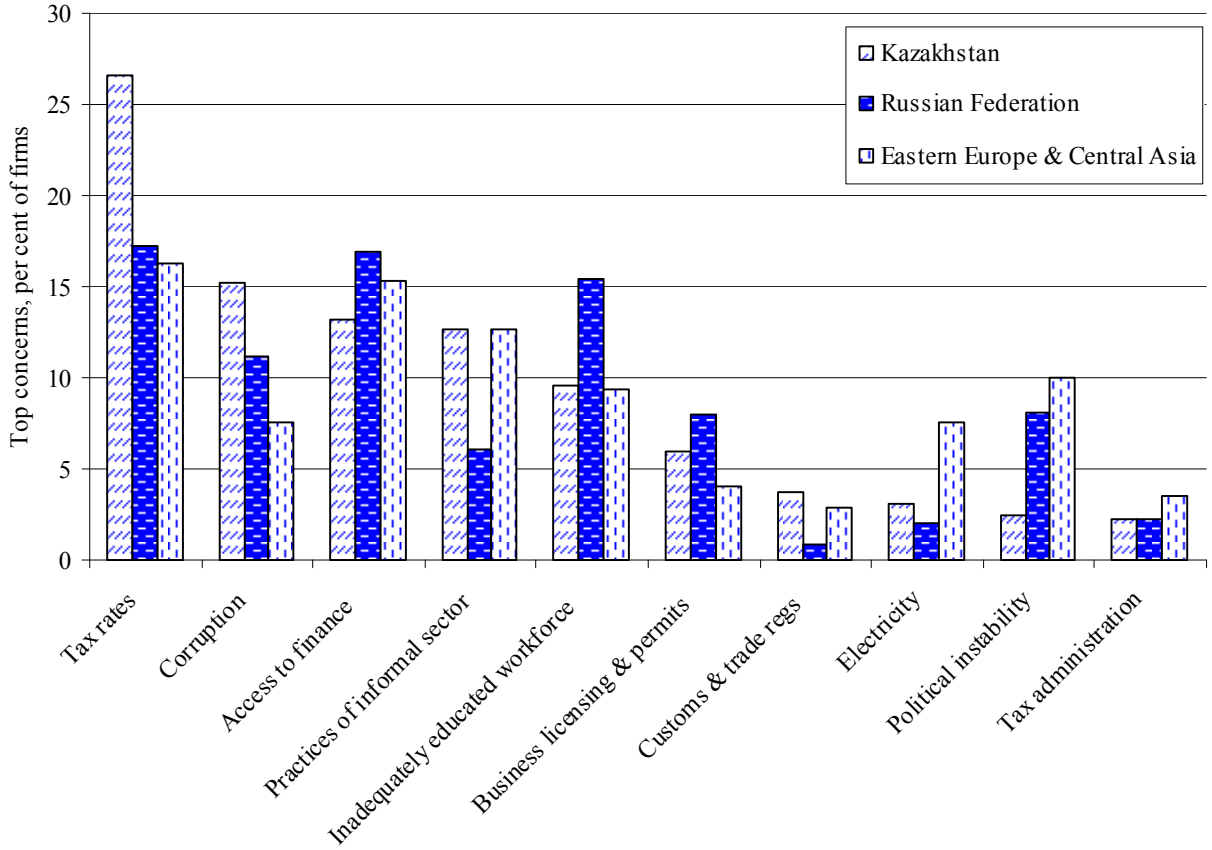
Table 17. Expenditures on education in Customs Union countries, 2009

Countries	**Total public expenditure on education % GDP**	**Total expenditure per student (Tertiary-ISCED 5-6)**	
		Expressed as per cent of GDP per capita	In US dollars, PPP
Kazakhstan	2.8	7.9	865
Belarus	4.5	15.0	1,957
Russia	4.1	14.2	2,889

Source: UNESCO Institute for Statistics (2011), Global Education Digest 2011: Comparing Education Statistics across the World, Montreal, pp.225-226.

[27] P. Aghion, H. Harmgart and N. Weisshaar (2010), Fostering growth in CEE countries: a country-tailored approach to growth policy, Working Paper No. 118, European Bank for Reconstruction and Development, October 2010.

Figure 11. Top 10 constraints for firms: Kazakhstan, the Russian Federation and Eastern Europe and Central Asia (EECA)



Source: Enterprise Surveys (http://www.enterprisesurveys.org), World Bank (country data from 2009).

There has been a significant expansion of the higher education sector over the last decade, including increased numbers of newly-established private universities. There are now 148 universities in Kazakhstan, with around 600,000 students enrolled in training.[28] Despite this increase in the number of institutions of higher education, the number of university students in Kazakhstan declined between 2005 and 2010 by around 25%.

Kazakhstan has also entered the "Bologna Process", prioritizing the international accreditation of universities, improving existing institutions and providing greater access to tertiary education as a way of overcoming regional inequalities. There are signs that the quality of university education is increasing and the current ambition is to have two universities considered among the top world institutions. One of these will be the Nazarbayev University (Chapter 2), an ongoing project that is receiving strong state support. It is envisaged to allocate increased levels of financing in order to attain these ambitious goals.

Kazakhstan is actively engaged in international cooperation in the field of education. The Bolashak programme, which was established in 2005 and is administered by the Centre for International Programmes of the Ministry of Education and Science, has provided grants to cover costs of studying abroad for around 3,000 students. Exchanges with foreign universities are extensive, considerably exceeding levels observed in Russia and Belarus (Table 18). In

[28] The State Programme of Development of Education of the Republic of Kazakhstan for 2011 – 2020.

addition, there are more than 10,000 foreign nationals studying in Kazakhstan, and plans are in place to increase the attractiveness of higher education institutions for international students. In particular, the Nazarbayev University has been created as an international university.

Table 18. International exchange of students in Customs Union countries

Countries	Students from abroad studying in given country		Students of given country studying abroad	
	Persons	Inbound mobility rate, per cent	Persons	Outbound mobility rate, per cent
Kazakhstan	10,458	1.6	30,077	3.9
Belarus	5,909	1	14,804	1.8
Russia	60,288	0.6	43,980	0.5

Source: UNESCO Institute for Statistics (2011), Global Education Digest 2011: Comparing Education Statistics across the World, Montreal; and OECD (2010), Education at a Glance 2010, Paris.

Vocational education plays a key role in facilitating innovation. Incremental innovation, particularly relevant for a country at Kazakhstan's stage of innovative development, is often the result of workers' actions. However, a shortage of technical skills impairs technology transfer and adaptation. Rapid structural changes in the economy have been accompanied by large shifts in the structure of labour demand, which have not yet been adequately reflected by changes in labour force skills. The imbalance between the needs of the labour market and the availability of employees with appropriate technical skills needs to be corrected through retraining and life-long learning, and support to all components of the education system.

Graduates from higher education institutions outnumber by far those with vocational training (VT). In fact, the number of students enrolled in VT schools has fallen by more than half since the 1990s. The underdevelopment of the vocational system in Kazakhstan is exemplified by the fact that 43 regional centres do not have a single vocational institution, despite the potential impact on growth of these educational institutions.[29]

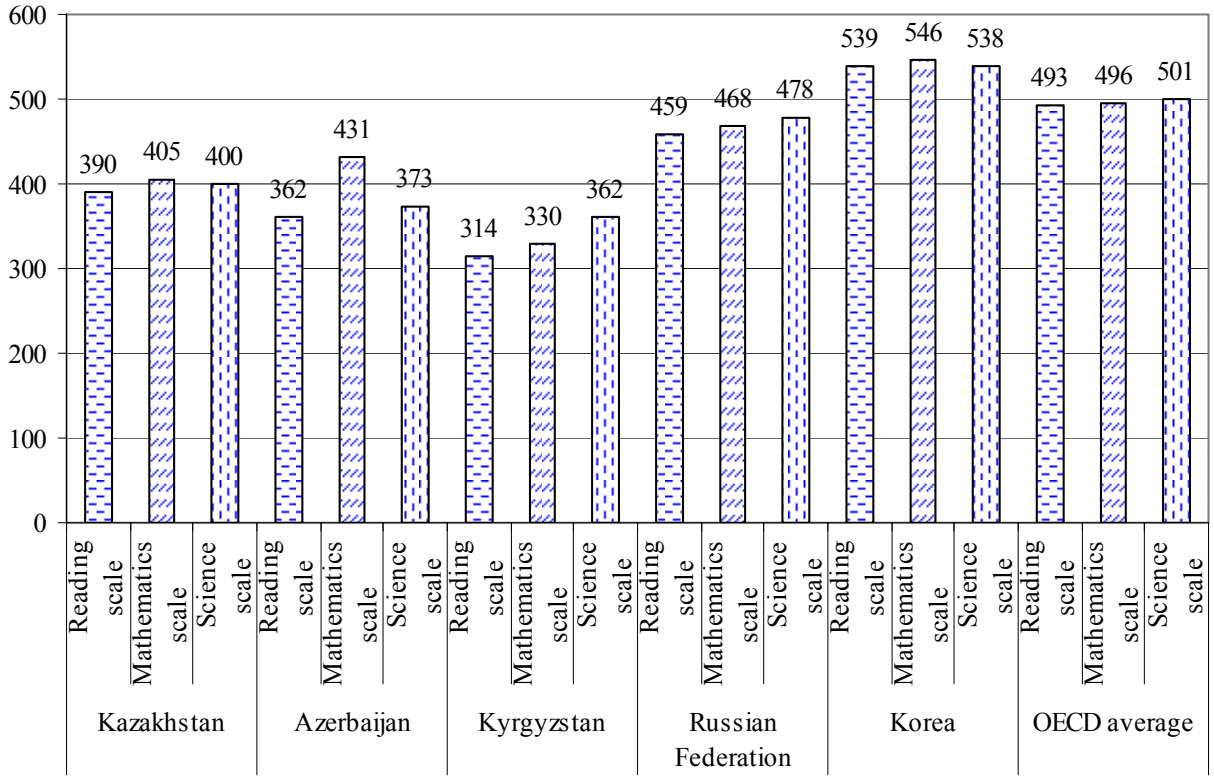
Recent initiatives have introduced a new emphasis on vocational and technical education development. These include the setting up of four new colleges in Astana, Almaty, Aktobe and Shymkent, which will be developed according to international standards. The Kasipkor state holding has been created as a result of partnerships involving the business community and some foreign universities. The aims are to develop around 20% of the training in associated enterprises. There are also plans to open a centre in Astana for the training of vocational education teachers and four interregional centres with sectoral specializations.

The quality of compulsory education is another key determinant of a country's innovative capacity. The OECD's Programme for International Student Assessment (PISA) conducts a survey providing indicators that are comparable across a range of transition and non-transition countries, which measures reading, scientific and mathematical achievement of students

[29] R. Abazov (2011), Stimulating Industrial Innovation in Kazakhstan, prepared for the National Innovation Fund by the School of International and Public Affairs, Columbia University, May 2011.

nearing the end of compulsory education. The latest round of PISA testing, carried out in 2009, shows the performance of Kazakhstan's students lagging behind that of most OECD countries, as well as Russia (Figure 12). The State Programme of Development of Education of the Republic of Kazakhstan for 2011-2020 targets an improvement of Kazakhstan's position in the PISA ranking to 50-55 by 2015, and 40-45 by 2020.

Figure 12. Student performance in reading, mathematics and science



Source: OECD, PISA 2009 Database.

The Law on State Support to Industrial Innovative Activity, adopted in January 2012, also addresses the need to upgrade human capital and establishes mechanisms of coordination to ensure that identified shortages in skills in priority sectors are reflected in state education plans.

4.7 Recommendations

Largely due to the legacies of the past, the knowledge-generation capacity of the country is relatively limited, reflecting overall low levels of spending on R&D, both in the public and, particularly, in the private sector. The authorities have set ambitious targets in this area but implementation lags behind. Despite marked progress, the existing infrastructure does not yet support easy access to and dissemination of knowledge. There is space for enhancing the knowledge-generation capacity of the economy through targeted policy intervention.

Recommendation 4.1

The authorities should put in place measures to meet targets to raise R&D expenditure in the economy. Public policy should be concerned with the level of R&D activity in both public and private organizations and should also target increasingly the capacity of the economy to absorb knowledge. The modalities of public support could include:

- *Increased budgetary allocations to provide long-term research grants to teams including staff from research institutes, researchers from high education organizations and industry. Grant financing could include an agreement between sources of financing (government), recipients (research institutions) and future users (companies) to ensure the relevance of the research;*
- *Differentiated policy instruments depending on the type of R&D (fundamental, applied), the level and type of risk as well as other factors affecting the innovation process. Instruments should at the same time target higher connectivity and better linkages in the national innovation system; and*
- *Enhanced collaboration with foreign direct investors to encourage the setting up of local R&D facilities and linkages with the domestic research base. Support to foreign investment through the tax system or other systems of incentives could be contingent on the development of these linkages.*

Companies still play a limited role in the generation of knowledge in Kazakhstan. The structure of R&D, which reflects the legacy of the former planned economy, with the still prominent role of sectoral research institutes, is not conducive to commercial success, given the detachment from the market. Market-driven demand for technology is also low, reflecting the pattern of productive specialization.

Recommendation 4.2

The authorities should continue efforts to increase the demand for techno1ogy by the business sector as well as its ability to develop new technologies and effectively apply technologies created elsewhere (Recommendation 3.2). They should aim to place firms at the centre of the innovation process by:

- *Introducing measures backed by adequate resources that target directly the innovative activities of companies;*
- *Developing instruments to strengthen linkages and foster the creation of collaborative networks and alliances (not only between enterprises and knowledge generation institutions but also between other enterprises and customers);*

- *Broadening the policy focus beyond R&D to include aspects such as design and engineering skills and the acquisition and use of technology produced elsewhere;*
- *Addressing financing constraints that limit the ability of the business sector, in particular SMEs, to undertake R&D projects, ensuring that existing grant schemes reach these companies and combining them with other instruments to facilitate the development of technology-based SMEs (Chapter 7); and*
- *Increasing the share of innovative products in public procurement.*

Kazakhstan clearly recognizes the importance of human capital development to enhance the growth potential of the country and create a conducive environment for innovation. However, despite progress, lack of qualified personnel constrains the growth of the private sector, while careers in R&D do not seem to be attractive to the brightest university graduates. Reforms in this area are critical but it will take time to reap the full benefits of current investment, so continued commitment and work in multiple directions is necessary.

Recommendation 4.3

Building on existing initiatives, the authorities should retain a strong focus on education and training in the innovation policy mix. In particular, they should pay attention to:

- *Raising the profile and attractiveness of careers in science and R&D to university graduates and setting up incentive schemes for students to do applied research in state enterprises and private businesses;*
- *The importance of encouraging the study of technical subjects in national scholarships;*
- *The promotion of access to information and use of ICT technologies as an enabling tool;*
- *The need to address specific regional requirements in education and training; and*
- *Understanding of innovation issues among public officers, which could be facilitated by a standard training course on public administration questions related to Innovation and Technological development.*

Structural changes in the economy, and the need to increase the national absorption capacity while facilitating technology transfer, both of which are critical for Kazakhstan, stress the importance of education to meet the increased demand for skills. While it is important to aim for academic excellence at the top universities, it is also essential that skills are improved more widely, addressing the need for different types of workers.

Recommendation 4.4

The authorities should strengthen ongoing efforts to enhance human capital and increase labour force skills, so that they are appropriate to serve the needs of a diversified knowledge-based economy. Practical steps could include the following:

- *Widening further access to higher education, including through the provision of grants to students, while monitoring quality through regular surveys that are widely disseminated;*
- *Disseminating good practices and lessons learned from the experience of elite national universities to other parts of the tertiary education system;*

- *Increasing support to vocational training based on the actual demand by business, and the creation of a system of practices in companies for students in higher education institutions, building on the basis of ongoing pilot initiatives;*
- *Developing a variety of life-long learning opportunities, including schemes that are based at the firm-level. The authorities could consider providing tax incentives and other measures of support to employers to encourage training;*
- *Introducing entrepreneurship education schemes targeting the young, in particular in technology programmes (see recommendation 2.2); and*
- *Facilitating changes in the curricula of universities regarding subjects and courses that are demanded by the business sector but not covered by the compulsory standards determined by the Ministry of Education and Science.*

Kazakhstan is making an increased emphasis on the science base of the tertiary education system. International links have been actively developed. However, it is also important to cultivate linkages among domestic institutions, in order to facilitate the diffusion of knowledge and the exchange of experiences. Closer relations between university and industry would also increase the scope for learning. Robust monitoring mechanisms would contribute to better assess the outcomes of existing initiatives.

Recommendation 4.5

The authorities should strengthen current education initiatives by making an additional emphasis on networking among academics and policy learning. The measures considered could include:

- *Promoting the creation of networks of scientists from different institutions and disciplines, including international exchange programmes, to facilitate exchanges and reduce isolation;*
- *Developing schemes for the temporary placement of young scientists and researchers in companies, which may include financial support to joint projects resulting from these placements; and*
- *Collecting in a systematic manner evidence resulting from these initiatives, which would facilitate an analysis of outcomes to improve future policies.*

Chapter 5

INDUSTRY-SCIENCE LINKAGES AND COLLABORATION IN THE INNOVATION PROCESS

This chapter aims to identify and analyse the existing mechanisms for interaction between research institutions and enterprises. First, it presents the key actors and modalities of their interconnectivity through knowledge demand and supply, including the role of facilitating factors such as framework conditions and intermediating structures. The chapter also assesses industry-science linkages (ISLs) on the basis of a systemic view of the National Innovation System (NIS). Finally, some recommendations are made regarding measures aiming to improve the functioning of the ISLs.

5.1 The evaluation of industry-science linkages (ISLs)

The intensity, diversity and effectiveness of the interactions (linkages) between the main actors involved in the generation and diffusion of knowledge are important factors in innovation performance. They can be of both a formal and an informal nature, which may be difficult to measure. The nature of ISLs also reflects the development stage of influencing factors, in particular, the presence and maturity of markets for science-based innovation, sophistication of communication mechanisms between the actors involved (supported by national ICT infrastructure), industry demand for linkages with the science base (a reflection of the knowledge intensity of production), financing, legal and management system enabling and supporting commercialization activities, sources of funds for public research bodies and their accountability (Figure 13).

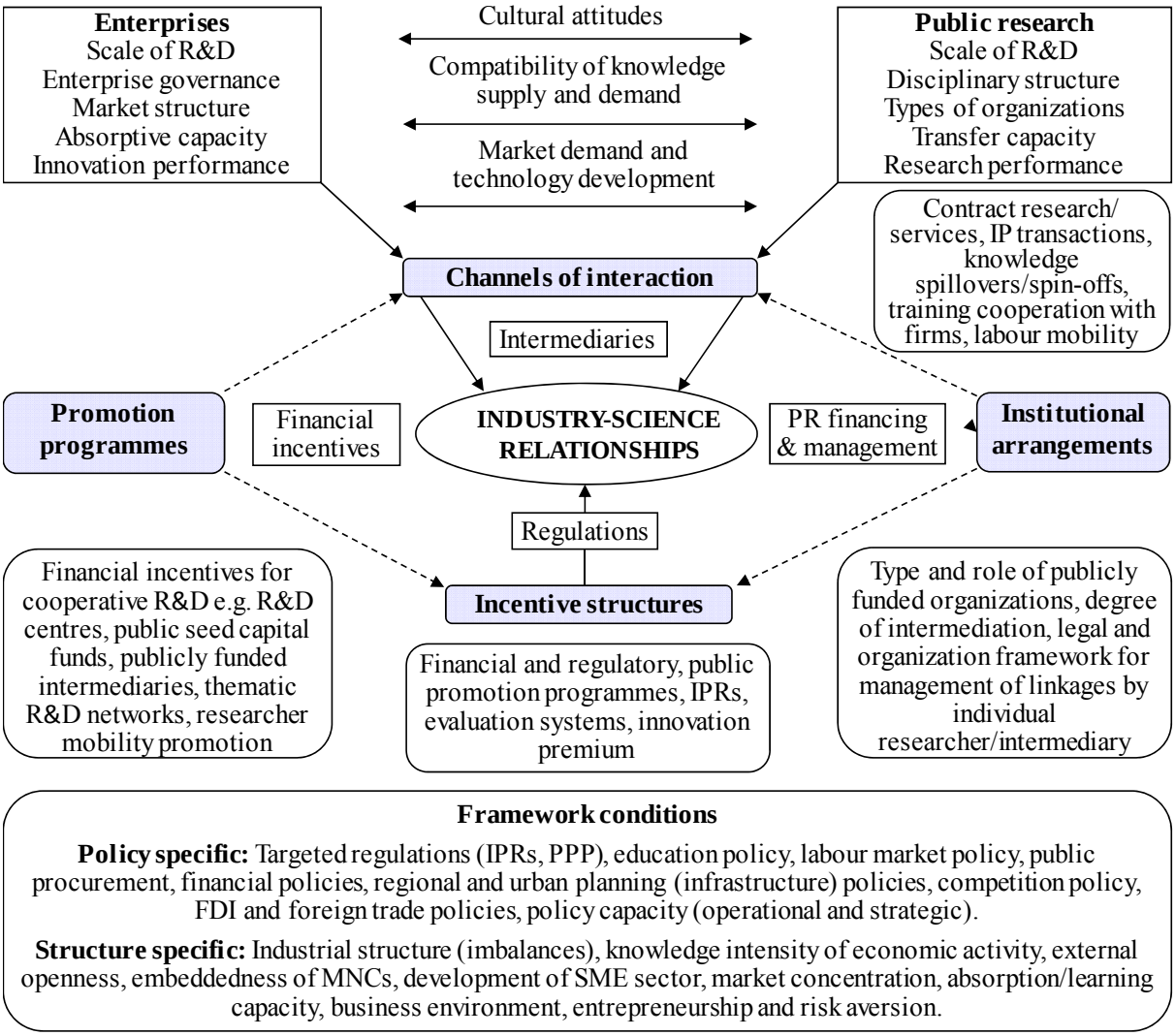
Besides the importance of the framework conditions, the nature of ISLs is crucially influenced by the embedded incentive structure of the national innovation system (and in a broader sense, of the economic and social system as a whole). The importance of country specific incentive structures as determinants of the quality and extent of ISLs is particularly evident when foreign practices are applied in a domestic context. Public policy in Kazakhstan has extensively drawn from international experience in the development of innovation initiatives. However, it is important that the adoption of international best practice takes account of the local context in Kazakhstan, including historic and cultural traditions, institutional settings and framework conditions, within a wider systemic approach. National specificities include, in particular, the prevalence of vertical administrative structures; a largely resource-based economy; the limited role of the SME sector; and generally low knowledge supply and demand intensities, featuring also a persistent mismatch between them.

5.2 Knowledge demand and supply interconnectivity (actors and forms)

This section examines ISLs from the different perspectives of the key innovation system segments and interactions. First, it considers the innovation performance of the business sector, its structural characteristics and intersectoral flows of R&D expenditure. Particular attention is given to institutional and organizational aspects of the innovation system and the mechanisms to support innovation performance. Second, it discusses science-innovation aspects of ISLs related to knowledge supply capacity, which is largely found in the traditional

knowledge producing organizations (R&D institutes and universities). Recent policy initiatives stress both the increasing role of science and education links and the innovation impact of R&D activities.

Figure 13. Industry-science linkages: actors, factors and forms



5.3 Innovation performance and public support to innovative development

Available macroeconomic statistics for Kazakhstan show a generally low degree of innovation activity, both in terms of output and the number of companies engaged in innovation (Chapter 1). Innovation performance varies between sectors and forms of ownership, but the very low numbers of innovative companies reflect a degree of low innovation capabilities across all sectors.

The intensity and density of ISLs are sometimes approximated by monetary flows between the sectors financing and performing innovation activities. The flows indicate to what extent the knowledge producing and exploiting activities are cross-sectoral. The informational value of the available financial data is, however, limited by the informal nature of some ISLs, which

may be based on personal rather than institutional (formalized) arrangements. In Kazakhstan, the structure of technology innovation expenditures and financing indicates the dependence of company innovation activities on own (internal) capacities (97.4% in 2007, 90.7% in 2008),[30] explained by the scarcity or unavailability of external resources. The role of FDI in financing innovation activities remains disproportionately low (0.9% and 3.9% in 2007 and 2008, respectively) in relation to its share of total investment (22.4% and 19.6%, respectively). FDI activities are primarily focused on capital intensive sectors, largely exploiting traditional technology. By contrast, the role of the government is more significant in relation to the financing and implementation of R&D activities, due to the inclusion of fundamental and academically-driven research.

ISLs and policy initiatives

The Strategy for Industrial and Innovative Development 2003-2015[31] set the framework for the Programme of Formation and Development of the National Innovation System 2005-2015.[32] Innovative development is considered as an indispensable part of government industrial policy. However, at this initial stage of policy development in Kazakhstan, innovation seems to be understood as being closely associated to capital intensive industrialization (investment projects).

The programme on the formation of the NIS includes two main priorities – the development of an innovation infrastructure and the formation of an efficient system of linkages between the key innovation actors, including platforms for dialogue and coordination of activities between the government and business sectors.[33]

The support to innovation has not yet been sufficient to offset the dominance of resource-based industries. A new State Programme for Accelerated Industrial Innovative Development 2010-2014 (SPAIID) was approved to promote economic diversification, including through an increase in the share of innovative enterprises to 10 % of the total.[34] The programme specifically targets 12 priority economic sectors, with selective support to be provided to high productivity companies (Chapter 2).

National development agencies were founded in Kazakhstan during the period 2001-2004 in accordance with the Strategy for Industrial and Innovative Development 2003-2015, which seeks to diversify the economic structure from resource-based industries towards higher value added manufacturing. The national development agencies specifically target industrialization, modernization, internationalization and economic diversification, including through innovation related activities. These include the Development Bank of Kazakhstan, whose Development Strategy for the period to 2020 supports economic diversification through the

[30] The largest research and engineering company in Kazakhstan is the Kazakh Institute of Oil and Gas (KING), a subsidiary of JSC National Company KazMunaiGas, although the share of domestic knowledge services in refining and petrochemical projects remains low. When developing technological aspects of projects, foreign companies are often preferred, due to deficiencies in the domestic scientific and engineering base.
[31] Strategy of Industrial and Innovative development of the Republicof Kazakhstan for 2003-2015 (approved by President decree No. 1096 on 17 May 2003).
[32] Programme for the formation and development of the innovation system of the Republic of Kazakhstan for 2005-2015 (approved by Government degree No. 287 on 25 April 2005).
[33] L. Demushkina (2010), Industrial-innovative policy of the state, presentation at the Astana Economic Forum.
[34] State Programme for Accelerated Industrial Innovative Development of the Republic of Kazakhstan (approved by the President decree No. 958 on 19 March 2010).

development of competitive non-extractive sectors and large scale infrastructure projects of national significance (including ICT), as specified by governmental sectoral priorities; the Investment Fund of Kazakhstan; Kazyna Capital Management; Export Credit Insurance Corporation KazExportGarant; the National Export and Investment Agency KAZNEX Invest; and the Entrepreneurship Development Fund DAMU. More targeted support to innovation and ISLs has been provided through the Science Fund, the National Innovation Fund, including the Centre for Engineering and Technology Transfer, and the network of technoparks and business incubators. The strategic role of state agencies is expected to increase over the period to 2020, according to the SPAIID, following the first five-year plan for the period 2010-2014. This institutional framework of support has yet to deliver a noticeable impact on innovation performance, as measured by the share of innovation (knowledge intensive) production.[35]

The innovation support activities of most state development agencies (in particular investment and export funds and banks) are somewhat general in character. In most cases, the innovation impact of their activities is not explicitly considered. Moreover, support to inter-agency linkages, their synergistic effects as well as linkages to the other agents of the national innovation system initially were not assigned high priority in their missions (Chapter 2). However, recent policy announcements envisage changes that would have a significant impact on ISLs (Box 9).

Box 9. Recent innovation policy initiatives with an effect on ISLs

A number of policy intentions were laid down with the authorities in early 2011, which will have a strong impact on ISLs:

1. Modernization of the national R&D base and innovation management through: measures for commercialization of R&D outputs (IPRs) produced with public financial support, participation of key stakeholders (private businesses, science, national holdings and companies) in the governmental policy and decision-making structures in science, technology and innovation (STI), development of systemic and direct industry demand mechanisms for scientific output (reflecting the priorities of the Intersectoral Plan for Scientific and Technological Development to 2020), increasing the share of applied research in the funding of R&D activities.

2. Increased financing of innovation by the extractive industries and the large state companies: allocating 1% of the profits of natural resource-based companies to the financing of science, technology and innovation (STI) activities and the application of their results, as well as initiating or increasing innovation activities in public companies by setting up STI organizations/units.

3. Creation of favourable conditions for innovative development: supporting measures in terms of financing and tax incentives, establishing sectoral centres of production and innovation to improve knowledge diffusion, legislative support for the development and protection of intellectual property rights, support for the development of high-tech and innovative companies, introduction of innovation support measures in the "local content"

[35] S. I. Mendalieva, Activity of the development institutes regarding the provision of financial and investment support to innovative processes, presentation at the Astana Economic Forum 2010.

Box 9. Recent innovation policy initiatives with an effect on ISLs *(continued)*

programme (Chapter 2), elaboration of sectoral plans for the development and implementation of innovations in the medium and long run, elaboration of innovation performance criteria and their inclusion in the evaluation of governmental organizations and public companies.

4. Laying the foundations for an innovative future, largely focused on enhanced management, regulation and effectiveness of the innovation infrastructure (special economic zones, regional technological/ innovation parks or parks of innovation technologies).[i]

[i] Other proposed measures with potential to support ISL development include: promotion of FDI (with appropriate incentives favouring knowledge intensive and non-traditional industries); knowledge diffusion mechanisms (e.g. raising public awareness); investment in skills; and enhanced international cooperation.

Intellectual Property Rights

The current system of intellectual property rights (IPRs) and related institutional arrangements were formally established in Kazakhstan in 1992 by National Patent Office legislation, reflecting the disintegration of the single patent space of the USSR. In the process of building an independent national IPR system, the National Institute of Intellectual Property (NIIP) was established in 2003[36] to fulfil the expert functions of the patent office. NIIP activities include the examination of intellectual applications, and administration of the state register of IPR documents. The institute also organizes training and retraining for IPR specialists. Besides training, education and dissemination activities, a special unit of NIIP was established in Almaty in 2006 to provide consulting services for securing, exploiting and protecting IPRs. So far, however, only annual analytical reports on IPR issues in Kazakhstan are available. External cooperation linkages with the other bodies in the national innovation system responsible for technology transfer and commercialization issues have been somewhat limited.

Table 19. IPR applications and granted protection to national applicants

	2003	2004	2005	2006	2007	2008	2009
IPR applications (national)	1,696	1,756	1,523	1,433	1,644	1,474	1,513
Preliminary patents	1,251	1,287	1,435	1,328	790	1,126	234
Patents	132	128	101	202	129	132	162
Innovation patents	-	-	-	-	5	354	1,167
Utility models	33	34	28	39	42	56	58
Industry designs	66	100	61	59	126	38	81
Trade marks	1,037	707	1,415	1,376	794	1,459	1,239

Source: National Institute of Intellectual Property of Kazakhstan, Annual report, 2009, 2010.

The 2007-2011 Patent System Development Programme, approved in 2006, specifically targeted accelerated examination of applications, including through incorporation into the e-government system. The **innovation patent** is a specific instrument seeking to enhance the

[36] Affiliated to the Committee for Intellectual Property Rights of the Ministry of Justice.

accessibility of patenting procedures for applicants. Since 2007, this instrument has replaced the "preliminary patent", introduced in 2004. The innovation patent in Kazakhstan is issued for three years with the possibility of extension for a further two years. As part of this streamlined procedure, the assessment is limited to an examination of local novelty and industrial applicability (as opposed to standard patent assessments that include the criteria of world novelty and inventiveness). Such a limited form of protection is often preferred by applicants requiring rapid (or parallel) practical implementation of their invention or innovation. In Kazakhstan, innovation patents have been a popular instrument for IPR protection since their introduction, and have been increasingly used by a wide range of innovation entities.[37]

5.4 Forms of ISLs

There are a number of innovation policy initiatives seeking to strengthen ISLs. These include sectoral integration projects through territorially defined pilot clusters, and the formation of regional social-entrepreneurial corporations based on the principle of cooperation between government (public) and business (private) sectors.[38] These two forms of collaboration follow a so-called **cluster approach** to economic diversification, as defined in the government Strategy of Territorial Development (2005). Further ISL initiatives include the strengthening of intra-sectoral linkages at the national level, or locally driven cooperation between innovation agents (universities, technoparks, businesses and R&D institutes).

The **Kazakhstan Cluster Initiative,** approved in 2005[39], defined seven pilot sectoral clusters: metallurgy and metalworking in the Karaganda region (later including the Temirtau industrial park); transport logistics focused on the development of modern infrastructure (including several special economic zones supporting cross-border cooperation activities); the textile industry in South Kazakhstan (including its SEZ) on the basis of vertical integration with cotton producers and processors; construction materials (with a specific industrial zone); food processing in the East and North Kazakhstan regions; tourism with the development of both horizontal and vertical linkages; and oil and gas machinery in the West Kazakhstan region (including technopark Algoritm). Supportive measures for cluster development include: tax and customs concessions; standardization of product/service quality; information support and awareness campaigns; marketing; funding for specific projects; and creation of favourable conditions for cluster development (such as establishment of special economic zones).[40]

Socio-entrepreneurial corporations (SEC) (Chapter 2) are a form of partnership between the public and private sectors, established to support economic diversification and providing an effective system of corporate governance by linking government resources (assets) and entrepreneurial initiative. SECs have operated in all administrative regions of Kazakhstan.

[37] In Australia, a country where a similar arrangement exists, the main users are SMEs.
[38] Related to, but distinct from public-private partnerships (PPP), defined in Kazakhstan as mid- to long-term partnerships for provision of socially significant work and/or services relating to the design, financing, construction, reconstruction, rehabilitation, operation or maintenance of facilities (Kazakhstan Public-Private Partnership Centre). Recent legislation includes the Law on Concessions (7 June 2006), followed by a number of subordinate normative and legislative acts. There have been five PPP projects in the transport sector, with around 15 more under consideration (mainly in transport, but also in the energy, education and health sectors).
[39] On the approval of plans for the creation and development of pilot cluster in priority sectors of the economy (approved by Government decree No. 633, 25 June 2005).
[40] M. Asylbaev and N. Kurmanov (2010), Instruments for regional development: practice in Kazakhstan, presentation at the Astana Economic Forum 2010.

Developmental priorities have included the creation of competitive, export-oriented production capacities based on a government-business partnership, the development of a favourable environment for investment, innovation in the small business sector and the implementation of business projects, with revenues used to address regional social problems.[41]

SECs were intended to address diverse developmental tasks and objectives, acting simultaneously as a mechanism for commercial projects, irrespective of political priorities, as well as an instrument for the development of non-extractive industries.[42] Although a comprehensive evaluation of SEC activities is unavailable, partial information reveals that the ambitions and aspirations have not been fulfilled so far. In 2010, all SECs were transferred to the regional administrative authorities and subject to a process of reorganization, while their role in the system of regional economic development remains undefined.

The **30 Corporate Leaders of Kazakhstan** initiative, launched in 2007, represents another form of partnership between the government and (private) business sectors. Its focus was the formation and development of selected non-extractive production capacities, in particular investments by leading companies or large-scale, cutting edge investment projects. These would be competitive in the global economy thanks to robust, vertically integrated value added chains. The government was to provide up to 50% co-financing, while taking a maximum 25% plus one share in the projects. Selected projects were eligible for sovereign loan guarantees, as well as tax and customs incentives.

5.5 Commercialization and technology transfer

Development of the innovation infrastructure began in 2003 with the establishment of the Centre for Engineering and Technology Transfer, merged in to the National Innovation Fund in 2011, having founded the first technoparks in 2004. Until 2009, the technopark network included a total of seven regional and two national entities. Business incubation services have been included since 2010. The National Innovation Fund created three design bureaux in 2009-2011 (transport engineering in Astana, mining equipment in Ust-Kamenogorsk and oil and gas equipment in Petropavlovsk), and a fourth (agricultural equipment) is currently being set up.[43] Although technoparks were formally intended to develop all types of ISLs, their actual knowledge intensity and impact on the diffusion of innovation has been somewhat limited. Their facilities have been used largely for business centre style activities (providing administrative support and consulting services, office rentals, laboratories, lecturing and exhibition facilities), and a recent evaluation concluded that technopark firms in Kazakhstan were not significantly more innovative than other firms.[44] Key problems have included: weak or non-existent linkages with knowledge producing institutions, i.e. universities and research

[41] N. Kuchukova (2010), Sources of financing for the industrial-innovative development of Kazahstan, presentation at the Astana Economic Forum 2010.
[42] G. Suleimenova (2010), Sotsial'no-predprinimatel'skie korporatsii: regional'nye instituty razvitiya v Respublike Kazakhstan, Zhurnal institutsional'nykh issledovanii, vol. 2, pp.72-80.
[43] Design bureaux in Kazakhstan, as approved by government decree No. 1131 of 26 November 2007, were inspired by the Soviet system of external, sector-specific technology services to meet the demands of production companies. Objectives include the development of high technology intensive production activities.
[44] S. Radosevic and M. Myrzakhmet (2009), Between vision and reality: Promoting innovation through technoparks in an emerging economy, Technovation, 29 (10), pp. 645-656.

& development institutes in the technoparks;[45] insufficient financial resources for technology commercialization; lack of expertise on the implementation of innovation projects; low levels of general management and innovation management capabilities; and non-effective stakeholder interaction mechanisms (Chapter 6). The new development programme on regional technoparks acknowledged these shortcomings, which are being addressed by various measures.[46]

Technology transfer from overseas through the exploitation of patents and licenses is considered a key part of Kazakhstan's catch-up strategy due to underdeveloped domestic knowledge capabilities. Government support will be available for both the application of foreign IPRs (so far only 4% of companies obtain technology through these channels), as well as to support the patenting procedures of domestic inventors abroad. The system will be operated through Kazakhstan's technology transfer network (including selected technoparks, and STI centres in chemistry, biotechnology and nuclear technologies), to support cooperation between domestic entities, as well as between foreign and local partners. It will therefore provide a mechanism to help match technology supply and demand, whilst also providing support to the commercialization projects of R&D institutes and companies. The range of services offered by the Centre for Engineering and Technology Transfer (which is being merged with the NIF) includes: development of specialized infrastructure (commercialization offices);[47] reinforcement of the legal basis for IPRs in Kazakhstan; provision of grants for commercializing front-end technologies; support for international cooperation between domestic and foreign R&D institutes and businesses in research and commercialization activities; and provision of innovation management expertise. Design bureaux should play an important role, in particular through the customization and adaptation of new technologies to local needs. More specifically, based on bilateral government agreements, a number of technology transfer centres are being initiated in Kazakhstan with the participation of foreign companies and knowledge-based institutions (Chapter 8).

A Technology Business Incubation Programme was launched in 2010 and is to be implemented within the existing technoparks in Astana, Karaganda, Almaty, Ust-Kamenogorsk, Uralsk and Shymkent. Residents will be offered a range of services to support their project's development, including training in innovation management and business planning, the search for suitable investors and partners, formulation of a marketing strategy, and product adaptation to specific client needs. Support will be provided to innovation projects selected annually by open tender. The business incubation programme is part of an envisaged new model of regional technoparks, under which technoparks become regional centres of innovation support, playing a core role in the development of regional innovation systems and, in the future, implementing the whole range of policy instruments supporting innovation. It remains to be seen, however, whether the support infrastructure would have the capacity to meet the demanding requirements of innovation technology incubation (Chapter 6).

[45] A. Gol'tsev and E. Zhumagazinov (2010), Tekhnopark "Altai" i perspektivy ego razvitiya, Nauka i innovatsii, 8 (90); T. Ipalakov and A. Gol'tsev (2008), Formirovanie regional'noi innovatsionnoi sistemy v Kazakhstane, Innovatsii, 12.
[46] Development plan of the Centre for Engineering and Technology Transfer for 2010-2014.
[47] In 2011, nine pilot commercialization offices are set to open (seven at universities and two at R&D institutes), based on the results of a tender organized by the National Innovation Fund.

5.6 Science and innovation (knowledge supply)

The linkages between R&D organizations in Kazakhstan, including both institutes and universities, are quite diverse, and include examples of more or less formalized networks, consortia or holdings. The diversity of linkages is further heightened by differences in the institutional backgrounds of the individual network entities. While the university sector retains its traditional ties with the Ministry of Education and Science, the R&D organizations have lost their historical umbrella in the form of the Academy of Sciences. The knowledge producing organizations in Kazakhstan underwent turbulent restructuring in the 1990s and their capacities decreased markedly. Financial constraints are reflected in the low overall share of R&D (as well as education) expenditure in Kazakhstan's GDP. The surviving organizations have had long-standing difficulties in raising financing, and face uncertainty regarding future development prospects (Chapter 4).

Current government policy priorities require knowledge producing entities to improve their innovation performance.[48] On the one hand, universities are due to be ranked in terms of their research or technological intensities, while research organizations are expected to be required to generate more results with commercialization potential. Research organizations and universities in Kazakhstan are therefore expected to play a wide range of roles (besides a contribution to regional innovation systems), each of which requires specific management and professional knowledge and skills. Such ambitious policy objectives will require a high degree of stakeholder and public support. The problem of knowledge supply and demand mismatch needs to be addressed in a systematic way that takes into account the allocation of competencies between the Ministry of Education and Science and the Ministry of Industry and New Technologies, using effectively the coordination mechanisms envisaged in the new Law on State Support to Industrial Innovative Activity, adopted in January 2012.

There are a number of recently established supporting structures and/or programmes that support linkages between scientific and innovation activities in Kazakhstan. However, the role of the business sector remains relatively limited.

The **National Science-Technology Holding 'Parasat'** represents a diverse structure of eight R&D organizations, two organizations providing technology brokerage services, technological expertise and patent strategy (the Science-Technical Library and the National Centre for Science and Technology Information), and a National Centre for Informatization in Education. It also includes the **Science Fund,** which provides (co)financing of R&D activities, together with implementation of their results. Initially, the Science Fund was established as a self-standing entity, and was integrated into Parasat in 2008. Projects supported are to focus on applied and experimental R&D and innovation activities. The fund considers its mission to be the linkage of fundamental and applied research, and the support of partnerships between the government and business sectors (including average commercial participation of more than 30%).[49]

[48] The share of universities with established innovation capacities, including R&D laboratories, is expected to increase from 12% in 2008 to 39% in 2011, with the share of faculty participating in R&D activities from 10% to 20% (Strategic directions for the activity of the Ministry of Education and Science of the Republic of Kazakhstan for 2009-20011, 17 June 2008).

[49] The National Info-communication Holding Zerde was established in the same year as Parasat, with a specific focus on development of the IT sector by supporting e-Government activities, and ICT market structure. Its initiatives include centres for e-Commerce and for the informatization of financial systems, the companies

A **Technology Commercialization Project** in Kazakhstan, financed by the World Bank over the period 2008-2012, seeks to improve the scientific performance and commercial relevance of research performed by inter-disciplinary teams of scientists selected through a transparent and competitive process.[50] The project targets existing segments of national R&D capacity with potential, after restructuring, to produce internationally competitive scientific outputs (knowledge supply), linked to the national and foreign technology market (knowledge demand). Close linkages between the scientific institutes and private businesses are strongly encouraged by requiring compulsory co-financing arrangements (up to 25%). R&D quality is to be supported by international cooperation linkages, as well as by access to the latest laboratory equipment and the attraction of young, talented scientists. A newly established technology commercialization office is expected to support efforts to connect with markets. The more quantifiable objectives of the project are defined through a set of output indicators, such as publishing activities and the number of licenses sold.

The knowledge-intensive institutions of Kazakhstan participate in various forms of cooperative structures, usually with a **specific disciplinary orientation**. They form associations, holdings and centres on the basis of linkages with varying degrees of formality, but typically underpinned by stable, long-term collaborative arrangements. Moreover, the knowledge-intensive institutions initiate new external links to (potential) technology users with varying degrees of intensity. No systematic evaluation, however, is available as to the quality, extent or impact of the established links and associated initiatives. Legally, so-called innovation-education consortia are defined as agreements that pool resources between universities, R&D organizations, and production companies to undertake initiatives based on R&D activities and technological innovations. Box 10 provides examples of these consortia.

Box 10. Innovation consortia

The consortium **Biotechnology** (established in 2006), includes two R&D institutes, the National Biotechnology Centre (also functions as a national laboratory for collective use in biotechnology), and the Centre for Biological Research, whose leading scientists teach at biotechnology faculties in a number of universities. The **Corporate University** is more business-oriented, established around Karaganda State Technical University (KSTU) and linking around 50 enterprises. The KSTU also hosts an engineering laboratory, specialized in the extractive and metallurgical industries. There are examples of cooperation arrangements developed around leading universities that include segments of the innovation infrastructure. The so-called **university-technopark** model is represented by the close links between the East-Kazakhstan State Technical University named after D. Serikbayev and the Altai technopark (established 2004), for which future aspirations include development of a high-technology, special economic zone. The university also hosts an engineering laboratory in nanotechnology and new materials. The **Agrarian science-production consortium** is to be developed around the Kazakhstan National Agricultural University (with its own technopark, extension and commercialization capacities), and KazAgro, the national holding in the agriculture industry, and will be linked to a number of SECs. The university also hosts an engineering laboratory in nano-biotechnology and ecology.

Kazsanets, National Information Technologies and Kazkontent, a 50% stake in the International University of Information Technologies, and a majority share in the National Processing Centre.

[50] N. Kapil (2011), Kazakhstan – Technology Commercialization Project: Implementation status results report 05, World Bank, 21 February 2011.

Domain-specific laboratories should play an intermediating role in the interaction between science and innovation, simultaneously improving the quality and capacity of the R&D base. These laboratories operate in the existing knowledge-intensive institutions (mostly universities) as national scientific laboratories for so-called collective exploitation (in the fields of nanotechnology and new materials, biotechnology, nuclear and renewable energy, coal and metallurgical extraction, information and space technology), and as engineering laboratories (15 in total, each specializing in one of the five priority fields).[51] These laboratories are eligible to receive state support to improve their financial and human resource capacities, but should also raise funds from external demand for their services. Following an evaluation of their activities reporting some positive outcomes, the laboratories were given more specific development directives in 2011, including stimulation of intensive linkages with external partners and supporting the implementation of R&D outputs.

The activities of the laboratories are to be wide ranging and cover all stages of the innovation process, including the diffusion and exploitation of new knowledge, commercialization of R&D outputs and attraction of private investment into high-tech fields. Cooperation should involve both other knowledge producing institutes (domestic and international), and technology users. Besides R&D producing activities, the application, testing, design and other technology-oriented services are to be provided. The laboratories are also expected to play an important role in attracting and developing highly skilled human capital through post-graduate and doctoral programmes, thus strengthening linkages between education and science.

The National Centre of Science and Technology Information seeks closer interaction between science and innovation. The centre collects and publishes information concerning knowledge production, based on dissertations and the outputs of R&D programmes financed from public resources. It then provides an overview of the patentability of R&D outputs, collects information on technology demand and provides so-called innovation brokerage services. While some expertise has been developed to make information about knowledge supply in Kazakhstan more accessible to users, actual implementation capacities remain insufficient. The National Centre of State Scientific and Technological Expertise is due to carry out an evaluation of R&D activities in Kazakhstan, which has been so far lacking. However, the scope of this exercise is apparently limited to the traditional R&D producing institutions.

Science-production groupings were established largely on a sectoral basis, in the form of joint stock companies. They include R&D organizations, laboratories, and other knowledge-intensive institutions. The concentration of sectoral knowledge capacities (and their financial resources), is motivated by a desire to strengthen the science and technology infrastructure. This should increase performance in terms of knowledge production, its focus on policy development priorities and technological needs/demands, and improve practical implementation and commercialization of R&D results (innovation impact). Moreover, an effective system of sectoral knowledge production and application should increase attractiveness for external investors and partners in international cooperation projects. Besides R&D activities and implementation of their results, the links to tertiary education capacities (i.e. science-education linkages) will be intensified.

Examples of sector-specific groupings include mainly traditional industries, following both sector-specific and so-called intersectoral policy priorities for scientific and technological

[51] Two universities in Almaty host both types of laboratory: Al-Farabi KNU, and K.I.Satpaev KNTU.

development.[52] Their organizational structures and institutional backgrounds are quite diverse. The largest scientific and technical grouping in the country is KazAgroInnovation (KAI) established in 2007, including the Centre of Transfer and Commercialization of Agro Technology established by KAI in 2009, and a special department for extension services on knowledge diffusion. The grouping includes more than 20 subsidiary R&D organizations located all over the country in the fields of agriculture, exploitation of natural resources, mechanization of agriculture, as well as sectoral economics and analysis.

Other forms of sector-specific groupings are organized as institutes affiliated with the related leading industry conglomerates, such as the above mentioned Kazakh Institute of Oil and Gas within KazMunaiGas.[53] KING is to provide the basis for the development of the new sectoral centre of advanced technologies.[54] The National Centre on Complex Processing of Raw Materials is affiliated with the Ministry of Industry and New Technologies, and represents the country's largest scientific and technological capacity in the mining and metallurgical industry. The centre provides a wide range of services, from fundamental and applied research to development and implementation of new technologies and equipment.

5.7 Learning from systemic evaluation: the role of ISLs

The strength of a National Innovation System (NIS) is determined by both the capabilities of its main actors and the quality of linkages between these different components. In Kazakhstan, weak or underdeveloped linkages remain a factor constraining the effectiveness of the NIS.

While there is a general awareness of existing weaknesses in the national innovation system, there is no regular and publicly available analytical assessment of the NIS on the basis of a standardized methodology that would allow for international comparisons, while taking a systemic perspective. Domestic capacity for appropriate evaluation, taking account of both systemic and qualitative aspects, are limited, which constrains effective policy formulation and implementation. Another impediment for such a critical assessment is the prevailing vertical direction of information flows in the managerial and analytical structures of Kazakhstan's national innovation system, together with the lack of connectivity of their individual components (Chapter 2). While there is local analytical capacity, it has yet to be fully exploited to provide a comprehensive assessment. Moreover, besides the challenge posed by departmental and sectoral divisions, data collection functions are often separated from their analytical processing, or the required information is divided between a large number of sources.

Related to the above, and due to country-specific and precise institutional details, the learning curve in terms of policy capabilities and practices has been somewhat costly, with many different initiatives being launched and frequent personnel changes. This pattern has been largely motivated by frustration with the inherited innovation infrastructure and policies failing to meet expectations. In the absence of a systemic evaluation, the ability to

[52] Government decree No. 1291 of 30 November 2010 on the Approval of the Intersectoral Plan of the Country's Scientific and Technological Development until 2020.
[53] The latter also includes the Kazakh-British Technical University, two more specialized R&D institutes and the "Naukograd" project, based on a model that concentrates the capacities along the whole innovation process, through to implementation of results.
[54] The planned integration of sector-based knowledge capacities is to take place in the three leading traditional industries to form so-called mining-metallurgy, agro-industry, and oil-gas complexes.

learn from failures and to place initiatives in an appropriate institutional, developmental and structural context is limited. Recent initiatives, including the reporting mechanisms envisaged in the new Law on State Support to Industrial Innovative Activity, acknowledge the importance of monitoring and assessment mechanisms and widen the scope for strengthening current attempts to evaluate public initiatives.

Systemic weaknesses are especially visible with respect to ISLs, as the latter require the active involvement of the various stakeholders, often without easily compatible institutional backgrounds or collaborative cultures. While there are examples of wide-ranging forms of ISLs operating in Kazakhstan on the basis of varied institutional arrangements, information on their actual functioning is scarce. More specifically, due to a rapidly changing institutional and organizational context, it is difficult to track the developments of most ISLs, from initiation to their current state, and assess them in relation to past and newly proposed policy strategies. There is a complex governance structure in the domains of research, development, tertiary education, technology and innovation, including the division of competences between the two leading ministries (on science/education and industry/technology), and the influence of other strong sectoral/government agency players. This may result in overlaps and/or lack of consistency in the programming proposals regarding ISLs, and especially, in an incomplete coverage of the innovation process (including its broader framework conditions). Some coordination structures are already emerging (Chapter 2) that could facilitate more consistent actions and encourage collaboration.

Until the present time, it has been difficult to achieve synergies in ISLs, partly due to an incomplete systemic matching of the complexity and peculiarity of the innovation processes in the NIS. These processes are often viewed as a sequence of segments (from fundamental research through to implementation), several of which must often be carried out by the same type of organization. For example, the tertiary education sector and other knowledge-intensive institutions are expected to undertake a wide range of functions. These range from R&D activities, as evaluated by citations in international journals, and capacity to produce patentable results, transfer and commercialization of technology, while contributing to the economic and social development of their regions and/or industries. Each of these activities, however, requires specific skills, infrastructure, facilitation and intermediation capabilities, and, last but not least, incentive schemes to ensure they operate efficiently and sustainably driven by their own dynamics.

The generally weak innovative performance of Kazakhstan's business sector, of both domestic and foreign origin, represents a key limiting systemic factor for the development of knowledge linkages, as it contributes to a generally low demand for knowledge. Consequently, in the absence of robust demand for knowledge, it is difficult to expect the emergence of strong and sustainable ISLs. Moreover, the absorption of large shares of the high quality factors of production by low knowledge intensity industries, most notably the extractive sectors, places other sectors at a disadvantage, and further cements an unfavourable economic structure with low levels of knowledge demand. The resulting vicious cycle poses a great challenge for policymakers seeking economic diversification. At the same time, the revenues extracted from resources make possible the undertaking of ambitious policy measures. The main challenge remains the precise targeting of such measures and the efficient channelling of the resources used.

Knowledge producing and processing sectors and actors so far remain largely isolated from one another, and their activities are structurally mismatched. This may be explained by the lack of incentives in the business sector to innovate, as innovation is often not seen as necessary to maintain or develop competitive advantages. In addition, the commercial orientation of public R&D capacities (knowledge supply) remains limited. This vicious cycle seems to have locked the national innovation system into a suboptimal, low knowledge-intensity equilibrium. The economic activities with low and medium-low knowledge/innovation intensity generate the bulk of total value added, using imported technology as well as human resources that have often benefited from been educated abroad.

The SME business sector in Kazakhstan is weak and has low knowledge intensity, and is therefore unable to play the role of a high-growth innovative segment. Given these characteristics, the reaction of SMEs to government innovation-support initiatives has been so far rather limited. Domestic SMEs operate largely in market niches with rapid return on investment, notably non-tradable economic sectors such as real estate, wholesale and retail trade, local construction and local services.

Some recent policy proposals[55] reflect the perceived weakness of underdeveloped ISLs, especially the problem of low knowledge demand combined with insufficient generation capacity of knowledge production outputs (knowledge supply). More specifically, these proposals include measures to enhance the incentive structure through legal changes to the IPR system to increase the benefits of commercialization for inventors (where public funding has been provided). The problem of knowledge/innovation supply and demand mismatch, however, is still not approached in a systemic way. The proposed individual measures do not seek to exploit synergy effects, and the formation of a system of evaluation, or at least a more sophisticated, horizontal analytical capability, has not yet fully emerged. This means that the capacity to make a long-run assessment has not yet fully emerged and, despite the formal presence of a number of the usual ingredients and mechanisms related to ISLs, further progress is required.

The Government Programme on Education Development for 2011-2020 outlines some key causes of the weak linkages between education, science and production in Kazakhstan. These include: intersectoral barriers between the universities and R&D organizations; excessive administrative burden in the educational process and the absence of economic incentives in the business sector to invest in R&D and innovation activities. Proposed measures include the establishment of sectoral business incubators, technoparks, and commercialization centres at selected universities, and building sectorally focused (concentrated) R&D and innovation capacities. The development of innovation support infrastructure, including special economic zones, and of sector specific, integrated capacities is considered a key measure in improving innovation performance in the strategic programme of the Ministry of Industry and New Technologies. However, it remains to be seen whether and how these intermediary and knowledge producing structures will work more effectively than those already in operation (Chapter 6).

Weak or missing ISLs are widely perceived in Kazakhstan as one of the key impediments to the development of a well-functioning National Innovation System. Improvements in this area need to target an interrelated set of interventions, given the complex and systemic

[55] Plan of measures for the control of implementation of the protocol of the enlarged session of the government with the participation of the President of the Republic of Kazakhstan of 17 April 2011.

nature of ISLs, while reflecting the peculiarities of the national innovation and economic systems. At the same time, it is necessary to improve markedly the knowledge and organizational capacities of the innovation stakeholders, including their willingness and motivation to interact. Legal changes may improve the framework conditions, but these alone will not make economic agents more innovative or knowledge producers more entrepreneurial. Other changes would be required to strengthen those components of the NIS that are necessary to match continuously the supply and demand for knowledge.

A developmental state policy may specifically aim to create those components that are weak or missing in the current system. The industrialization strategies of some South-East Asian countries provide examples of both good practices and lessons learned from past experience. Specific institutional and economic conditions have a bearing on the success of these policies. Kazakhstan's resource-based economy makes factor re-allocation in favour of new industries extremely challenging. It requires a long-term perspective, strong commitment and a pre-planned exit strategy to ensure that the system becomes self-sustaining, with the state role gradually diminishing in favour of a market-based coordination mechanism.

5.8 Recommendations

Improving the innovation impact of industry-science linkages (ISL) will require coordinated policy actions at all levels of the innovation system, employing a wide range of policy instruments as part of a systemic, comprehensive approach. ISL policy must reflect the specific characteristics of innovation agents on both the supply and demand sides of knowledge production and use. Policy support must be tailored to the specific context of Kazakhstan. Improved needs assessment would provide the basis for informed policy decisions.

Recommendation 5.1

The authorities should consider conducting an ISL mapping and evaluation exercise reflecting both international best practice and the specifics of the national innovation system. The main objectives of this exercise could be to:

- *Identify bottlenecks and barriers, in particular concerning the interaction of actors from different institutional sectors and their motivations;*
- *Raise the attractiveness to private entities of participating in government financed projects or cooperation arrangements;*
- *Provide an independent evaluation of existing experience in ISL development and their support, based on a qualitative field survey of actual achievements and failures; and*
- *Provide recommendations for further concrete policy actions to address the above issues.*

The promotion of ISL requires a good understanding of the capabilities of innovation stakeholders and the impact of policies. Support measures should take as a departure point existing capacities and needs, attempting to accommodate the support provided to the requirements of their beneficiaries. Areas with a particularly large impact potential or those that are considered as critical barriers impeding progress should be specifically targeted. This defines a complex agenda of intervention that should be founded on a thorough

analysis of the existing situation and requires specific instruments. The design and implementation of effective interventions targeting ISL requires a good knowledge of the potential of the existing system, the driving forces of interactions among innovation stakeholders and focused policy actions.

Recommendation 5.2

The authorities could review existing policy design mechanisms with a view to raising the efficiency of the interventions targeting ISL and boosting their positive effect. This would imply the widening of the scope of horizontal policies and instruments at the expense of the narrowing of vertical ones. Related measures could include:

- *Conduct an annual cross-sectoral evaluation of ISL, within the context of the overall national innovation system (NIS). This evaluation, which could be linked to the annual evaluation of the NIS carried out by the NIF, would combine self-assessment of the key organizations and institutions (including intermediaries) and their activities and field enquiries, at a level of disaggregation sufficient to reflect performance differences. The evaluation should, in particular, seek to identify what motivates and what hinders motivations and linkages among innovation stakeholders;*
- *Collect not only quantitative but also qualitative indicators, in particular, leading to the compilation and dissemination of good practices. Use the evaluation results to differentiate the support provided and better tailor the expertise offered to the needs of clients;*
- *Introduce horizontal policy instruments that specifically target ISL, such as the planned technology platforms, and modify existing ones to include eligibility criteria related to ISL activities and outcomes in ongoing innovation-related programmes;*
- *Put in place horizontal actions targeting young knowledge-based small companies, which are disadvantaged but have a high potential for linking science and markets, and to the development of innovative networks and local industry clusters (see recommendation 3.3 and 4.2); and*
- *Introduce measures to increase knowledge transfer capacity, in particular, by promoting effective intermediating services and skills, including both the external provision of these services and initiatives to encourage internal development.*

Intellectual property rights (IPR) create basic incentives for the commercialization of research outputs and the development of ISL. The importance of these incentives is particularly high given the underdevelopment of knowledge entrepreneurship in the country. Despite some positive steps in this direction, there is still considerable potential to enhance the role of IPRs in Kazakhstan's innovative development. In particular, the low capacity of knowledge institutions to deal with IPR issues is a barrier to innovation.

Recommendation 5.3

The authorities should aim to strengthen the role of intellectual property rights as a driver of the country's innovative development by:

- *Clearly defining the options for transferring of ownership of publicly funded research results from the state (government) to the (public or private) agent performing the research, down to the level of the individual inventor;*
- *Establishing clear incentives for innovation by protecting the rights of researchers and scientists, while creating favourable conditions for the creation of firms based on the results of their research;*
- *Providing precise guidelines that allow knowledge organizations to understand the opportunities and limitations of IPRs and offer guidance on how to deal with the different options. Based on this, organizations would be able to develop their own intellectual property guidelines, providing clear and strong incentives to the inventor;*
- *Facilitating preliminary IPR evaluation in an accelerated regime. Model applications and contracts covering a range of situations should be made available; and*
- *Using the information resulting from the IPR application process to improve understanding of the effectiveness of innovation support initiatives and overall innovation performance.*

Public education and research institutions in contemporary national innovation systems are asked to perform a variety of roles. Although these may be all-important for the performance of the national innovation system, there may be conflicts between different goals that need to be managed. Public education and research institutions in Kazakhstan are still not well equipped to meet so many different expectations.

Recommendation 5.4

The authorities should consider introducing specific measures to develop the capacities of public education and research institutions to perform efficiently their role in the national innovation system, in particular, by:

- *Identifying the capabilities of public education and research institutions to perform different functions (education, scientific, entrepreneurial and mediating) in a realistic way that is based on current strengths;*
- *Introducing criteria in the evaluation of knowledge producing organizations that reflect the different achievements expected from them. In addition to traditional indicators on research and education, these could also include the measurable effects of external linkages, commercialization and technology-transfer activities, academic entrepreneurship and others; and*
- *Formulating a development plan for public institutions to reinforce ISL, based on an analysis of the starting level, the identification of strengths and weaknesses of existing links and current and potential partners. Progress in improving ISL should be part of the overall evaluation of each institution and could also be linked to access to external funding. The business sector should be involved in the development of these plans, which would include advice on how to form innovative alliances and strategic partnerships.*

Chapter 6

INNOVATION SUPPORT INSTITUTIONS

This chapter examines the various innovation support institutions existing in Kazakhstan, including science parks, business incubators and technology transfer centres. It considers the rationale for the creation of such institutions, the public initiatives developed so far, the outcomes achieved and the appropriate indicators of success for such initiatives. The chapter also discusses the role played by these support institutions in the implementation of innovation policy and suggests some recommendations to improve their performance.

6.1 Institutional and policy framework

The authorities in Kazakhstan have for some time recognized the need to promote economic diversification by encouraging the production and export of goods and services that are more knowledge intensive. This is in line with the prevailing view regarding the direct impact innovation has on the performance of firms.[56] To achieve these policy aims, a number of institutions have been created to support knowledge creation, its diffusion into the business community, and the capacity to absorb and make use of this to drive successful commercialization of research.

The National Innovation Fund (NIF) was established in 2003 with a mission that included supporting the development of technology intensive, innovation-led small and medium-sized enterprises (SMEs) and developing markets for these companies. The Centre for Engineering and Technology Transfer (CETT), integrated into the NIF, aimed to contribute to economic development through innovation based on local sources of technology. Strategies to achieve these goals included, among others:

- Establishing a number of design bureaux to provide a central resource for helping SMEs and particularly those in the manufacturing sector to develop and deploy technology to improve their efficiency;
- Establishing a number of science and technology parks to support knowledge and technology-based SMEs;
- Providing suitable locations for attracting inward investment; and
- Supporting these investments with the necessary complementary public funding.

The different innovation-related programmes and strategies adopted in recent years (Chapter 3) are broadly concerned with improving the business environment through investment in different types of infrastructure. They also create funding streams to support development of the skills and technology needed to drive innovation in existing companies, as well as the formation of new SMEs by contributing to upgrade human capital and technology needed to create new market "niches".

[56] OECD and Eurostat, joint publication (2005), The Measurement of Scientific and Technological Activities, Oslo Manual, Guidelines for collecting and interpreting innovation data, Third edition, Paris, OECD.

The authorities place strategic value on attracting inward investment involving the transfer of new technologies into the domestic economy, as well as on investing in international companies as a means of accessing new technologies with potential for use in Kazakhstan. In relation to the latter, the NIF has created a number of venture capital (VC) funds and invested in some foreign funds to support this internationalization (Chapter 7).

The **Science Fund** was established in 2006 and is active in ICT and space technology, nanotechnology and new materials, biotechnology, renewable energy technology and nuclear. The Fund offers loans to scientists planning to set up a company or sell the results of their research within a three to five year period. Funding ranges from around US$50,000 to an upper limit of US$2 million. 11 projects have been supported so far; by mid-2011, three of these started repayment of the funding provided.

A new government agency KazNex was established in February 2008 to attract FDI and assist national companies in export markets. In addition KazNex also helps other institutions to support export-related activities. This new agency complemented an existing network of development-focused organizations, including the Development Bank of Kazakhstan, the Investment Fund of Kazakhstan and the DAMU Fund.

In 2010 the Kazakhstan Industry Development Institute (KIDI) was established to support research on theoretical, methodological and practical issues facing the industrial development of the country. Some of the work by the Institute has focused on the development of industrial zones and clusters; stimulating inter-industry cooperation; diversification of production, and the creation of methodologies and practical toolkits for estimation and monitoring of industry development, among other topics.[57]

A National Agency for the Development of Local Content (NADLoC) was created in 2010. The objectives of this Agency are to help domestic producers improve their competitiveness by increasing the percentage of local content in goods, works and services sold on the domestic market. Part of this work involves developing public policy to support this ambition and to engage with external agencies and international organizations to advance this goal, including through technology and know-how transfer.

Innovation policies have been a priority in Kazakhstan over recent years. A number of programmes have been adopted with an impact on factors influencing innovation and targeting the performance of firms, in particular the State Programme for Accelerated Industrial Innovative Development 2010-2014 (SPAIID)[58] and the Business Roadmap 2020[59]. The Productivity 2020 programme, which was launched in April 2011, targets companies directly. The themes underpinning this new programme include: support for improving business processes; supporting companies in order to both accelerate and lower the cost of innovation[60] by assimilating new ideas that encourage internally-generated innovation, and providing enterprises with relevant information on which to base business decisions. Since the

[57] http://eng.kidi.kz/faq/#v11
[58] A Resolution to the Decree of the President of the Republic of Kazakhstan dated 19 March 2010 No. 958 on the State Programme of Accelerated Industrial-Innovative Development of Kazakhstan for 2010-2014 and Repeal of Certain Decrees of the President of the Republic of Kazakhstan".
[59] http://www.minplan.kz/economyabout/264/
[60] http://caspionet.kz/eng/business/Kazakhstan_quadruples_funds_for_innovation_grants_1309924112.html

adoption of the SPAIID, all the national institutions associated with economic development have been directed to support innovation-intensive projects.

6.2 The innovation environment

A number of domestic and international assessments have highlighted the relatively weak potential for commercialization of the results of much of the publicly funded R&D in Kazakhstan.[61] The government recognizes the need to prioritize the stimulation of greater demand for innovative technologies from domestic companies, and seeks an increase in business R&D from the present low levels. Current reforms in the knowledge-generation sectors and new incentives (Chapters 3 and 4) seek to address this situation.

A characteristic feature of regions that regularly produce innovative companies in countries that are considered as innovation leaders is a vibrant university research environment. University-based research programmes are fertilized by the inflow of new people and ideas, creating the necessary environment for experimentation. Initiatives to develop this important component of the innovation system in Kazakhstan include the creation of Nazarbayev University, which opened in August 2010, the selection of further universities from the top public institutions to develop as research universities, and the decision to relocate the Kazakh-British Technical University (KBTU) to Alatau Innovation City. The KBTU is also aspiring to build strong working links with the Oil and Gas Research Institute once this relocation is complete. Some other universities are taking the initiative locally, and recruiting staff that are collaborating in EU-funded research projects, or working with international groups in South Korea, United Kingdom, Germany, United States, Russian Federation and Japan**.**

In 2006, the National Innovation Fund announced a new competition for the country's universities called 'Start-up Kazakhstan'. The programme focused on the creation of a network of technology-focused business incubators and the provision of seed financing for these centres.[62] The government has also committed to increasing expenditure on a number of priority areas for research.[63] To support this more targeted approach to research funding, the government has carried out a Foresight Programme (Chapter 3).

The National Institute of Intellectual Property has developed and implemented a number of initiatives[64] to support both researchers and SMEs in protecting their intellectual property. These include providing assistance in the preparation of documents seeking legal protection for intellectual property (IP); the sale and acquisition of licenses in international markets; and measures to support the commercialization of intellectual property.

[61] World Bank (2007), Private Sector Development Unit ECCU8 Europe and Central Asia Region, Report No. 41821-KZ, Facilitation of Innovation Entrepreneurship through Technoparks.
[62] RIPKA (2008), INCO-CT-2006-043533, Deliverable 4.3, Country Briefing for Kazakhstan – (A) Restructuring of the R&D System, (B) Policy Monitoring. Researching Innovation Policy in Kazakhstan and Armenia, p.9.
[63] These include: metallurgy; oil refining, oil and gas infrastructure and the extractive industries; alternative energy; chemical and pharmaceutical industries including medicines, pharmaceuticals and biotechnology; agro-industrial activities, including the food industry; defence industry; construction industry and construction materials; transport and info-communications; engineering; uranium; light industry; tourism; space; and ICT.
[64] A. Batyrbekova (2009), Country Report – Kazakhstan, WIPO-PPO-KIPO Eastern European Regional Forum on Using Intellectual Property (IP) Panorama for Building Capacity of Small and Medium-sized Enterprises (SMEs) for Strategic Intellectual Property Management, Warsaw, 2 April 2009.

Kazakhstan has made important progress in removing barriers to entrepreneurship, liberalizing the business environment and dealing with the limitations arising from poor infrastructure.[65] There remains, however, a shortage of necessary skills to support the policy ambitions to drive economic diversification through innovation. Technology-based entrepreneurs are key forces that drive the creation of a flourishing SME "ecosystem". There are almost 150 higher education institutions in Kazakhstan. Most are private, although the highest ranked institutions, which also often recruit many of the best students, tend to be public universities. The range of courses on offer is comparable to the higher education sector in most developed countries. However, in order to develop a culture of entrepreneurship that results in the creation of a new raft of SMEs, the number of courses or modules teaching the necessary skills to develop entrepreneurship should be increased.

The government has also created a "virtual business" website[66] providing various forms of advice to companies, and the country has an active Entrepreneurs' Club, which offers members various business-related training programmes. However, in most instances these programmes are oversubscribed.

6.3 Infrastructure to support technology transfer and commercialization

Science and technology parks have been developed in many countries as a way of supporting the commercialization of technology, particularly where this is derived from public sector research. The initial concept was based on the idea that the co-location of business and universities would lead to innovation, although business incubation[67] and later pre-incubation programmes have also been added. In addition, many parks host specialist divisions of large companies, usually research facilities, and high growth science, technology or engineering companies.

Two defining features of science and technology parks are the presence of on-site management to support business development, and a working partnership relationship with a host organization. Many parks have developed these relationships as alliances combining the interests of a number of stakeholders under a company structure. Some have been established by a single host, either as a department or through a company structure, while others are co-operatives where the host organization simply lends its name to the project and provides access to its technology and skills base. All these structures can be effective in the right environment. In addition, some parks offer tax advantages to occupiers by being established as Special Economic Zones (SEZ) with the specific intention of attracting foreign capital to support the development of infrastructure and supplement national R&D programmes. The performance of science parks is significantly influenced by the economic environment in which they operate.

The authorities of Kazakhstan have recognized the potential of science and technology parks and through the CETT,[68] 12 incubators, seven regional technoparks[69] [70] and six national

[65] E. Teal, A. Toxanova, and G. M. Izzo, Entrepreneurial development in Kazakhstan: A review and update. Journal of International Business and Cultural Studies Vol. 5, August 2011.
[66] http://www.virtual-business.kz/
[67] NESTA (2008), Policy briefing: Business incubation in challenging times, November 2008, UK, see http://www.nesta.org.uk/library/documents/Business-incubators.pdf
[68] Government of the Republic of Kazakhstan, Resolution №775 (1 August 2003) to support the implementation of the Strategy for Industrial and Innovative Development of the Republic of Kazakhstan for 2003-2015.
[69] http://www.wok.kz/ru/science/general/technopark/

technology parks have been established. The national parks often combine a sectoral focus with the status of a SEZ, while regional parks have a local orientation.

In addition, the CETT developed a Kazakhstan Grid of Technology Transfer[71] to support the formation of engineering companies affiliated with networks in different regions of the country and facilitate the formation of joint ventures with foreign companies. The services provided include access to information on modern technologies and scientific and technical studies through a "Virtual Technopark Concept" for all organizations that are either currently engaged in innovative activities, or planning to do so, and training on innovation for managers as part of the capacity building process.

The CETT also established Design Offices[72] to link companies with both technology suppliers and potential markets. These offices help domestic companies and other users of engineering products to acquire design specifications for new ideas and enter into partnerships to develop these into quality products.

Special Economic Zones

The main objectives of Kazakhstan's Special Economic Zones (SEZ) include the following:

- Developing linkages with the global economy by attracting FDI;[73]
- Promoting the successful development of specific sectors;
- Promoting technology transfer and knowledge diffusion among firms, research centres and universities;
- Establishing a number of high-growing, export-oriented domestic companies active in the production of a range of high value added, advanced technologies; and
- Creating employment opportunities for highly qualified professionals in Kazakhstan.

The advantages for foreign investors include tax benefits for a pre-defined period of time, a simplified mechanism for employing foreign labour and support in dealing with domestic regulations.[74]

SEZs are active in the following locations:

SEZ Petrochemical Park Atyrau was established in 2007 on a site of nearly 3,500 hectares. The main objectives include creating incentives for the entry of both domestic and international companies capable of adding value to oil and gas commodities, as well as producers of products that are new in a domestic context.

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[70] Committee on Science and Technology in Kazakhstan, Office of the Central Europe and Eurasia, National Research Council (2007), Science and Technology in Kazakhstan: Current Status and Future Prospects, ISBN 0-309-66858.
[71] Presentation by M. Akshalov, Director, Regional Technology Park of Astana. Kazakhstan grid of technology transfer.
[72] *Ibid*.
[73] http://e.gov.kz/wps/portal/Content?contentPath=/web%20content/business/ind_innov/dev_instit/innov_fund/article/1169&lang=en
[74] State Programme for Accelerated Industrial Innovative Development 2010-2014 (SPAIID).

SEZ Aktau Sea Port was established on 26 January 2002 on a site of 982 hectares, which was later expanded to 2,000 hectares. Its strategic location has logistical advantages and is attractive to high-tech and export-oriented SMEs. The main activities of this SEZ include the production of household electric appliances, leather goods, chemicals, rubber articles and plastic, non-metallic mineral products, metallurgy and metal work, machinery and equipment, petrochemicals and warehousing and transport. A number of domestic and international companies with investments in steel, plastics, oil and gas related industries, waste handling, pharmaceuticals, and logistics are located in this SEZ.

SEZ Ontustik is based in Shymkent City in the Sairam district of the South Kazakhstan region. This 200 hectare site was established in 2005 as an initiative to support the creation of a cotton-textile cluster. Investments of nearly US$500 million of private capital have been attracted to the site, including FDI in advanced yarn and other textile-related products.

SEZ Burabai is a 370 hectare site in the Borovoe resort area of the Akmola region, which is being developed as a tourism city as part of government plans for economic diversification.[75] The project seeks to take advantage of the possibilities offered by the creation of the Customs Union. The purpose of the project is to create an effective and competitive tourism infrastructure by providing land and transport links to Western Europe and Western China, and improved education and training opportunities for the sector to boost its attractiveness to a wider potential customer base.

SEZ Astana - New City has been nominated as an investment zone to support industrial innovation in 2011, with a territory of around 6,000 hectares. This zone has the added benefit of providing land for the now operational, research-based Nazarbayev University. The project has been a success, attracting around 100 applicants to date.

SEZ Park Innovation Technology (PIT) Alatau was established in 2003 on a site 25 km from Almaty, thus being close to Kazakhstan's highest concentration of R&D activities, while also being easily accessible from Almaty's international airport, which is around 7 km away. Initially planned as a site of 342 hectares, the area was reduced to 163 hectares in 2009.

This is a particularly important initiative, intended to support the development of an active, commercially-backed IT sector in the country. There is a wide range of envisaged activities, including: training professionals for industry; providing access to various software and hardware development programmes; new mobile technologies; undertaking R&D on Internet protocol information security; developing information-telecommunication systems and data networks; advanced IT based on artificial immune and neural systems; information-telecommunication systems and data networks; remote sensing of land; market research on information technology; and R&D on project management in the IT field. The site was also intended to accommodate some high-value manufacturing.

The Park has been somewhat slow to develop, and by 2007 only seven hectares were completed.[76] There is a central office and services facility with space available for renting by smaller tenant companies. This area is connected to two large production spaces, currently unoccupied, that offer flexible work spaces for a variety of potential uses. A World Bank

[75] *Ibid*.
[76] World Bank (2008), Facilitation of Innovative Entrepreneurship through Technoparks, FY08 Joint Economic Research Programme, Washington.

report[77] noted that the reception building and offices would be unlikely to become commercially viable without the presence of some larger units attracted to the site through which to subsidise the development, and this remains the case.

A shift in oversight of the park's future development to the Office of the President is expected to boost the momentum for accelerated development of this nationally important project. A further impulse will be provided by the planned relocation of the Kazakh-British Technical University from central Almaty to a 25 hectare site on the park that will include academic and residential accommodation, a business incubator and research activity in the life sciences. Collaboration with the Kazakh Research Institute for Oil and Gas is also envisaged.

A project to link the Park to new communications infrastructure is being developed through ZERDE, a state holding in the IT industry. The connection of the Alatau Park to the national IT network is part of a national plan to improve information and communication connectivity, facilitating the development of innovative SMEs in the IT sector and helping attract FDI. However, the development of the site is being constrained by the still poor access infrastructure (an issue currently being addressed), the absence of attractively-priced broadband access, lack of a reliable and resilient power supply and the absence of a host and research base.

SEZ Pavlodar was established in November 2011. It is located in the Northern industrial region of Pavlodar city, covering a territory of around 3300 ha. The main activities are chemicals, petrochemicals and related technologies.

SEZ Saryarka was created in 2011, being located in the territory of Karaganda city, covering a territory of around 534.9 hectares The main types of activity include metallurgy, finished metal products, machinery and equipments, vehicles, computers, electrical and optical products, electrical equipment, chemicals, rubber and plastics articles, building materials and non-metal mineral production.

SEZ Khorgos-Eastern Gate was established in 2011 on the basis of the international border cooperation centre “Khorgos”. It is located in the Almaty region. Main activities include logistics, food production, manufacturing of leather, textiles, non-metal products, chemicals, machinery and equipment and metal products.

Despite the significant level of investment, official assessments[78] show that many SEZs have so far only made a limited contribution to the growth of investments, SME development or the attraction of FDI.

Technology parks

The development of a network of technology parks is perceived as an essential element in strengthening the national innovation system.

[77] *Ibid*.
[78] Programme: Investment Attraction, Special Economic Zone Development and Export Promotion in the Republic of Kazakhstan for 2010-2014, approved by Resolution of the Government of the Republic of Kazakhstan No. 1145, 30 October 2010.

Policy objectives include:

- Strengthening the cooperation of all stakeholders (public and private) in the innovation process;
- The formation of a regional, market-oriented scientific and industrial infrastructure to integrate the scientific, industrial and educational capacity needed to encourage innovation;
- Providing facilities to support initiators of innovative projects[79] with business services and developing favourable conditions for the commercialization of scientific research;
- Establishing business incubators with associated integrated support programmes for small innovative enterprises;
- Providing the capacity for management training and education;
- The promotion of new technologies to develop competitive import substituting and export orientated products;
- Promoting the international relations of small high-tech firms in science and innovation; and
- Creating locations which would be attractive to foreign direct investment.

An internal review by the National Innovation Fund of the operational parks in Kazakhstan identified[80] nine operational parks created since 2004. While this is not a sufficient time period over which to evaluate long-term success, some observations may already be made at this stage.

Technopark "Algorithm" (The Uralsk Technopark) is based on links with the Hydropribor Scientific Research Institute, CETT and the Agrarian Technical University. The sectoral focus of the park includes oil and gas engineering, metal processing, petrochemicals, manufacture of instruments and environmental protection and technology. A full range of facilities, including laboratories, rapid prototyping facilities and office space for technology business incubation are provided. However, a review by the World Bank[81] noted that the rental capacity relative to the total size and high level of staffing would make it challenging to achieve financial sustainability. Nonetheless, the overall assessment was that the park is a modern facility that is attractive to investors, with a team of trained staff operating the centre. As such, it has attracted a number of businesses and has potential for further development.

Technopark "UniScienTech" Karaganda provides offices for the incubation of technology – focused businesses, and laboratory space with support from well-trained technicians for microstructure analysis. The Park has a leaning towards technology companies with potential to influence industrial performance, with a particular emphasis on the mining industry, the production of new materials, engineering, the chemical industry as well as environmental protection and conservation. The park reports that it currently supports 22 companies and 33 prospective projects. An assessment by the World Bank[82] suggested that the park was possibly too focused on the companies' technologies as opposed to their commercial potential, and would advise the need to develop a stronger commercial orientation to the project selection process.

[79] http://www.wok.kz/ru/science/general/technopark/
[80] http://www.nif.kz/308
[81] World Bank (2008), Facilitation of Innovative Entrepreneurship through Technoparks, FY08 Joint Economic Research Programme, Washington.
[82] *Ibid*.

Almaty Regional Technopark is oriented towards construction technologies and building materials, the chemical industry, metallurgy and engineering. The physical infrastructure includes an administrative facility, and there is access to pilot production facilities at the associated Centre for Earth Sciences, Metallurgy and Enrichment, located in the vicinity.

"Satpayev KazNTU" Technopark is located in a converted science faculty building in the University campus, with a sectoral focus on the oil and gas industry, metallurgy, mechanical engineering, ecology and information technology. It is based on a traditional business innovation centre model, with a focus on commercializing university research, with a number of research laboratories offering various services, as well as a JSC KazTransOil research centre. An early assessment[83] identified good facilities that were being actively managed; at the same time, the park had a relatively low national and international visibility.

In 2011, the park was working with companies across a range of activities, including production of structural steel; production of coagulant for natural and waste water purification; pilot production of aluminum alloy and finished goods; pilot production equipment and software for an integrated, secure information environment; electromagnetic oil de-emulsification; and new technologies in the petroleum sector.[84]

"Altai" Technopark in Ust-Kamenogorsk was co-funded by the regional authorities and the East Kazakhstan State Technical University, on whose campus it is located. It also works with other universities, research institutes and industrial enterprises in the Ust-Kamenogorsk region as part of a larger plan to accommodate both independent research units and technology businesses. The project is led by the university and based on a clear vision of creating a technological cluster of economic and social activities to accelerate regional development.[85]

Sectoral priorities include: the production and processing of nonferrous metals; information technology; engineering; environmental technology; and the production of new materials - including those for the construction industry. Development objectives include: access to cutting edge S&T and comprehensive support for the commercialization activities of innovative SMEs, particularly those with a focus on developing products for import substitution; an effective management system for innovation projects; attracting investors to the park's companies; employment creation; managerial training; and promoting international relations of small high-tech firms. The park remains at the development stage and is seeking occupants.

The Regional Technology Park of South Kazakhstan was established in 2008. The sectoral priorities include: the chemical technology of building materials; the production and processing of agricultural products; hydrocarbon processing and environmental technology. This technopark is being developed and is looking for new residents.

The Regional Industrial Park "Aktobe" includes both office accommodation and some industrial space, with sectoral priorities, including mining and smelting, agriculture, and oil and gas, as well as a range of other technical projects. The Park received in early 2008 an

[83] *Ibid*.
[84] Science and Technology Center JSC "KazTransOil" is working on the development and introduction of new technologies in the petroleum sector.
[85] World Bank (2008), Facilitation of Innovative Entrepreneurship through Technoparks, FY08 Joint Economic Research Programme, Washington.

ISO/IEC 17025 testing centre accreditation, enabling it to provide a physical and mechanical testing service to the construction industry for a range of building materials and structures. Since June 2009, the park has been a member of the Kazakhstan Technology Transfer Network, which is designed to facilitate technology transfer between academia and industry.

The Regional Industrial Park in Astana has sectoral priorities that include developing new technologies and materials for the construction industry, and support technologies for the country's machinery industry. The park is actively engaged in business incubation and supporting innovative companies.

North Kazakhstan Regional Industrial Park "Kyzylzhar" has sectoral priorities that include: resource and energy efficiency technologies; environmentally sensitive technology; new construction materials; information technology; creative technologies; and astrophysics research and technology. The park also has links with the mining, geological, engineering, energy, construction, architecture and agricultural sectors.

Business incubators

As elsewhere, the broad objective for business incubation in Kazakhstan[86] is to help micro and small enterprises become self-sustained revenue-generating companies. Incubators typically combine fully serviced physical accommodation with business development services in order to reduce the early stage financing needs of firms, and lower the risks associated with building a company. These usually include: access to appropriate equipment and related services to drive technology towards the market (the technology journey); assistance in drawing up business plans to develop a company's markets and raise the required finance; analytical and marketing research; legal, accounting, marketing and other business services; access to rapid prototyping and laboratory facilities; and a range of high-growth coaching and mentoring services.

Before the economic crisis, the Almaty-based national incubator association KABIC had a membership of 17 incubators,[87] and it has been estimated that there were 40 operational business incubators in Kazakhstan in 2010.[88] The issue of business incubation is receiving increased policy attention. Since 2010, the government started to allocate a special budget for business incubation through technoparks, supporting 36 projects that year, followed by more than 40 in 2011.

In March 2007, the National Innovation Fund[89] received applications from a total of 20 higher education institutions across all regions of the country for developing business incubation facilities. The winners of this 'START-UP' Kazakhstan programme were offered training on the organization and management of business incubators, and the commercialization of innovation.

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[86] Resolution of the Government of the Republic of Kazakhstan № 1294 of 26 December 2007, "On the Concept of formation and development of industrial and innovation infrastructure" (includes special economic and industrial zones, industrial parks and business incubators).
[87] Science Park and Innovation Center Association: http://www.spica-directory.net/associations/
[88] E. Teal, A. Toxanova, and G. M. Izzo, Entrepreneurial development in Kazakhstan: A review and update. Journal of International Business and Cultural Studies Vol. 5, August 2011.
[89] http://www.nif.kz/309

Universities in the programme included:

- East Kazakhstan State Technical University "Serikbayev";
- Karaganda State Technical University;
- Kazakh National Technical University "Satpayev";
- Kazakh-British Technical University;
- West-Kazakhstan Agro-Technical University "Zhangir-khan"; and
- South Kazakhstan State University "Auezov".

This programme is supported by a national "Business Advisor"[90] initiative under the "Business Roadmap 2020" programme. The initiative offers a subsidized package of advice to current and potential entrepreneurs in all regions of Kazakhstan on starting a business. This includes relatively basic but comprehensive advice on the following business related topics: creating and running a business; the correct choice of legal forms and procedures for company registration; preparation of statutory documents; guidance on writing a business plan; securing finance; forms of interaction with government agencies; and financial expertise, including how to analyse financial statements and business performance, and details of the tax regime. It is estimated that in 2011 15,000 people benefited from this programme.

Discussions with a number of investors and with the National Centre for Scientific and Technical Information revealed that, despite the opportunities promoted through the incubator programme, relatively few successful companies have emerged from this initiative. Business incubation is a relatively recent initiative in Kazakhstan, and has yet to gain sufficient momentum to have a perceptible impact on the development of entrepreneurship. However, it is important to recognize that business incubation is a long-term activity, requiring long-term risk sharing and initial public funding of operations.[91] It is crucial to have 'patient money' to back these projects.

Some aspects of the business model for these incubators observed in Kazakhstan differ from observations in international practice:

- Incubators are often working with technologies requiring substantial further development before their market potential can be clearly recognized. In these cases, a pre-incubation phase of development would be more suitable;
- Accommodation is sometimes provided for R&D grant-funded activities at a preliminary phase which, in some cases, are unlikely to have commercial potential. This is not a typical activity for most business incubators; and
- Academic rather than commercial aspects seem to be emphasized in the incubators' public communications strategies.

[90] http://www.minplan.kz/pressservice/77/37456/
[91] NESTA (2008), Policy briefing: Business incubation in challenging times, November 2008, UK, see http://www.nesta.org.uk/library/documents/Business-incubators.pdf

6.4 Regional systems of innovation support

Regional Commercialization Centres (RCCs)

Regional aspects have been assigned increased prominence in innovation policies and strategies (Chapters 2 and 3). This has led to new initiatives, including further institution-building at the regional level. The concept of Regional Commercialization Centres (RCCs), as institutionalized entities to strengthen subnational innovation systems, was proposed by the National Innovation Fund (NIF) in 2009. RCCs were intended to act as the nodes of these systems, fostering collaboration and closer partnership between scientists, inventors and business, in close cooperation with Offices of Technology Commercialization (OTCs). The envisaged regional cross-section of the innovation support institutions is shown in figure 14.

The Centre for the Coordination of the Technology Commercialization System (CCTCS) at the NIF was created only in April 2011, so RCCs and OTCs are not yet operational. Close cooperation between RCCs, OTCs, and the Socio-entrepreneurial corporations (SEC) (Chapter 2) is planned within this technology commercialization system.

The National Commercialization Centre (NCC) at the NIF is the head body in this structure and responsible for a variety of tasks. These include the supervision and monitoring of RCCs and OTCs and methodological support, as well as advisory services, processing applications and exchanging information between RCCs and representing their interests in negotiations with foreign partners. Moreover, RCC directors are to be appointed by the NIF.

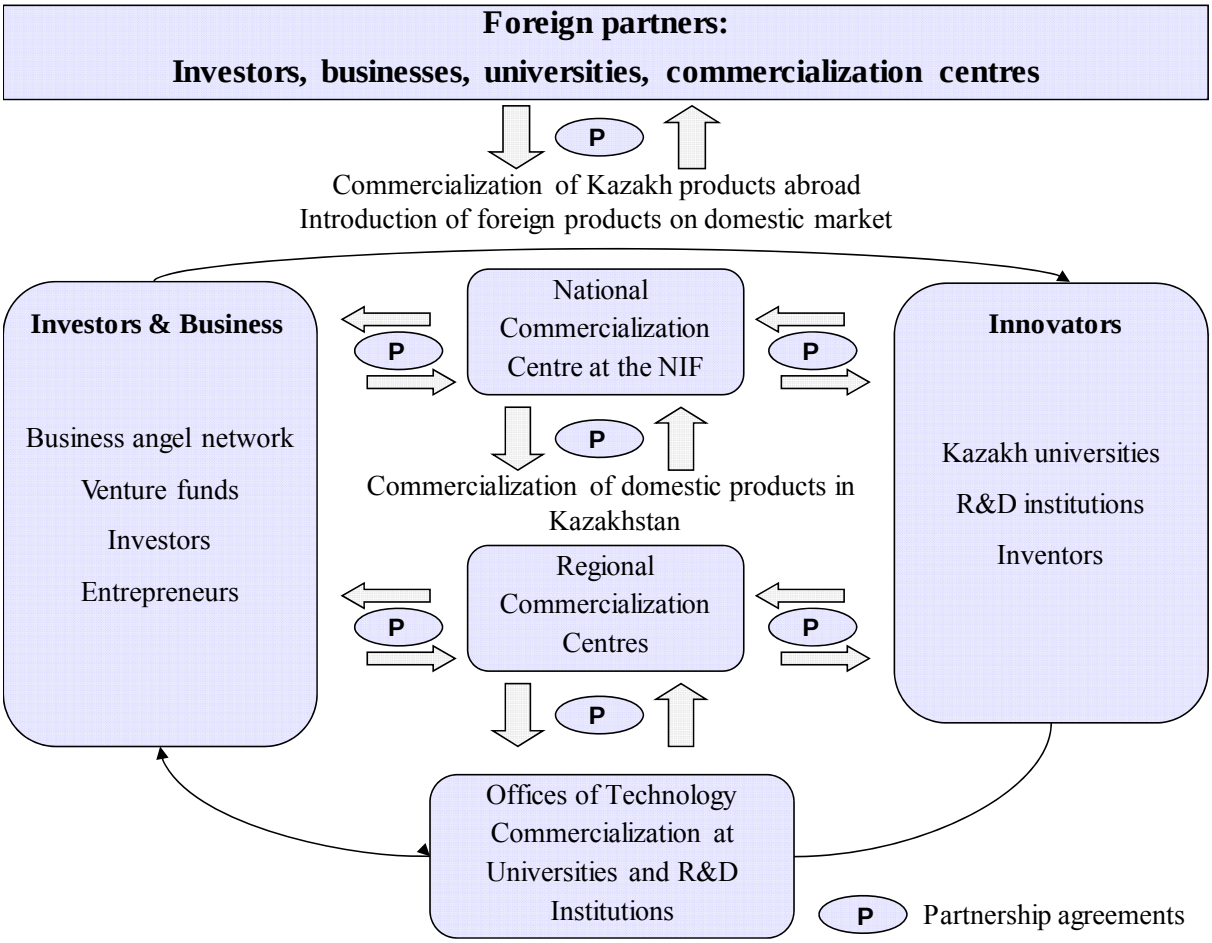
Discussions on establishing RCCs considered two potential approaches: using the existing technopark infrastructure or establishing them as independent bodies overseen by the CCTCS.

As currently planned, the network would follow the example of regional development agencies found in some European countries. They are to be set up on the basis of existing technoparks and are expected to start operations in 2012. RCCs are seen as the key element bridging the gap between knowledge-generation entities and business by promoting innovative products and technologies while carrying out commercial activities. RCCs will be affiliates of the NIF, supervised by Coordination Committees consisting of representatives of the NIF and relevant akimats, the private sector and local higher education and R&D entities.

Regional Centres will support the commercialization of technologies by:

- Strengthening ties with R&D organizations through the implementation of grant-funding policies and by encouraging them to create OTCs;
- Acting as an information resource for funding and related questions;
- Managing commercialization of projects that obtained a grant;
- Providing marketing, business planning and intellectual property management support to local R&D entities;
- Encouraging local businesses to develop and introduce innovative products, and fostering partnerships with research organizations;
- Setting up and maintaining a network, including local firms, science, public administration, government institutions, technology parks and business incubators; and
- Providing seminars and conferences for the training of personnel to attract new participants to the commercialization programme.

Figure 14. Regional cross-section of the innovation support institutions



Source: Adapted from NIF (2011), Development of Technology Commercialization in the Republic of Kazakhstan, Presentation, 3 March 2011, Astana, Kazakhstan.

Offices of Technology Commercialization (OTCs)

Offices of Technology Commercialization (OTCs) are expected to be established at existing universities, R&D institutions and state-owned enterprises that are actively involved in scientific research, reporting directly to the host organization. OTCs will be assisted by the corresponding RCCs in terms of consulting and staff training.

The envisaged range of functions of OTCs will include:

- Active search for inventions and technologies with commercial potential, i.e. business ideas;
- Supporting the commercialization of business ideas;
- Determining a cost-effective way to market a product;
- Promoting the introduction of contractual relations within R&D institutions; encouraging R&D and innovation bodies to provide technical consulting, advisory services, etc.;
- Negotiating license agreements and identifying prospective customers;

- Working with external specialists on all aspects of the commercialization process;
- Operating as the primary link between scientific personnel, innovators, and the RCC (which helps establish contacts with the business sector); and
- Market research activities.

In OTCs, there would be at least one employee appointed by the management of the host organization, responsible for providing technical support to projects.

Implementation

It is envisaged that initially, RCCs will be funded by government through a NIF-led programme, with total financing for each centre expected to amount to around US$1 million (funded from the CCTCS annual budget), approved for a three-year period. Host organizations are expected to make financial or non-financial contributions, such as the provision of staff or premises. RCCs will be able to apply for additional financial resources in the form of grants, although it is expected that, in the future, centres may become independent from state support by generating stable income flows from services provided (market research, business planning, etc.). However, they will continue to receive state support for performing certain functions, in accordance with government priorities. Grant financing will amount to more than US$18 million in 2011-2014 but the envisaged support to current expenditures of these centres is rather limited.
Nine OTC host organizations are to be selected through competition between R&D organizations and universities according to criteria developed by the NIF. Once selected, OTCs will be developed at host organizations through either the reinforcement of existing commercialization offices, or by launching new OTCs.

Necessary pre-conditions include:

- Existence of an adequate S&T potential;
- Availability of adequate facilities and technical base;
- Availability of adequate human resources to manage an OTC;
- Availability of an adequate potential of projects for commercialization;
- Experience in commercialization and links to domestic and global markets; and
- Managerial commitment to running an OTC within the organization.

Having examined the innovation potential of the 16 regions of Kazakhstan, the NIF decided to initially establish three RCCs: in Almaty, Karaganda and Oskemen.

Meanwhile, the NIF expects the first nine OTCs to soon be operational in five different akimats. It is also planned to establish five RCCs and 25 OTCs by 2014.

The implementation of this regional strategy should take into account the main lessons from the mixed results of other innovation support institutions with a territorial focus, namely, the importance of developing strong linkages with other innovation stakeholders, the awareness of the limitations of the environment in which these institutions operate and the need to combine institution-building with strong policies and adequate provision of resources (Chapter 3).

6.5 Assessment

The government of the Republic of Kazakhstan has established a wide ranging set of policies and made substantial investments in support of innovation. However, despite this intensive effort, there has been relatively little visible outcome as reflected in the indicators of innovation performance, including a reduced presence of technology-based companies.[92] The technology parks so far have had limited success in transforming research outputs into new products[93] and there is little evidence that these sites have been able to form strong linkages with the knowledge base. The flow of companies with high-growth potential and global product reach into these centres is relatively low. However, an assessment of the situation should also take into account that supporting policies and accompanying funding have only been in place for a relatively short period of time. International experience shows that change is often rather slow as new generations of entrepreneurs emerge from higher education institutions, take up the challenge of trying to build businesses and seize the opportunities created by existing support programmes.

The existence of markets for technology and knowledge-based businesses is a crucial part of any National Innovation System. Thus, part of the process of encouraging entrepreneurial activity is to create markets for the technology-based products created by the new companies established by the entrepreneurs.

Policies to support this include:

- Ensuring that a proportion of government R&D programmes is available to SMEs; and
- Linking the projected large increases on R&D spending in large public companies (Chapter 3) with the requirement that a proportion of this R&D work is subcontracted to SMEs.

Some of the difficulties faced by these institutions are related to the general characteristics of the economic and innovation environment of the country. The absence of a significant pool of entrepreneurial skills upon which to draw in order to commercialize ideas with significant potential is a key constraint. Other constraints are the low supply of new ideas with the potential for commercialization and the low demand for technology from large corporations, which reduces entrepreneurs' incentives to build technology-based businesses. Overall, there are weak linkages within the national innovation system between research, education, domestic business, and foreign business (Chapter 5).

The core challenges for science and technology parks in Kazakhstan[94] include the following:

- Science and technology parks have low visibility, both nationally and internationally, with limited promotional presence in the marketplace. Those institutions that are very active do not participate in international science and technology parks and incubator networks. There are no members from Kazakhstan in the International Science Park

[92] E. Teal, A. Toxanova, and G. M. Izzo, Entrepreneurial development in Kazakhstan: A review and update. Journal of International Business and Cultural Studies Vol. 5, August 2011.
[93] S. Radosevic and M. Myrzakhmet (2009), Between vision and reality: Promoting innovation through technoparks in an emerging economy, Technovation, 29 (10), pp. 645-656.
[94] World Bank (2007), Private Sector Development Unit ECCU8 Europe and Central Asia Region, Report No. 41821-KZ, Facilitation of Innovation Entrepreneurship through Technoparks, p.18.

Association, the world's largest and most active science park and incubator association, nor are there any in the Association of Asian Business Incubators.[95] Documentation and support provided on the Internet largely concerns regulations as opposed to business. There is a limited response to requests for information;
- The development focus has primarily been on creating physical infrastructure, without a parallel development of the management needed to create the fertile links with the host organizations or the existing business community to increase the occupation of these sites. In some instances, the infrastructure has not been developed with sufficient speed to match the demands of potential occupiers of these sites;
- Many of the research results seeking commercialization are at an early stage of development and require significant further investment to establish whether they have commercial potential; and
- Where technology parks had associated SEZ status, they had not proved sufficiently attractive to domestic companies as locations in which to develop businesses.

Innovation performance is supported by investment in R&D and programmes that seek to align this R&D base with the needs of industry, while encouraging the growth of SMEs that can diversify the economy and developing the necessary skills. Soft (networks and funding programmes) and hard (physical facilities) infrastructure are required to facilitate the dissemination of ideas.

The Key Performance Indicators (KPIs) for successful policy interventions include:

- Measures for assessing bids for R&D funding against national R&D priorities by adding a rating in any assessment criteria that looks at the potential for commercialization;
- Using the information provided by the tax system to measure the level of R&D investment by business;
- Looking at the destinations of graduates over time to assess whether these are being attracted into the private or public sector;
- Measuring technology company formation on science and technology parks;
- Assessing the level of funding raised by micro-companies and SMEs through business angels, venture capital and loan finance; and
- The diffusion of ideas through networks is hard to assess. However, this could be based on an audit of the organizations involved, which could serve as a basis to develop measures of performance.

[95] Asian Association of Business Incubators, see http://www.aabi.info/search.asp

6.6 Recommendations

The commercialization of technology presents significant challenges and the likelihood of success is often overestimated by those engaged in research with little commercial experience. In Kazakhstan and other countries with economies in transition, this is a particularly serious problem, given the share of research carried out in public institutions. Increasing awareness of pitfalls and the involvement of partners with a commercial understanding in research decisions is important to assess and respond to market needs.

Recommendation 6.1

Public funding of applied research should seek to encourage a commercial orientation. In order to achieve this, authorities should consider the measures:

- *Requesting the introduction of a statement describing the commercial potential of the research seeking financing;*
- *Giving higher priority to proposals that also receive funding by commercial companies, in line with the proposed conversion of innovation grants into a matching funds instrument;*
- *Strengthening the links between publicly-financed R&D organizations and companies, providing mechanisms that allow technology to be tested against market needs as it is being developed;*
- *Engaging business interests in decisions related to R&D through the creation of science-industry groups covering different priority areas, through the planned introduction of technology platforms and other instruments;*
- *Supporting the creation of technology transfer offices in research organizations and strengthening existing office; and.*
- *Further development of the infrastructure necessary for the generation of scientific knowledge, the provision of training and the commercialization of technology.*

The relatively weak support to technology businesses, especially newly emerging ones, limits the effectiveness of support measures targeting later stages in the development of a company. Early intervention is therefore necessary to explore and generate new projects that could grow further while ensuring that resources are not wasted in those that do not show sufficient commercial potential. Support to the creation of companies, even those where technological innovation is not a major driver, contributes to increase management capacity, which is essential to encourage the growth of clusters. In order to create a flow of potential opportunities, it is important that support measures target the very early stages in the development of a company.

Recommendation 6.2

The authorities should develop pre-incubation initiatives that would help companies to grow and be ready for full incubation such as:

- *Supporting the establishment of pre-incubators in research organizations and setting up funding programmes that target the early stages of development of technologies with commercial potential; and*

- *Extending incubation initiatives beyond the traditional focus on university and research institutes, including the wider business community in competitions for funding, thus increasing the potential to develop new ideas.*

Technology parks in Kazakhstan tend to be based on the assumption that the mere presence of resident technology-based companies staffed by skilled personnel will automatically lead to spillover effects resulting in the creation and development of innovative SMEs. However, this is insufficient. Successful technology parks are those that become focal points in a chain of linkages that can effectively support the development of companies.

Recommendation 6.3

In order to facilitate the role of technology parks as catalysts of innovative activity, the authorities should make an effort to align them with the standards of such institutions in advanced industrialized countries. In particular, they could consider:

- *Various measures aiming at the integration of technology parks into the national innovation system by establishing new linkages and facilitating connectivity with other innovation stakeholders, in particular, by establishing specialized teams tasked with such assignments; and*
- *Promoting collaboration in innovation involving technoparks through horizontal programmes and instruments, which result in close linkages between research centres, universities and industry.*

Kazakhstan has made a significant effort in improving educational standards and providing opportunities to study abroad. However, the range of skills required to support innovation is very varied, and must be developed in close cooperation with the private sector. Some recent policy initiatives, such as the provision of management courses in the "Business Roadmap 2020" or the financing of practices in foreign companies within the Bolashak programme, recognize the importance of developing the necessary skills. However, the shortage of relevant managerial skills continues to constrain the success of innovation initiatives.

Recommendation 6.4

In order to ensure that appropriate skills are available to support innovation performance, the authorities could consider providing additional support to the development of management skills both in the public and in the private sector. This could include:

- *Providing short business courses for managers working in the industry along the lines of the Bolashak programme. Requirements for a minimum period of work in the private sector for returning students could also be considered;*
- *Developing a high-growth coaching programme for managers of firms operating in technology parks and incubators, which could be linked with the business development component of the Bolashak programme;*
- *Providing commercial training for the management of business incubators, in close collaboration with science park professionals. This would ensure consistency and quality in the provision of business development programmes; and*

- *Introducing modules on business in the curricula of all undergraduate courses to encourage technology-based entrepreneurship and develop linkages between incubators and business schools (see recommendation 2.2).*

The technology park and business incubator programmes in Kazakhstan have relatively low national and international visibility. This is a major obstacle to the formation of linkages with other innovation partners, and to integration with the national and global chains through which knowledge diffusion occurs. Ongoing efforts to improve the situation through roadshows and mechanisms to request the feedback of potential users on the services provided should be continued and strengthened.

Recommendation 6.5

The authorities should take steps to develop the brand image and external projection of technology parks and business incubators, so there is a better understanding of the opportunities available to the organizations looking to locate on these sites for the purpose of technology commercialization.

Chapter 7

FINANCING OF INNOVATIVE ENTREPRENEURS

This chapter discusses the various sources of entrepreneurial finance in Kazakhstan, with a particular focus on innovative activities. It describes recent developments in the financial sector and the public institutions that promote investment and innovation activities. The role of the tax system in facilitating the development of innovative companies is also considered. The chapter also discusses and assesses various programmes and mechanisms of public support that seek to offset market failures in the provision of finance for innovative activities.

7.1 Innovation financing and development stages

Economic diversification is a well-established objective of the Government of the Republic of Kazakhstan that is reflected in the ambitious targets set out in the State Programme for Accelerated Industrial Innovative Development of the Republic of Kazakhstan, 2010-2014. This programme foresees a steady increase in the contribution to growth from innovation-based activities. As oil production is expected to double in the next decade, the objective of reducing dependence on commodities is a significant policy challenge.

The state programme focuses in the first stage – which started in 2010 after a preparatory phase – on the modernization of the industrial base. The second stage, the "creation of a new economy", concentrates on the prospects of setting up new ventures in Kazakhstan with the participation of companies that are global leaders in identified niches. At the third stage, the foundations for the economy of the future are to be laid through investments in aerospace, biotechnology, IT and alternative energy production technologies (Figure 15).

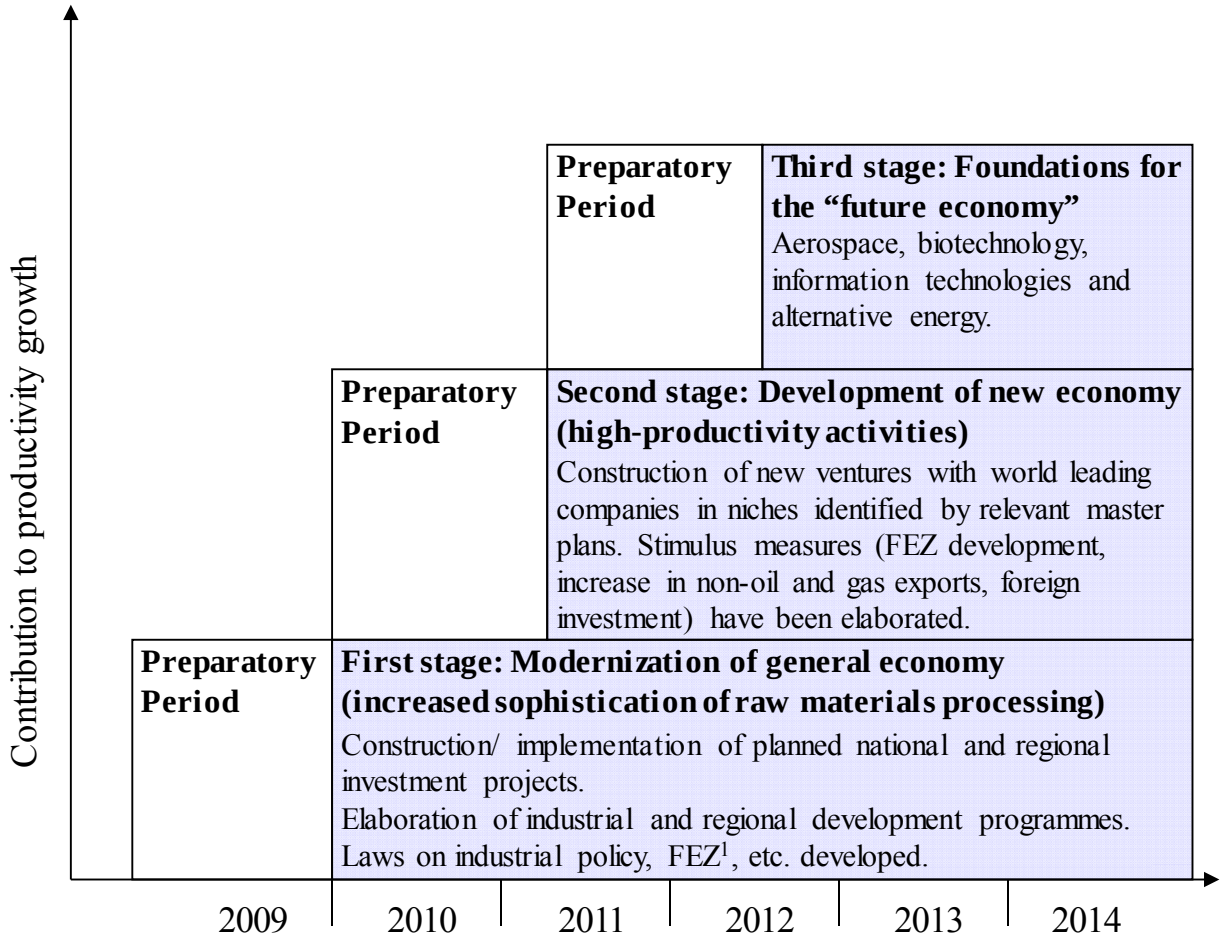
The state programme sets the objectives of modernizing existing industries, as well as creating new ones working at or close to the technological frontier, attained when productivity levels achieved in Kazakhstan match those of globally leading firms, sectors and countries.

It is now widely accepted that the policy mix for catching-up with front-running countries – i.e. countries close to the technological frontier – must differ from the one used by more advanced countries in order to be effective. The same applies for the different objectives related to the three stages of Kazakhstan's development strategy. The upgrading of existing structures is mostly driven by investment, which entails the import and efficient use of production technologies, including improved shop-floor management, organizational innovation and upgrading the skills of employees. Resulting productivity impacts may be substantial. This process can be facilitated by a financial system that supplies sufficient investment capital through loans and/or equity finance, while supporting companies in making the right investment decisions.

In Kazakhstan's context, catching-up strategies should dominate initially, with efforts to develop the innovation potential of the economy – which might be approximated by stage two of the SPAIID – increasing over time. The focus here is on creating an environment conducive to innovation that promotes steady and mostly incremental progress on a number of

issues. The emphasis is put on managing an evolutionary process that helps companies and organizations to progress toward the technological frontier over time.

Figure 15. State programme for accelerated industrial innovative development of Kazakhstan (SPAIID)



[1] Free Economic Zone
Source: SPAIID.

Flagship projects – be they technological, thematic or organized around "grand challenges" – largely seek a radical departure from existing modes of operation, and require tailor-made financial arrangements, adequate planning and risk-taking abilities. Stage 3 of the SPAIID envisages the ambitious task of leapfrogging to the technological frontier in some areas.

7.2 Financial system of Kazakhstan

The banking sector in Kazakhstan has been one of the most highly developed and dynamic among transition economies, with a largely domestic ownership base. The rapid development of the sector was enabled by credit market reforms,[96] which improved the modus operandi of

[96] These led *inter alia* to the introduction of international prudential standards, including requirements relating to capital adequacy, liquidity ratios, transparency as to the auditing of banks by local and international auditors,

Kazakhstan's banks and forced consolidation in the sector. The number of banks decreased from more than 200 at the beginning of the 1990s to 33 in 2007, of which the eleven largest accounted for around 80% of total assets. In contrast to other countries with economies in transition, pension funds played a vital role in the development of the financial sector and have emerged as important investors in the local bond market since the launch of pension reforms in 1998. The growing assets under management in pension funds provide a supply of long-term funds that is lacking in most emerging markets, including many other CIS countries.[97]

Kazakhstan experienced rapid credit expansion until 2007 with annual growth rates of loans to the private sector at around 40%. The stock of outstanding loans amounted to about 45% of GDP in 2006 and reached 56% in 2007. The rapid expansion of credit was financed through increased foreign borrowing, as domestic saving was insufficient to further expand the loan portfolio. As a result, banks held slightly less than half of the total gross external debt of Kazakhstan, which amounted to 41.4% of GDP in 2007.

Kazakhstan was one of the first countries to feel the impact of the global financial crisis in 2008. As a result, Kazakhstan's banks were effectively excluded from international financial markets. Without the ability to refinance, banks stopped lending, leading to a real estate slump, with prices falling by 30% in Astana and 50% in Almaty.[98] This situation was compounded by falling commodity prices. The share of non-performing loans, which had stood at a moderate 2.7% at the end of 2007, almost tripled in 2008 (7.1%) and exploded to 37.8% in 2009.[99] A 20% depreciation of the KZT in February 2009 increased substantially the cost of foreign currency loans, adding to the difficulties of many debtors. This forced an increase in the loss provisions made by banks, but reduced the outflow of funds and improved the external competitiveness of the country.

The Government of the Republic of Kazakhstan played a strong role in the management of this crisis, including a dramatic restructuring of the financial sector. In November 2008, it pumped US$5 billion into the financial system to increase liquidity. Four systemic banks (Halyk Bank, Kazkommertsbank, BTA Bank and Alliance Bank), issued shares that were bought by the National Welfare Fund Samruk-Kazyna, effectively nationalizing two of the largest banks and recapitalizing two others. Samruk-Kazyna also deposited €1.3 billion in the banking system, and channelled €1.5 billion in additional finance to construction, mortgage lending, SMEs (through its subsidiary DAMU[100] – see below) and the agricultural sector. The two nationalized banks defaulted on their significant international liabilities and conducted debt restructuring negotiations that resulted in a haircut for their external lenders. Kazakhstan

harmonization of local accounting practices to International Financial Reporting Standards (IFRS), personnel training programmes, the adoption of recapitalization and corporate enhancement plans with the aim of boosting capacities to attract long-term, private investors, the establishment of guidelines for bank inspections and for periodic reporting by commercial banks to the National Bank and, last but not least, the implementation of internal risk management systems.

[97] Asian Development Bank (2006), Proposed Assistance to Private Banks in Kazakhstan, Report and Recommendation of the President to the Board of Directors, Project Number 40908, Manila.

[98] European Bank for Reconstruction and Development (2010), Strategy for Kazakhstan, London.

[99] S. Barisitz and M. Lahnsteiner (2010), From Stormy Expansion to Riding out the Storm: Banking Development in Kazakhstan, Financial Stability Report 19, Vienna.

[100] DAMU spent more than US$3 billion in three separate tranches to refinance SMEs. 70% of these funds were used to support existing loans, and 30% for new loans. P. Alexander (2009), Battered and bruised but ready to move forward, The Banker, May 2009.

emerged from the financial crisis in a remarkably short period, and access to international financial markets has been restored.

The stimulus package of the National Bank of Kazakhstan included low interest rates, the provision of refinancing loans to banks to ensure adequate short-term liquidity and low deposit rates to discourage banks from hoarding funds and incentivize lenders to provide credit to the real sector of the economy. Through Samruk-Kazyna, the government financed a portfolio of measures to combat the crisis (worth around US$10 billion).

The shocks changed the operating mode of Kazakhstan's banks fundamentally. In pre-crisis years, the rapid expansion of lending was fuelled by strong capital inflows that created a dynamic financial environment. Now, domestic deposits are the key source of funding for lending activities.

Reforms of the banking sector during and after the crisis have made the system more resilient to external shocks. Nonetheless, the high proportion of non-performing loans remains a challenge and access to finance is still a major obstacle for small and medium-sized firms. In the latest Business Environment and Enterprise Performance Survey (BEEPS) of the EBRD, 10% of small and 14% of medium-sized companies identified difficult access to finance as the main business obstacle. Small and medium-sized enterprises in particular could be an important driver of diversification but their presence in Kazakhstan is limited.[101] There is a strong tradition of family-based business, sometimes operating informally, that could provide a source of entrepreneurial energy if supported by policy efforts.

7.3 Public financial institutions

Institutional overview

In the present policy cycle, SPAIID provides the policy guidelines and legal basis for the development of financial support for innovation activities in Kazakhstan. It is part of the Strategic Development Plan of Kazakhstan until 2020.

Kazakhstan has a number of institutions that are involved in funding and managing the modernization process. This includes providing finance for investments, involvement in infrastructure projects and resources for innovation. The most important institutions in this domain are:

- The Development Bank of Kazakhstan (DBK) provides financial support to the private sector and state organizations by granting medium- and long-term low interest loans. The bank focuses on infrastructure projects and lending to manufacturing enterprises and is owned by Samruk-Kazyna. The DBK was founded in 2001;
- The Entrepreneurship Development Fund (DAMU) was established in 1997 to offer financial and non-financial support to SMEs and to stimulate demand for the products and services of these enterprises. DAMU operates at regional and national levels and is wholly owned by Samruk-Kazyna;

[101] Korean Institute for Development Strategies (KDS) (2011), SME-centred Enterprise Development Strategy for Sustained Economic Development of Kazakhstan, Korea knowledge-sharing programme.

- The Investment Fund of Kazakhstan was created in 2003 and focuses on private equity investments, and is fully invested in 36 funds. Due to the economic crisis and flaws in the selection process, most of these investments are in distress. The Fund is reorganizing operations;
- The National Innovation Fund plays an active role in the promotion of innovation through equity investment, the capitalization of national and foreign venture funds, R&D grants, support of technology parks and fostering innovation culture. The fund was established in 2003 under the Ministry of Industry and New Technologies; and
- The Science Fund was established in 2006 and is active in ICT and space technology, nanotechnology and new materials, biotechnology, renewable energy technology and nuclear. The fund offers loans to scientists planning to set up a company or sell the results of their research within a three to five year period. Funding ranges from around US$50,000 to an upper limit of US$2 million. Eleven projects have been supported so far; by mid-2011, three of these started repayment of the funding provided.

This institutional set-up was, with the exception of DAMU, created within the last decade. The range of financial instruments used to modernize economic structures and support innovation focuses on equity finance, subsidized loans and grants (Table 20). Additionally, DBK - Leasing, a subsidiary of the DBK, provides lease finance for investment projects. All institutions are currently considering new options to complement their portfolio of instruments. DAMU, for example, has been working on a guarantee mechanism to help SMEs in securing financial support from the banking system and is also considering equity-based approaches. The NIF has been strengthening activities for business incubation at technology parks (Chapter 6).

Table 20. Overview of major institutions and their financial instruments

	Equity finance	**Loans**	**Grants**
Development Bank of Kazakhstan		Infrastructure, pilot project and manufacturing companies	
Entrepreneurship Development Fund (DAMU)		Various programmes, Microfinance, Business Roadmap 2020, Productivity 2020	
Kazakhstan Investment Fund	Various development projects		
National Innovation Fund	Investment projects in innovative companies, national and foreign venture funds		R&D grants supporting, e.g. patenting, technology acquisition, feasibility studies, R&D
Science Fund		Commercialization	R&D grants

Equity finance instruments reach only a limited number of projects, but tend to offer more substantial financial support. The opposite holds true for grant schemes and subsidized loans. Here the cost per unit of support may be small, except where the project or company defaults.

The allocation of resources to instruments therefore determines how many firms and what kind of projects can be supported through the system.

Equity finance – in particular, venture finance if innovations are concerned – may help to promote innovative and risky projects that have not yet reached the break-even stage. Equity instruments seem to be highly developed in Kazakhstan, and the number of programmes using this form of financing is likely to increase. However, demand for this type of financing is still low as the number of radical innovation projects requiring such support is somewhat limited. Moreover, Kazakhstan's market presents limited opportunities to exit investments (i.e. to sell to another investor or float the company on the stock market).

Overall, the institutional set-up provides a range of financial instruments to cater for the different needs of enterprises. The limitations come rather from a lack of demand for funding – i.e., the small number of innovative projects – or from the restricted capabilities of firms to put additional financial resources to productive use. Programmes that help to develop management techniques (including innovation management) and an innovative entrepreneurial culture are important complements to the financial support programmes discussed here.

Initiatives under the SPAIID already combine the actions of different institutions to cater for the individual needs of companies. This is an important step closer to a one-stop-shop approach that combines financial and non-financial instruments to develop the innovation capabilities of companies.

Development Bank of Kazakhstan

The mission of the Development Bank of Kazakhstan is to facilitate sustainable economic growth by providing long-term financing and various financial services to the non-extractive industries. Since its creation in 2001, the bank has been involved in or is considering a total of 180 projects, with a total value of US$10.4 billion, of which US$5.1 billion has been provided by the DBK.

The portfolio of the bank has grown substantially, more than tripling in the four years since 2007. It holds assets worth more than US$6 billion, of which around US$2 billion are loans to customers. The bank also wholly owns DBK-Leasing, which was established in 2005 and offers short- and long-term leasing finance.

The present loan portfolio shows substantial lending to the resource-based industries – oil processing, energy, metallurgy and non-metal industries accounted for almost two thirds of the total lending portfolio by the end of the first half of 2011. Lending to transport and logistics is also significant, representing around 10% of the total.

DBK is intended to be the primary provider of long-term finance for infrastructure development, strategic investment projects, and export activities and plays an important role in the SPAIID. During the course of this state programme, the bank plans to enlarge the share of lending to metallurgy, transport, energy production (electricity), chemical and petrochemical, telecommunications and other manufacturing in its portfolio. The leasing subsidiary participates in the Productivity 2020 programme of the SPAIID.

Entrepreneurship Development Fund - DAMU

The Entrepreneurship Development Fund "DAMU" was established in 1997 with the mission to offer financial and non-financial support to SMEs and stimulate demand for the products and services of these enterprises. With 16 offices in all regions and 270 employees, this Samruk-Kazyna subsidiary aims to act as an integrating channel of public measures for entrepreneurship, to support SMEs through 13 financial and 11 non-financial programmes and to improve the business environment more generally.

DAMU was initially responsible for the management of state funds borrowed from the Asian Development Bank (ADB) and the European Bank for Reconstruction and Development (EBRD). It commenced direct lending of own funds to SMEs in 2002 and was responsible for the allocation of funds under the Stabilization Programme in 2007. DAMU is now the financial agent for the "Business Roadmap 2020" programme – one of the four action lines of the SPAIID.[102]

The cumulative value of DAMU's support activities over the years has been around US$3.7 billion, and the number of SMEs having received support stands at almost 11,000 (Table 21).

Table 21. DAMU financial support programmes

Programme	**Resources** US$ million	**Share** per cent	**Number of borrower**	**Share** per cent
Stabilization programme - Tranche 1	597.1	16.1	2,791	25.4
Stabilization programme - Tranche 2	1,115.9	30.0	2,996	27.3
Stabilization programme - Tranche 3	1,359.3	36.6	3,009	27.4
Damu-Regions	330.2	8.9	1,392	12.7
Damu-Ondiris (Manufacturing)	262.2	7.1	214	1.9
Financing SMEs in Zhanaozen	1.0	0.0	17	0.2
Microfinance for female entrepreneurship	12.1	0.3	442	4.0
Loan financing for SMEs	6.9	0.2	39	0.4
Damu-Regions 2	22.8	0.6	69	0.6
SME projects funding programme	6.7	0.2	17	0.2
Total	**3,714.2**	**100.0**	**10,986**	**100.0**

Source: DAMU.

[102] Other financial programmes currently run by DAMU focus on regional development, lease finance, and development of business infrastructure. In its non-financial programmes, DAMU organizes support for SMEs through a call centre, a business portal, the "Business Advisor" training programme, the development of business infrastructure, the provision of analytical material on SME development, cooperation with German and Dutch senior expert exchange programmes, and the "Business Story" TV programme.

Most of these funds (about 70%) were used under the Stabilization Programmes to support enterprises affected by the financial crisis. Regional support through the DAMU-Regions I and II (9.5%) and the DAMU-Ondiris programme (7%) for the manufacturing sector account for the majority of remaining funds. Interest rate subsidies, loan guarantees and micro credits are the instruments used to support SMEs. The establishment of an equity fund is in progress. However, there is no programme that promotes innovation in SMEs or focuses on the specific needs of small innovative companies.

At the sectoral level, there is a strong focus in DAMU's activities on retail and wholesale (46% of funds), services (25%), and manufacturing (16%), reflecting the sectoral distribution of SME activities by number of firms, employees and bank lending.

DAMU has obtained a new US$500 million loan from the Asian Development Bank. The loan, which is an indicator of Kazakhstan's return to international capital markets, will be used to finance new SME projects.

Since 2009, DAMU has also been providing non-financial support activities which were in high demand from potential beneficiaries, and this new service has strengthened over time. This type of support includes training and consulting activities, such as business plan support organized in cooperation with Nazarbayev University, and the creation of a country-wide network of business support centres. Similar services (i.e. training of entrepreneurs, service support, internships abroad) are also foreseen for the Business Roadmap 2020 programme.

Investment Fund of Kazakhstan

The goal of the Investment Fund of Kazakhstan (IFK) is to facilitate implementation of industrial and innovation policy of the Republic of Kazakhstan through realization and attraction of investments into projects, and the provision of financial support to initiatives of the private sector in non-primary sectors of economy. These aims are pursued through direct equity participation in invested companies.

The IFK carries out investments in new and existing companies which are involved in the processing of raw materials, the use of new technologies to develop competitive products and the provision of services to other companies. It also co-finances and participates in the management of investment projects in non-primary sectors. In addition, it is engaged in joint financing of investment projects abroad in connection with industrial cooperation initiatives between domestic and foreign companies.

The current portfolio of the IFK contains 28 investment projects, worth US$670 million. The direct contribution of the IFK amounts to US$198 million. The IFK participates in the management organs of the companies in which it invests.

National Innovation Fund (NIF)

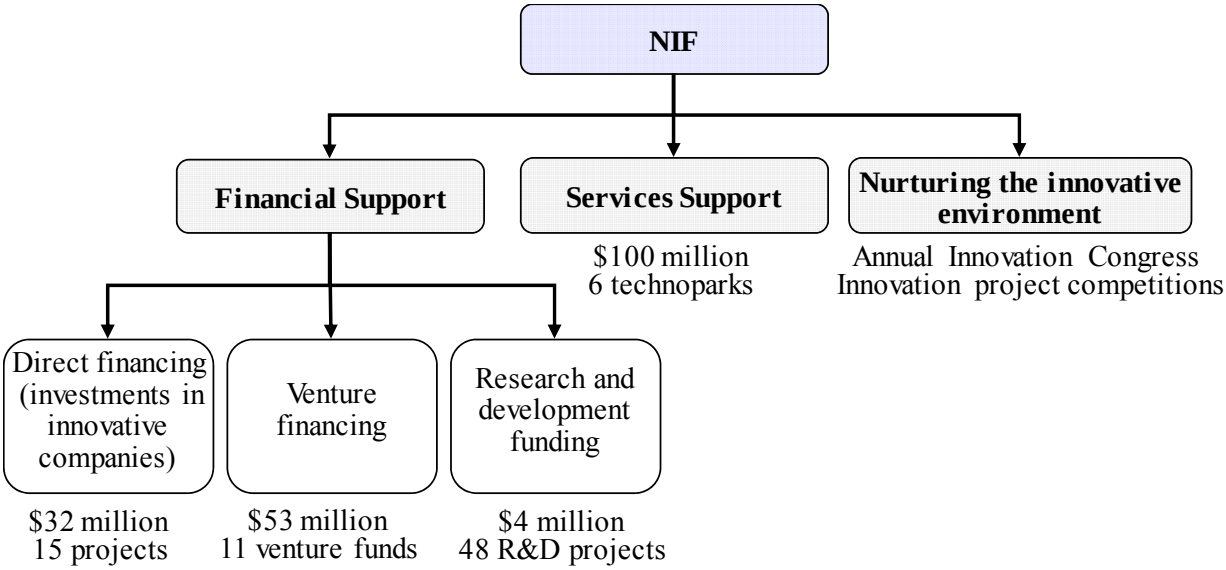
During the last decade, Kazakhstan has taken a number of steps to establish the institutional infrastructure to support its innovation system. One of these steps has been the establishment in 2003 of the National Innovation Fund (NIF) under the Ministry of Industry and New Technologies.

The NIF comprises the following:

- Centre for Engineering and Technology Transfer (CETT) (Chapters 5 and 6 for more details);
- KazSat project, which launched Kazakhstan's satellite in 2006;
- Direct investment in innovative firms and support for R&D projects;
- Financial participation in six local and five foreign venture funds; and
- Other activities related to the creation of an environment conducive to innovation (e.g. annual innovation conferences).[103]

In accordance with recent policy debates, it is expected that the NIF would be merged with the CETT to form the National Agency for Technology Development (NATD).

Figure 16. Activities of the National Innovation Fund



Note: Spending figures include planned values for 2011.
Source: NIF.

The NIF's endowment is around US$70 million. Since its establishment, including planned activities for 2011, the Fund's portfolio is structured as follows (Figure 16):

- Equity stakes of US$32 million in 15 companies to support investment projects in innovative companies. At present, there are nine companies in the portfolio with investments of around US$23 million and NIF stakes of between US$0.5 million and US$5 million. The average investment is around US$2.6 million;
- Investments amounting to US$53 million in venture funds, with stakes per fund between US$0.25 million and US$8.8 million. Current stakes in such funds total US$42.15 million, of which slightly more than 60% is held by Kazakhstan's venture funds; and

[103] See Decree No 1308 for details of other planned and existing initiatives in this domain that are not necessarily delivered by the NIF.

- Support to 50 projects through R&D grant schemes. These activities include R&D, technology acquisition, patenting, feasibility studies and pilot equipment across a range of sectors (Table 22). The average project support amounts to US$11,500. There are defined levels of support available for each of these activities.

The overwhelming majority of NIF funding activities support modernization as distinct from an emphasis on "pure" innovation. This focus on modernization, which appears to reflect the needs and demands of companies, is evidenced by the activities that are supported by R&D grant schemes: purchase of equipment, feasibility studies, implementation of new management techniques and R&D. In fact, the above noted scarcity of "pure" innovation projects sets limits to the amount of money that can be invested to support them.[104] From a sectoral perspective, almost half of the funds are allocated to investments in construction materials; a quarter flows into ICT, an eighth into pharmaceutical, and less than a tenth (around 7%), into chemical and mining and metallurgy.

Table 22. Sectoral composition of NIF investment projects and R&D grants

	Investment projects (equity stake)				**R&D grants**		
Sector	Number of cases	Project volume	NIF investment US$ million	Share, per cent	Number of cases	NIF grant US$ million	Share, per cent
ICT	3	13.3	5.60	24.0	5	0.0476	8.30
Construction materials and buildings	3	52.7	11.60	49.8	1	0.007	1.22
Pharmaceuticals	1	8.5	2.80	12.0			0.00
Chemicals	1	15.7	1.70	7.3	8	0.085	14.83
Mining and metallurgy	1	7.5	1.60	6.9	5	0.056	9.77
Biotechnology					4	0.0705	12.30
Mechanical engineering					6	0.0566	9.87
Medicine					6	0.1049	18.30
Petrogas					4	0.0401	7.00
Agriculture					4	0.0241	4.20
Energy					3	0.0566	9.87
Competition NIF50K					4	0.0248	4.33
Total	**9**	**97.7**	**23.3**	**100**	**50**	**0.5732**	**100.00**

Source: NIF, own calculations.

It is important to note that most of these figures are cumulated stocks as opposed to annual funding flows. The venture fund investments (US$42.5 million in total, of which US$26.5 million is invested in Kazakhstan), and the investment projects in innovative companies (US$23.3 million) account for more than 90% of all funds invested (around US$66 million). The NIF therefore has the majority of its capital tied up in these investments.

[104] This is acknowledged in official documents (e.g. the SPAIID), and was also observed during the project field study.

The remaining funds, additional budgetary allocations, participation in other programmes and the ability to exit investments determine future room for manoeuvre.

Venture capital financing

The NIF has fuelled the development of the venture capital industry in Kazakhstan by setting up a number of hybrid funds where it holds stakes of no more than 49% of the capital, while the rest of the funds are provided by private investors, who are supposed to take investment decisions and run the companies in which the VC funds invest. In practice, the degree of influence of the NIF is larger than that which would correspond to its minority position. Returns are shared between the public and private investors on a pari passu basis, i.e. there is no asymmetric distribution of returns to encourage further involvement of private investors. However, the main problem appears to be not the scarcity of capital but the low level of investable opportunities that are large enough and have an acceptable risk-return profile for private investors. This reflects some general features of the environment for innovation in Kazakhstan (such as the lack of entrepreneurial dynamism or under development of the research base), but also the existence of bottlenecks at early-stage financing, which prevent the emergence of opportunities that are mature and large enough to be considered by VC companies. Plans to set up regional funds may face similar problems. Existing hybrid funds have invested mainly at relatively late stages in the development of companies and the authorities have plans to introduce a compulsory minimum 15% investment in early stage ventures. The associated higher risk levels should be taken into account when considering the design of incentives for private sector participation and the monitoring of the use of public sector funds.

Although the overall impact has been limited, the experience so far has had some success, with six exits from venture financing to date. In addition, in the framework of the Customs Unions with Belarus and the Russian Federation, Kazakhstan has started negotiations on the creation of a joint venture fund to take advantage of opportunities emerging in this common economic space (Chapter 8).

The development of a domestic VC industry is a slow process which has benefited from public support in most countries. As in other areas of the National Innovation System, linkages are of paramount importance: to other types of investors (as a source of referrals and exit alternatives), to the research base (to have access to other potential opportunities), and to other public programmes (which can provide other types of support). Beyond its immediate impact on entrepreneurial finance, public involvement can contribute to the emergence of local investment management expertise, so capacity building issues should also receive attention when designing policies in this area. Investment in foreign funds has been seen as a way to have access to foreign technology but it can also be an instrument to train local fund managers.

7.4 Integrated programmes

Productivity 2020

The Productivity 2020 programme, which is being implemented under the SPAIID, aims to increase productivity in Kazakhstan's economy. The programme integrates a substantial

number of programmes and institutions under this objective and is managed by the Kazakhstan Institute of Development and Industrialization (KIDI).

Applicants are required to develop a "complex plan," detailing their project and its likely productivity impact. This phase is managed by KIDI. Applications in the regions are to be lodged with SECs (Chapters 2 and 6) that organize support in the drafting of applications through consultants. This plan is the entry point for access to the low interest long-term leasing finance facility administrated by DBK-Leasing (a subsidiary of DBK) or a broad array of programmes organized by the NIF. The latter encompasses the "traditional" grants for feasibility studies, R&D, patents, technology transfer and new initiatives created for the Productivity 2020 programme: contracting design and engineering organization, the implementation of process and management technologies, and the employment of international experts (Table 23). In the future, there are plans to introduce grants for other types of expenditures, including staff training, improving the efficiency of business processes, grants for conducting industrial research or the commercialization of technology. Grant financing is an important novelty which has attracted an increased amount of resources: around US$50 million in 2011, 4.5 times more than in 2010, when the NIF became the operator of the grant programme. The acquisition of new technologies accounted for almost three quarters of the total allocated funds in 2011.

Table 23. Organization of the Productivity 2020 programme

Programme Administrator:	Ministry of Industry and New Technologies
Programme Operator:	Kazakhstan Industry Development Institute
Instrument Operators:	
KIDI	Development of Complex Plan
DBK Leasing	Leasing Financing
National Innovation Fund	Project and Engineering Organizations
	Managerial and Production Technologies
	Grants

Source: NIF.

The level of support for the Productivity 2020 programmes appears adequate. While conditions may change as the programme proceeds, companies can receive funding amounting to up to 100% of their costs depending on the activities they wish to perform (Table 24).

Upon being accepted for funding, the administrative processes are straightforward. Companies will need to provide evidence of their expenditures for the various activities supported, and will then have their costs refunded up to the relevant maximum threshold level.

Table 24. Financial support provided by NIF programmes in the Productivity 2020 programme

Activities		**Support provided as a share of costs** per cent	**Maximum amount** KZT million
Managerial and production technology		70	5
Involvement of project and engineering companies/ consultants		30	30
Foreign engineers and technicians		50	9, up to 3 engineers
Innovation grants	R&D	100	
	Pilot equipment	100	20
	Feasibility studies	100	10
	International patenting	100	10

Source: NIF.

The Productivity 2020 programme provides an instructive example of how the combining of different instruments can form a coherent offering for potential innovators. The programme can accommodate both investment and innovation projects. Such an integrated approach reduces significantly the complexity of support programmes for enterprises.

The major drawback of this programme is the duration of the application process, which takes 155 working days for project evaluation. While the process is thoroughly planned, there appears to be ample room for its streamlining. Strengthening the evaluation competencies in the organizations providing the financing – in this case the DBK and NIF – would be a positive step, and could contribute to a quicker assessment of applications.

Business Roadmap 2020

Financing constraints are most serious for both nascent entrepreneurs and already existing SMEs, as risks are considerable for financial institutions. The Business Roadmap 2020 (described fully in chapter 3), provides substantial subsidized loans of up to KZT 3 billion (around US$20 million). The interest rate of 12% is below market rates faced by SMEs (around 20-25%). However, the amounts requested by SMEs and entrepreneurs are generally more modest. In addition, most entrepreneurial start-ups and are not funded by banks, which will limit the impact of these financial support measures.

Commercialization grants

Kazakhstan has recently launched a three-step initiative for state support through grants in the context of existing plans to set up Offices of Technology Commercialization (OTC) (Chapter 6). The first step involves the selection of R&D organizations and universities that will support the creation of the OTC, from which projects will be considered. The procedure includes presentation of a business idea, proof of concept and the complete application for a grant. Financing is split into two stages: funding for proof of concept (around US$5,000) and commercialization grants (around US$200,000). Seven projects are expected to reach this

final stage. The main body responsible for awarding grants will be the Ministry of Industry and New Technologies (MINT).

7.5 Tax incentives

Tax incentives have become popular across Europe in recent years because they are relatively straightforward to administer and are non-discriminatory, i.e. whoever meets the criteria receives them. A critical aspect when assessing the impact of tax incentives is their "additionality", i.e. the amount of private money that is "levered in" by the public support granted through the tax credit. In many cases, this may be lower than the "additionality" of direct innovation support measures. Tax incentives can nonetheless be an important ingredient of innovation finance.

The fact that tax incentives support all innovative companies irrespective of the overall innovation strategy while presenting a low administrative burden makes them an interesting instrument for Kazakhstan's authorities. General innovation support through tax incentives can be combined with more selective support through direct innovation finance.

A major drawback of tax incentives is the timing of support. Tax incentives are usually included in the tax declaration and will thus be disbursed after the innovation project is complete. They are thus an *ex post* reward for innovation, but do not provide innovation finance at the initial stage of the project. This feature is somewhat problematic for start-ups and all companies facing binding *ex ante* constraints in the financing of innovative projects. The same argument holds for present discussions at the NIF regarding *ex ante* or *ex post* disbursement of financial support. Some companies have agreed to receive support after project completion. This suggests that they are able to finance innovation expenditures from external sources or internal cash flows, or that they can use the funding promise of the NIF as collateral for bank loans. In the first two cases, public support for innovation is not needed; in the third case, it is also unlikely that public support is essential.

Tax credits play a role in the overall system of financial support to innovation, which needs to be tailored to the specific stage of development of innovative activities. Tax credit should be given consideration in Kazakhstan in the medium-term, particularly once the number of innovative firms has risen substantially. At the present time, it is unlikely that tax credits could stimulate a substantial increase in R&D spending or address the other factors constraining innovative activities. A system that employs traditional instruments of direct innovation support and is adapted to a larger number of applications should be given a preference. Nonetheless, conceptual work on tax credits could begin now, so as to prepare for more extensive future use of tax incentives. The Tax Code establishes that R&D costs can be used to offset corporate tax payments and the Programme of Innovative Development and Support for Technological Modernization for 2011-2014 envisages increasing this tax relief by an additional 50% to provide further incentives for R&D. This has been confirmed by the changes introduced by the new Law on State Support to Industrial Innovative Activity, adopted in January 2012.

7.6 Recommendations

The development of SMEs is critical not only for innovation but also to foster the modernization and diversification of the economy, which are major objectives of Kazakhstan's industrial policy. SMEs can also contribute to economic dynamism but so far they have not been among the key drivers of innovative development in the country. Access to finance remains a key constraining factor with banks reluctant to finance risky and innovative projects, particularly those of SMEs, which can in many cases offer only limited collateral. Public support is also weak with DAMU (the Entrepreneurship Development Fund) having at present no initiatives targeting the innovative activities of SMEs. The NIF provides R&D grants to SMEs on an individual basis as part of the Productivity 2020 programme. A conducive environment is necessary to allow SMEs to expand and develop beyond the traditional sectors where they are currently concentrated.

Recommendation 7.1

The authorities should broaden public support to innovative SMEs, in particular, by expanding the existing initiatives undertaken to finance SMEs, going beyond the temporary policy response prompted by the crisis to cover support areas such as:

- *Offering adequate finance over the life-cycle of a company wherever the private sector is not providing sufficient support, identifying and addressing any bottlenecks at different stages of enterprise formation;*
- *Strengthening the approach that links access to financial resources to an upgrading of management practices in SMEs. Helping SMEs to manage their businesses more efficiently and to improve capabilities to absorb technologies is complementary to easier access to finance;*
- *Introducing a special new programme to support R&D and innovation activity in SMEs; and*
- *Increasing micro financing and small grants provision to encourage experimentation of potential opportunities and entrepreneurial initiative, including in universities and research organizations.*

The financial system in Kazakhstan is bank-based, as the capital market plays a minor role in providing finance to companies. A bank-based system favours industries which rely on incremental innovations as banks are usually not prepared to accept the risk involved in (radical) innovation projects - and SMEs, especially start-ups and service sector companies, are not in a position to collateralize investments. However, the financing of radical innovation is strongly linked to the development of equity instruments and, in particular, those concerning early-stage financing. The focus on equity financing is likely to increase in the medium to long term as the economy develops and becomes more sophisticated. This requires the creation of the necessary infrastructure.

Recommendation 7.2

The authorities should undertake a broad effort to enhance the equity dimension of the financial system. In particular:

- *Stock markets should be strengthened as an exit mechanism for equity/venture finance, paying particular attention to the needs of young, innovative companies; and*

- *Venture activities by private persons (e.g. business angels) should be stimulated by creating adequate framework conditions and developing public initiatives to overcome coordination and information problems in the private sector, including through support to the formation of networks.*

Financial support for innovation is currently divided between equity finance that produces a small number of highly supported projects, and R&D grants that distribute relatively small sums over a larger number of firms. Most of the beneficiary projects and activities are investment projects with limited "pure" innovation content. This reflects the capabilities of successful applicants rather than a bias from funding agencies, strongly suggesting a shortage of genuine innovative projects seeking finance. If Kazakhstan is to continue to modernize the economy and gradually increase the innovation content in this process (i.e. some incremental product and process innovation), the number of firms engaging actively in innovative activities should increase substantially in a medium-term perspective.

Recommendation 7.3

The public innovation finance system should be developed further to reflect a pattern of demand characterized by a large number of applications that focus on incremental innovation projects (minor changes, improvements to a product or process with limited risk),and a more limited number of projects with substantial innovation content. This requires a wider set of instruments that cater for the needs of different types of innovation projects:

- *Equity finance would be used for risky projects with promising potential, mostly start-ups. Financial support to this type of high-risk projects should be increased;*
- *Incremental innovation projects are often less risky (and less innovative), but a major source of increased competitiveness. Such projects can be supported by grants, subsidized loans, guarantees or a combination of these instruments; and*
- *Pure investment or modernization projects should be gradually phased out from access to public equity funds. Subsidized loans could be made available if the project is of particular interest and meets predefined criteria. Increased depreciation rates could also be used for tax purposes to encourage investment into physical equipment that contributes to modernization.*

Kazakhstan has carried out initiatives to develop a venture capital industry, investing along private funds. This is a valuable experience that will contribute to create domestic expertise in venture investing and exploit some existing opportunities. However, this is a slow organic process which can only yield limited results, being constrained by the existing deal flow and the amounts of financing available from these emerging specialized intermediaries. Established companies can be a complementary source of financing and knowledge.

Recommendation 7.4

The authorities should encourage the development of corporate venture capital, where established large companies, including foreign ones, take equity stakes in new innovative firms by facilitating matchmaking and providing tax and other incentives, including risk-sharing with the use of public funds. These efforts could build on existing agreements between the National Innovation Fund and financial industrial groups to develop joint venture funds. Linkages with research organizations and universities should be strengthened to provide access to potential opportunities.

Because of the inherent risk of innovation support and the unpredictable outcomes, policy learning depends on regular evaluation of the rationale, procedures and impact of support programmes. However, until now public innovation support programmes have been subject to only limited evaluation. Without the insights drawn from evaluation, policymakers are likely to have difficulties designing policy instruments in an effective and efficient way. However, it is important that evaluation and control mechanisms reflect appropriately the characteristics of innovation processes. Existing evaluation procedures require that each and every investment project is successful, rather than the portfolio of supported projects, and disregards the positive indirect effects of innovative activities, resulting in excessive risk aversion.

Recommendation 7.5

In order to gain a better understanding of the effects of different mechanisms of support and improve policy design, the authorities should introduce a systematic and regular evaluation cycle of innovation support programmes that:

- *Collects data on the development of each financed project through a well-designed monitoring system that covers both pre- and post-innovation years;*
- *Compiles a complete database of these projects, incorporating a selection of indicators that allows for a quantitative analysis of the effects of the promotion programmes and the characteristics of the awarding process;*
- *Includes measures of overall contribution to innovation to prevent excessive risk avoidance in the selection of projects that emphasizes short-term outcomes; and*
- *Assesses returns from public investments in innovative projects on a portfolio basis rather than focussing on the performance of each individual project (see recommendation 3.6).*

The integration of financial measures with other forms of support enhances the positive impact of interventions. A number of initiatives have sought to integrate packages of instruments into comprehensive support programmes, such as Productivity 2020 and Business Roadmap 2020. Combined with a one-stop-shop approach, this is a very positive development that avoids system fragmentation while allowing tailor-made support packages for enterprises.

Recommendation 7.6

The authorities should continue to develop integrated programmes that link the provision of financial resources (supply interventions) to other instruments aiming to increase the managerial and innovative capacities of beneficiaries. In particular, they could:

- *Use the experience of existing integrated programmes to improve future policy design (see recommendation 7.1);*
- *Identify the potential for synergies on the basis of an in-depth cross-sectoral analysis of existing system of support;*
- *Build new programmes on the basis of previous achievements; and*
- *Involve target groups in consultations at an early stage in the design of new programmes or in the overhaul of existing ones to better understand the potential needs of beneficiaries.*

Chapter 8

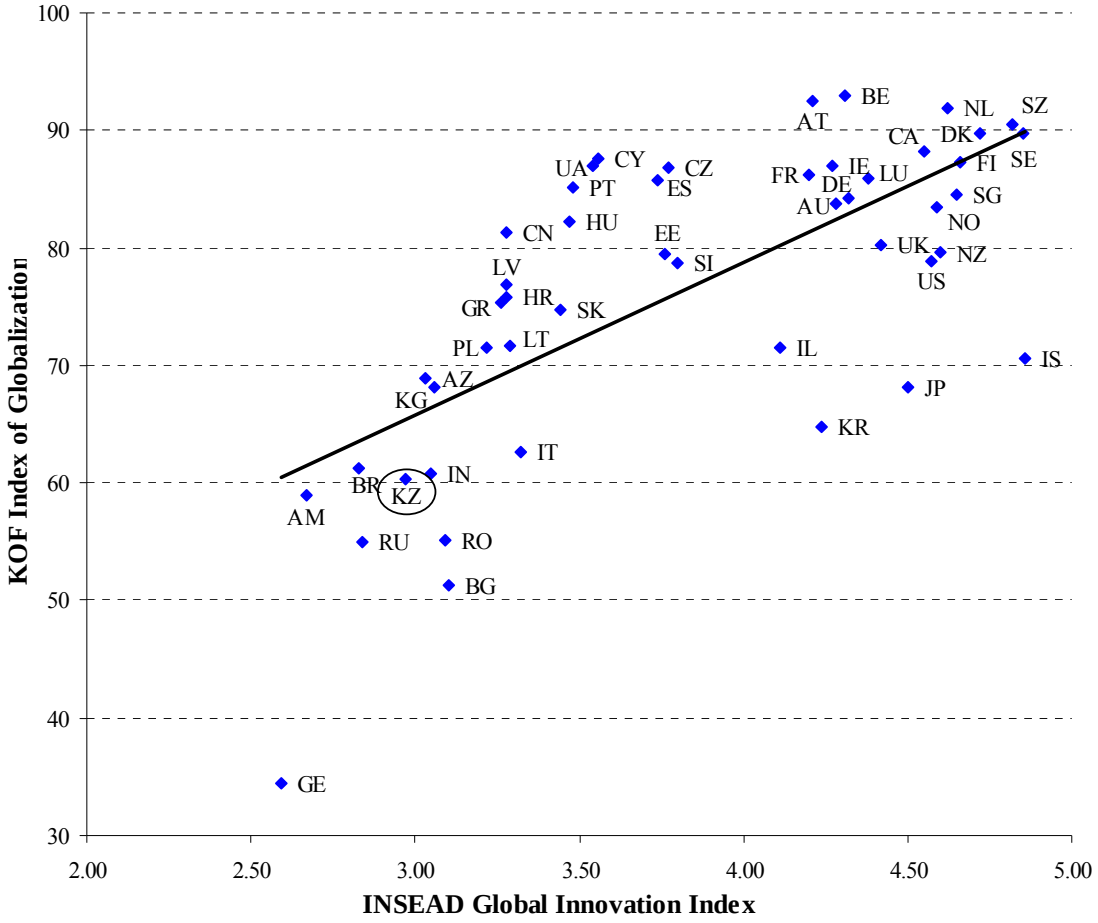
INNOVATION AND INTERNATIONAL ECONOMIC INTEGRATION

This chapter considers the international dimension of innovation. It presents the main channels through which knowledge flows internationally, and describes the existing legal and institutional framework to support international cooperation in areas related to innovation, and Kazakhstan's participation in various programmes and initiatives. The chapter also examines the potential of current integration processes within the Commonwealth of Independent States (CIS) and the Eurasian Economic Community (EurAsEC) to foster innovation. The analysis serves as a basis for drawing policy conclusions and making recommendations.

8.1 International knowledge flows

Internationalization of enterprises, trade and attraction of FDI and skilled labour are key drivers of innovation and competitiveness in modern economies, facilitating knowledge exchange and creating a competitive environment conducive to innovation. Figure 17 reveals a close association between innovation and globalization.

Figure 17. Globalization vs. innovation



Source: Global Innovation Index 2010 (INSEAD), KOF Index of Globalization 2010 (Swiss Economic Institute).

Cross-border mobility of scientists

The low number of research personnel is a policy concern in Kazakhstan. According to the Agency of Statistics of the Republic of Kazakhstan, there were almost 19,000 researchers in Kazakhstan in 2005, but by 2010 this number had fallen to 10,870. The ageing R&D community in the country is another challenge.[105] The demographic profile of researchers is also an obstacle to international cooperation, as it is associated with a lower average level of proficiency in English - a skill much more prevalent among the younger generation of Kazakhstan researchers.

The Bolashak Scholarship Programme (Chapter 4) has a great potential to help Kazakhstan's science infrastructure in the future. The government has decided to emphasize more science-related studies in the programme. In 2011, the target was to have 60% of scholarship students in technical engineering, which should boost the international capacity of Kazakhstan's science sector. The Bolashak programme is an important contribution to facilitating internationalization through mobility.

Kazakhstan joined the Bologna Process in 2010. The purpose of Kazakhstan's participation in the Bologna Process is to facilitate access to European education, improve quality and increase the mobility of students and teaching staff by introducing an internationally compatible system of grading and academic credits in higher education, allowing the recognition of Kazakhstan's educational programmes and curricula.

The Nazarbayev University (NU) in Astana was designed along the lines of internationally recognized models of higher education to further accelerate the process of internationalization. The second academic year began in August 2011 with around 1,000 students. The university will have a strong focus on science and engineering, although business education programmes will also be provided. NU partners include a number of high-ranking universities from around the world, including University College London, Wisconsin Madison, and the University of Singapore. During its first year, 52 of 54 professors were from other countries, with the requirement of spending at least one academic year in Astana, and forming research groups that they will continue to lead part-time. The working language of the NU is English (Chapter 2).

Kazakhstan's researchers have benefited from the International Science and Technology Centre (ISTC) Mobility Programme, which provides Kazakhstan's scientists with additional opportunities for cooperation with senior scientists and researchers from other CIS countries, Canada, the EU, Japan, Republic of Korea, Norway and the United States. The ISTC organized several conferences and seminars under its Competency Building Programme in 2009-2011 – four of which were held in Kazakhstan. The programme aims to enhance the skills of scientists and experts in developing and implementing commercialization projects.

Trade

Kazakhstan's economy needs to overcome its dependence on natural resources while accelerating the development of processing industries and promoting high-tech start-ups. The current trade structure (Chapter 1) shows limited progress in diversification so far, with

[105] UNESCO Science Report 2010: The Current Status of Science around the World, Paris.

around 80% of exports accounted for by mineral and fuels. Imports are an important factor in the upgrading of the technological capabilities of the country, providing an access to global high-tech flows. Imports of machinery, equipment and transport goods account for more than 40% of the total. Imports benefit from a number of customs advantages when related to investment projects (Chapter 6). Access to foreign expertise has contributed to the deficit of the balance of services. Payments for royalties and licence fees reached US$86 million in 2010, more than three times the level observed in 2005.

A liberal import regime can have a particularly beneficial impact on innovation for a country within the "technological frontier", as it facilitates access to foreign knowledge. Imports can also be a factor of economic dynamism, increasing competition and thus encouraging innovation. This is a consideration which is also relevant for Kazakhstan, given existing framework conditions (Chapter 3).

Access to foreign markets is also important to facilitate the growth of enterprises, helping them to overcome the limitations of domestic markets, including the relative lack of sophistication of demand, which may be a deterrent for innovation. SMEs, which are a major source of innovation and new products, are at a disadvantage when trying to internationalize. According to research by DAMU, the main barriers to exports by SMEs are transport costs and finance. Despite provision of SME financing by DAMU, SMEs lack capital and have restricted access to bank loans.

Foreign direct investment (FDI)

Kazakhstan has been a leading recipient of FDI in Central Asia. Much of this has been in the extractive industries, although some diversification took place in the 2000s with increased international investment in the financial and construction sectors (Chapter 1).[106]

Kazakhstan has sought to increase the impact of FDI on the domestic economy through the introduction of local content requirements, i.e. the obligation to purchase goods, services and other inputs from Kazakhstan's producers and to employ local workers. In 2011, a law came into effect establishing an upper limit of 30% on foreign participation in a company's senior management and a 10% limit for engineers.

Administrative constraints and sanctions for non-compliance have often taken precedence over the creation of incentives for foreign companies to invest in local content. However, there are plans to link technological agreements with established companies (an established instrument for technology transfer in existing programmes) with local content policies.

Weaknesses in infrastructure, particularly in the areas of national transportation, energy and telecommunications, act as a deterrent to FDI, and so ongoing efforts to modernize infrastructure could have a positive impact on the attraction of foreign investment and, more generally, on private sector development.

[106] UNCTAD (2011), World Investment Report 2011: Non-equity modes of international production and development, Geneva.

8.2 Institutional framework for international cooperation on innovation

Legal framework

International cooperation is being developed on the basis of international agreements and contracts between partner organizations. More than 140 agreements on research cooperation have been concluded to date. International grant agreements in Kazakhstan are free from any local taxes and duties, except for those applying to individuals' incomes. In addition, there are a number of national programmes and strategies envisaging different forms of international cooperation.

The State Programme for Accelerated Industrial-Innovative Development (SPAIID) aims to promote economic diversification. Under SPAIID there are subprogrammes such as Business Roadmap 2020, Export 2020, and Investment 2020. Business Roadmap 2020 targets the development of entrepreneurship. Export orientation and/or increasing the local content with improved access to foreign markets are two of the main criteria used when granting support. Investment 2020 sets targets for attracting FDI and multinational companies to Kazakhstan. Measures include exemption from customs duties and tax incentives in special economic zones. The Export 2020 programme aims to facilitate the entry of domestic companies in foreign markets through various tools, including grants, trade finance and export insurance, and export support services. The “Science Development Programme in Kazakhstan for 2007-2012” includes 15 specific S&T subprogrammes, including international S&T cooperation.

Kazakhstan’s Law on Investment, adopted in 2003, provides for equal rights to foreign and domestic investors while reducing or eliminating a number of the guarantees previously available to foreign investors. It retained, however, the stability of contracts (with certain exceptions), free use of income, and other investment guarantees. Kazakhstan has strengthened intellectual property protection, including through participation in international conventions, specifically those pertaining to patents.

Institutions supporting international cooperation

The National Innovation Fund (NIF) has extensive responsibilities in the area of innovation, including international cooperation activities (Chapters 2 and 3). The Centre for Engineering and Technology Transfer (CETT), established in 2003 under the National Innovation Fund, provides engineering and technology transfer services in Kazakhstan. It is being merged with the NIF to create the National Agency for Technological Development (Chapter 2).

The National Centre for Scientific and Technical Information (NC STI) promotes integration of Kazakhstan into the global scientific and technological landscape. It collects data from the various state programmes, conducts analysis and facilitates access to information by researchers. NC STI is the national representative in the International Centre for Scientific and Technical Information (ICSTI). NC STI organizes seminars and workshops with foreign scientists and trains Kazakhstan's researchers on how to apply for international grants and how to write in international journals. NC STI has signed a contract with the Journal of Science which provides organizations in Kazakhstan with the opportunity to order discounted services through the NC STI. In 2004, NC STI also developed a web portal, the National

Scientific Portal, in the English, Russian and Kazakh languages.[107] The aim of the portal is to facilitate access by the scientific community to scientific, technical and educational information by making it available on the Internet.

The National Coordination Board (NCB) on cooperation with the European Union Framework Programmes on research, technology and innovation development is an advisory and deliberative body under the Ministry of Education and Science of the Republic of Kazakhstan. The main tasks of the NCB are to elaborate recommendations to the government on research and technological development, and the innovation system in Kazakhstan, and contribute to the definition of the main orientations of state policy in research, technological development and innovation (RTDI). The NCB analyses the RTDI proposals regarding state institutions, business entities, and public organizations and coordinates international cooperation in RTDI.

The Centre for International Programmes (CIP) was established in 2005 to carry out the Government's Bolashak programme, which provides full scholarships to study in leading universities around the world. The programme has 200 partner universities in 27 countries.

The Kazakhstan Industry Development Institute (KIDI) provides analytical and methodological support to the formulation of Kazakhstan's industrial and innovative development strategy. In the field of international cooperation, KIDI priorities include the development of international contacts, attraction of external experts and the preparation of analytical materials relating to industrial development.

The National Export and Investment Agency Kaznex Invest JSC (Kaznex) aims to contribute to the diversification of the economy by creating more favourable conditions for development and promotion of non-commodity exports and attracting foreign direct investment in priority sectors of the economy. Kaznex carries out its activities under the SPAIID. It is a one-stop-shop for foreign investors working in Kazakhstan. Kaznex works with Kazakhstan companies that already export their products, as well as with companies with a potential to export.

In addition to these organizations, a number of government agencies and institutions are engaged in international cooperation. There have been some attempts to provide informational resources to national researchers on international S&T opportunities, such as the web portal of NC STI. However, there is no global strategy for information sharing on activities and international opportunities, or coordination between the different institutions involved.

8.3 Forms and directions of international S&T cooperation

The government of the Republic of Kazakhstan has a number of bilateral contracts and agreements in different sectors, some of which have a direct influence on innovation. Some of these agreements can be seen as targeting innovation directly, while others (on trade policies and regulations, transport networks) have an indirect impact. The National Innovation Fund and other organizations involved in innovation-related areas have sought to develop and strengthen contacts with a number of international partners (Box 11). S&T linkages are being developed in commercial sectors, particularly with regard to the development of oil and gas resources.

[107] See www.nauka.kz

Bilateral cooperation agreements

Kazakhstan has traditionally close cooperation with Germany. The German Company for International Cooperation (GIZ, formerly GTZ) has supported Kazakhstan in its reform efforts since the early 1990s. GIZ activities currently focus on four key areas: sustainable economic development, promotion of vocational training, environment and climate, and good governance. GIZ is currently implementing two educational programmes in Kazakhstan: Reform of Educational Systems in Central Asia, and the Programme of Professional Education and Training in Central Asia I. The former is being implemented with the participation of the Ministry of Education and Science and the national education institutes, and the latter with the Ministry of Agriculture and Ministry of Education and Science. There are also ongoing activities with the German Academic Exchange Service (DAAD). In 1999, Kazakhstan and Germany jointly opened the Kazakh-German University in Almaty.

Kazakhstan has also established close cooperation with the United Kingdom, particularly in the fields of research and technical development. Around 45% of projects funded under the EU Framework Programmes are with the participation of UK partners.

Cooperation with the United Kingdom is also important in Kazakhstan's vocational education skills development initiatives. Kazakhstan's Ministry of Education and Science has signed a Memorandum of Understanding covering cooperation with Technical Vocational Education and Training UK which represents a wide range of British vocational education colleges, accreditation bodies and corporate training providers. A major institution is the Kazakh-British Technical University, which was established in 2001. Several United Kingdom universities are involved in running programmes, and Shell and BG Group has provided substantial funding for the post-graduate school. In 2008, Haileybury School opened a subsidiary in Almaty and another one in Astana in 2011. University College London (UCL) is also working in partnership with the new Nazarbayev University in Astana on the delivery of foundation and English language teaching (ELT) programmes.

Kazakhstan has bilateral agreements on cooperation in the fields of culture, education and science with Bulgaria, Spain, Greece, France, Turkey and Poland. These agreements foresee joint research, the exchange of students and teachers, joint participation in EU programmes such as Technical Assistance to the Commonwealth of Independent States (TACIS), the Trans-European Mobility Programme for University Studies (TEMPUS) and the EU's Framework Programme projects, as well as in other areas.

Box 11. International collaboration and innovation-supporting institutions

The National Innovation Fund cooperates with organizations across many countries, including the United States, United Kingdom, Germany, France, Belgium, Finland, Israel, Turkey, South Korea, Malaysia, Russia and others. The NIF also cooperates with international organizations such as the United Nations Economic Commission for Europe (UNECE), the European Union (within the EU Framework Programmes), the World Innovation Foundation (WIF) and the OECD. The NIF also promotes integration within EurAsEC that contributes towards the formation of a Eurasian innovation system. The NIF has signed 16 memoranda and agreements relating to cooperation with foreign

Box 11. International collaboration and innovation-supporting institutions *(continued)*

organizations. These are in various fields, e.g. venture capital, multimedia development, technoparks and business incubation.

In 2010, the NIF and Korea Innovation Cluster Foundation signed an agreement on the establishment of the Korea-Kazakhstan Centre of Technological Cooperation. There is also close cooperation with the Korean Institute of S&T Evaluation and Planning (KISTEP) in developing the first national system of scientific-technological foresight. The Centre of development of the innovation infrastructure of the NIF also oversees the work of the Kazakh-French Technology Transfer Centre.

Besides the NIF, other organizations have become parties to memoranda of cooperation with international partners. This indicates the strong importance attached to international cooperation by Kazakhstan's authorities and the willingness to explore different opportunities for cooperation. However, the degree of follow up and extent of impact on participating organizations is variable, in some cases being quite limited.

Cooperation within wider Europe

The EU is an important trading partner, and therefore plays a significant role in international cooperation initiatives. In 2008, the President signed the Decree on the State Programme "Path to Europe", to be realized during the period 2009-2011. The aim of the programme is to intensify technological, energy and transport cooperation, among other areas, between Kazakhstan and European countries.

A number of ministries have created working groups to develop cooperation between the EU and Kazakhstan. In the area of science and technology, the primary concern remains increasing the critical mass of Kazakhstan participants in the EU's Framework Programme and other research programmes, as Kazakhstan's rates of participation in EU programmes has been lower than anticipated.

The European Commission's (EC) cooperation with Kazakhstan and other countries in Central Asia is based on a multi-annual regional cooperation strategy that takes into account the situation and needs of each country. In Kazakhstan, EC cooperation focuses on social and economic development and support for state and administrative reform, while regional programmes prioritize cooperation in the fields of energy and transport, environment, education, security and stability. Since 1991, more than 300 projects of direct support to Kazakhstan, amounting to €140 million, were funded by the EU. During the period 2011-2013, an average of €13 million per annum is foreseen. The largest share of these funds is allocated to policy advice and technical assistance to the public authorities, in sectors jointly identified as priorities. Recent EC projects of direct or indirect relevance to S&T or innovation and involving Kazakhstan are listed in table 25.[108]

[108] European Commission, Central Asia DCI Indicative Programme 2011-2013.

Table 25. Recent EC projects with involvement of the Government of Kazakhstan including S&T and innovation environment aspects[109]

Partner	Title	Amount (euros)	Implementation period	Main objectives
Ministry of Economic Development and Trade (MEDT)	Diversifying and Strengthening Foreign Direct Investments and Sector Competitiveness (OECD joint management)	2,000,000	Jan 2010-Dec 2011	Strengthen capacities of state authorities for economic diversification.
	Promotion of Public Private Partnership	1,900,000	Oct 2010-Aug 2012	Advise and strengthen capacities of the PPP centre under the MEDT.
	Development and implementation of trade policies and regulations	1,900,000	Jul 2010-Jun 2012	Advise the Centre for Trade Policy Development on questions relating to WTO accession and other relevant trade policy developments.
Ministry of Education and Science (MES)	Vocational Education and Training successor programme	4,000,000	Oct 2010-Oct 2013	Support Kazakhstan's national VET strategy. Steering Committee chaired by Director VET of MES.
Ministry of Finance (MF)	Support to Public Procurement	1,200,000	Dec 2009-Apr 2011	Strengthen capacities of MF in developing and implementing public procurement regulations.
Ministry of Industry and New Technologies/ Ministry of Oil and Gas	INOGATE: Support to energy market integration and sustainable energy (SEMISE)	5,670,000	Jan 2009-Jan 2012	Regional: Assist the INOGATE Partner Countries in promoting energy market convergence, investment facilitation and the use of sustainable energy.
	INOGATE: Harmonization of electricity standards	1,482,000	Sep 2009-Mar 2011	Regional: Assist the INOGATE Partner Countries in adopting international standards, rules and practices in the electricity sector.

[109] European Commission, Overview of ongoing and planned EU projects with involvement of the Government of Republic of Kazakhstan, 31 January 2011.

Table 25. Recent EC projects with involvement of the Government of Kazakhstan including S&T and innovation environment aspects *(continued)*

Partner	Title	Amount (EUR)	Implementation period	Main objectives
Ministry of Industry and New Technologies/ Ministry of Oil and Gas *(continued)*	INOGATE: Energy saving in the building sector	4,449,650	2010-2012	Regional: Support the INOGATE Partner Countries in developing and enforcing energy efficiency-related legislation in the building sector
	Assistance in Clean Coal and Environmentally sound Storage Solutions	481,000	Jan 2011-Dec 2012	Strengthen local capacities for the development of Clean Coal Technologies (CCT) and identify Carbon Capture and Storage (CCS) potential in the country
	INOGATE: Capacity building for sustainable energy regulation in Eastern Europe and Central Asia	505,856	Mar 2010-Sep 2011	Regional: Promote sound practices in energy regulation in the INOGATE Partner Countries and the harmonization of energy regulatory practices.
	INOGATE: Central Asia Sustainable Energy Programme: Energy Efficiency/ Renewable Energy	6,000,000	2011-2014	Regional: Support central policy, regulatory and institutional mechanisms aimed at increasing the use ofrenewable energy sources and improving energy efficiency

Cooperation with the EU on science and technology started in 1994, with the first pilot action of the International Association for the promotion of cooperation with scientists from the independent states of the former Soviet Union (INTAS), including creation of the first INTAS InfoDesk.

Kazakhstan has participated actively in the TEMPUS programme, which supports the modernization of the education system and its convergence with European standards. The involvement in 48 projects over the last decade has resulted in changes in curricula and improvement in standards in a number of universities. Kazakhstan has also participated in the Erasumus Mundus programme for mobility in higher education, benefiting more than 175 students and academic staff in 2007-2009.

Kazakhstan signed an agreement for collaboration in fusion energy research with Euratom (the European Atomic Energy Community) and engaged in a large number of projects receiving funding under the FP4 and FP5, although participation has declined in recent years. There were seventeen projects funded under the FP7 with participants from Kazakhstan, fourteen of which were in progress as of September 2011:

- Two projects in the fields of food and biotechnology;
- Two projects in the environmental field;
- Four projects in networking (S&T cooperation);
- One project in energy;
- Two projects in health; and
- One project in infrastructure.

Kazakhstan has signed two Memoranda of Understanding with the EU on cooperation in the field of energy and on the development of transport networks. Better infrastructure improves the framework conditions for innovation, as it facilitates private sector development and is an important factor in attracting FDI.

In addition to the EU institutions, there are a number of international organizations participating in the development of Kazakhstan's S&T and innovation environment. The European Bank for Reconstruction and Development (EBRD) supports Kazakhstan's efforts to promote economic diversification and improve infrastructure, and is the largest investor outside the oil and gas sector, having invested €9.9 billion in 145 projects across the country. The Asian Development Bank (ADB) is another major contributor to Kazakhstan's programme of reforms, while the World Bank has been working with the Ministry of Economy since 2009 on coordinating business environment reforms to improve the economy's "Doing Business" ratings. During 2010, the World Bank also collaborated closely with the Ministry of Industry and New Technologies in assisting the development of financial and technical support mechanisms for stimulating R&D, innovation, enterprise modernization and moving up the value added chain.[110] The Technology Commercialization Project aims to accelerate the creation and commercialization of intellectual property (IP) and to improve the country's participation in knowledge-based industries (Chapter 5).

Cooperation within regional integration initiatives

Since the early 1990s, the linkages between the former Soviet Republics have weakened but the level of integration remains high, especially among some of the newly independent states. CIS countries share common technical standards; the Russian language is a traditional communication channel, and there are long-standing educational and professional ties, providing fertile ground for a revival of economic ties in the 21st century.

There is an abundance of bilateral agreements involving Kazakhstan and CIS countries in various fields of activity, from student exchange programmes to novel high technology projects (Box 12). The CETT is a member of the Russian Technology Transfer Network (RTTN) and cooperates with a number of science- and technoparks in Russia and Belarus. The CETT has also signed Memoranda of Understanding with the Technology Transfer

[110] World Bank (2011), Kazakhstan Partnership Programme Snapshot, September 2011, Washington.

Centre of Belarus, Technopark "Idea"(Tatarstan, Russian Federation), and Innovation Centre "Koltsovo" (Russian Federation).

Increasingly, institutional and policy collaboration has shifted towards multilateral cooperation, common policies and even the creation of supranational institutions working on shared priority goals and areas of interest. While Kazakhstan's innovation system is still rather weak in terms of network-based cooperation (Chapter 2), integration initiatives could provide further impetus to the development of linkages. At the firm level, growing competitive pressures are likely to result in increased demands for innovative solutions.

At present, the Commonwealth of Independent States (CIS), the Eurasian Economic Community (EurAsEC) and the Shanghai Cooperation Organization (SCO) are the main integration initiatives in the region.

Several CIS committees work in the fields of S&T, R&D and innovation cooperation. The CIS has set an ambitious goal to develop an “Inter-State Programme on Cooperation in Innovation of the CIS Member-States for the period to 2020”, which is considered a step towards integrated innovation cooperation between the member states as opposed to a group of single or targeted measures. The programme is also expected to complement the EU Framework Programme, and similar programmes in the Asia-Pacific region.

Kazakhstan is a member of this programme, together with Armenia, Belarus, Kyrgyzstan, Moldova, Russia, Tajikistan and Ukraine. The main body of the programme includes five subprogrammes aimed at developing the science, technology and innovation potential, human capital, market mechanisms, regulation, and infrastructure for innovation. It is implied that each of these directions should take national aspects of member states into consideration.

Box 12. Cooperation agreements with CIS countries in science and education[i]

Key intergovernmental documents negotiated with the Russian Federation include the Agreement on Cooperation in Education (1993), which sets annual quotas for Kazakhstan students to study at Russian universities, and the Agreement on Cooperation in Culture, Science and Education (1994). They provide the essential legal framework for collaboration in education, S&T and R&D&I.

The Agreement on Cooperation in Science and Technology with the Kyrgyz Republic (1997) provides a framework for a range of joint scientific and research initiatives. The Agreement on Cooperation in the Field of Training and Certification of Research and Pedagogical Personnel (1997) provides support for students, PhD students and post-doctoral researchers to attend universities and research institutions in the partnering country.

An Agreement on Deeper Cooperation in Culture, Health, Science, Education, Tourism and Sports was concluded with the Republic of Uzbekistan. The agreement was complemented in 1998 by the Agreement on Cooperation in Education, which provides the basis for the exchange of scientific staff in various areas.

A number of agreements have been established with Turkmenistan, including, for instance, the Agreement on the Mutual Recognition of Education, Scientific Degrees and Titles (2001), which facilitates educated specialists to work in S&T and R&D&I structures

Box 12. Cooperation agreements with CIS countries in science and education *(continued)*

in both Kazakhstan and Turkmenistan. A similar framework for collaboration exists with the Republic of Tajikistan (2000), enabling also the exchange of students and R&D staff between these countries.

Moreover, numerous bilateral cooperation agreements have been concluded between Kazakhstan and Belarus, Ukraine and Azerbaijan, covering various fields of education and science, including the exchange of students and the recognition of degrees.

[1] www.edu.gov.kz/fileadmin/user.../Mezhdunarodnye_dogovora_-1.doc (accessed on 15 August 2011).

Innovation projects are seen as the core of the programme and are generally supported throughout their life cycle; from the initial stages of development to commercialization. The only prerequisite is that projects should be developed by at least three partner organizations from three different CIS countries. At present, 120 projects have already been registered, predominantly in the fields of nanotechnologies (22 projects), manufacturing and industrial infrastructure (20), living systems (18), and medicine and health (11). However, so far this programme is not backed by adequate financial instruments, such as those of the EU's Framework Programmes, to support joint R&D and innovation projects with the participation of R&D organizations and researchers from different countries.

Another existing mechanism in the CIS is the International Innovation Centre for Nanotechnologies, which was founded in December 2009 by ten organizations from six CIS member states including science centres, academies of sciences, universities and companies. By July 2011, the Centre had developed fifteen projects in the Russian Federation, and ten in Belarus. None of the projects was launched in Kazakhstan. The commercialization of technologies is supposed to go through Technological Innovation Alliances which provide close linkages between universities, applied research institutions and firms. However, these institutional linkages are in many cases yet to be developed.

Kazakhstan is also actively involved in projects run by the International Science and Technology Centre (ISTC) of the CIS. In 2010, there were four of these projects in Kazakhstan, with a total value of US$2.8 million (around 20% of total ISTC funding). Biotechnology (44%) and the environment were the main project areas funded by the ISTC in 2010.

The Eurasian Economic Community (EurAsEC) is an international organization whose member states are Belarus, Kazakhstan, Kyrgyzstan, Russia, and Tajikistan. Armenia, Moldova and Ukraine have observer status. The main focus of EurAsEC is on economic cooperation and integration. The ultimate goal is the creation of a single economic space while facilitating the integration of its member states into the international economy and trading system.

Innovation has become a central theme for the EurAsEC in recent years, leading to the Concept of the Eurasian Innovation System,[111] which has been put into practice since 2010. The EurAsEC Centre for High Technologies was established as the main platform for future integration in the field of S&T, R&D, and innovation, and is expected to coordinate and combine the efforts of the respective national innovation systems of the EurAsEC states. Furthermore, the Centre is responsible for attracting potential investors and maintaining relations with them. However, as in similar CIS initiatives, EurAsEC countries have not yet put together financial instruments to support joint R&D and innovation projects with the participation of R&D organizations and researchers from different countries.

The Eurasian Patent Information System (EAPATIS) was created to provide efficient coordination in the field of innovation, and provides information regarding patents and patent applications of the EPO, EPA, USPTO, former USSR, and Russian Federation to all members of the Eurasian Patent Organization (Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, and Turkmenistan).

The Eurasian Innovation System foresees cooperation at all levels of innovation systems: from local innovation centres through subnational innovation systems up to national and supra-national systems.[112] In these terms, the obvious challenge for Kazakhstan is the lack of a well-developed subnational innovation system, including its institutional aspects (Chapters 2 and 6). This regional dimension is an important, and in many cases crucial, link for innovation activities. The whole national system of generating, supporting and introducing innovation lacks so far the feedback loop of a subnational system of institutions to assess the impact of measures adopted at the national level and complement and refine them on the basis of local needs and potential.

The government of the Republic of Kazakhstan is aware of the problem, and since 2009 has taken measures to establish a regional innovation network. There are plans to organize regional centres of commercialization (RCCs) and offices of technology commercialization (OTCs) that will work in partnership with the NIF and under its administrative and methodological support (Chapter 6). To date, however, there is no general framework or adjusted procedures that could provide the basis for coordination between the Eurasian Innovation Centre and the entities of a future subnational innovation system of Kazakhstan.

The idea of collaboration in innovation-related activities is also gaining popularity within the Shanghai Cooperation Organization (SCO). A plan for establishing the SCO Centre for Innovation was discussed in July 2011 at the most recent SCO Youth Forum in Almaty. Within the SCO, Kazakhstan signed an agreement on Cooperation in Education in 2006 that, for example, allows students from Kazakhstan to apply for a scholarship to study in China. Up to 20 grants are awarded per year.[113]

Despite an increased number of initiatives, there is not yet an integrated strategic and political response to the opportunities and challenges resulting from regional integration processes. The establishment of the position of Minister for Economic Integration in April 2011 could

[111] Intergovernmental decision "On Creation of a Concept of the Eurasian Innovation System", 11 December 2009, St. Petersburg.
[112] *Ibid*.
[113] www.edu.gov.kz/fileadmin/user.../Mezhdunarodnye_dogovora_-1.doc (accessed on 15 August 2011).

mark a shift towards the development and implementation of a more consistent strategy in this area.

The Impact of the Customs Union

Kazakhstan faces a challenging geographical position, being landlocked and relatively distant from large markets. Integration can contribute to overcoming such obstacles by widening its potential local market and facilitating access to international markets.[114] It also makes possible closer cooperation in research, development and innovation.

The Customs Union with Russia and Belarus is the most recent integration initiative within EurAsEC. Some of the expected potential benefits include:

- Cost reductions through easier customs procedures or their abolishment, and therefore improved competitive performance in external markets.
- Increased FDI in the non-primary sectors due to an enlarged market.
- Increased R&D and improved innovation performance of manufacturing firms with higher added value, due to increased international cooperation and knowledge spillover.[115]

In joining the Customs Union, Kazakhstan also enters a common innovation sphere and re-establishes access to the industrial and technological legacy of the former Soviet Union, with its considerable scientific capacities.

However, the Customs Union has also presented Kazakhstan with difficulties, one of the key issues being that the level of effective customs protection has increased considerably. In 2009, the level of customs protection was higher in Belarus and Russia, while in Kazakhstan it was in line with the world average.[116] The basis for the United Tax Tariffs (UTT) was provided by the current Russian import tax rates, meaning that Kazakhstan needed to raise around 48% and lower roughly 5% of its customs duties.[117] The most significant increase is to be found among motor transport vehicles, furniture, clothes, wood products and metallurgical products. In these categories, significant increases in imports from other Customs Union members are expected.[118]

For some industries, step-by-step import tax rate increases are planned – i.e. three years for the rolling stock building industry, four years for petrochemical products and five years for

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[114] World Bank (2011), Trade Expansion through Market Connection, The Central Asian Markets of Kazakhstan, the Kyrgyz Republic and Tajikistan, Washington, p. xi.
[115] Tsouz.kz (2011), http://www.tsouz.kz/index.php?option=com_content&view=article&id=231:-l-r&catid=65:2011-01-24-16-29-48&Itemid=84 (accessed 24 July 2011).
[116] Tsouz.kz (2011), http://www.tsouz.kz/index.php?option=com_content&view=article&id=1496:tamozhennyj-soyuz-s-vstupleniem-v-tamozhennyj-soyuz-uroven-effektivnoj-tarifnoj-zashhity-kazaxstana-znachitelno-vyros-lyaziza-sabyrova-lrakursr&catid=82:intervyu-intervyu&Itemid=73 (accessed 24 July 2011).
[117] *Ibid*.
[118] Tsouz.kz (2011), http://www.tsouz.kz/index.php?option=com_content&view=article&id=1497:tamozhennyj-soyuzspeczialisty-czentra-ekonomicheskogo-analiza-lrakursr-rasschitali-uroven-effektivnoj-tarifnoj-zashhity-kazaxstana&catid=58:2010-12-19-10-37-26&Itemid=83 (accessed 24 July 2011).

pharmaceuticals.[119] Such a policy was adopted to mitigate steep one-off price increases in sectors such as pharmaceuticals, where prices were already high.

Kazakhstan's companies will face increasing competition from Russian producers. Local enterprises will need to undertake continued and rigorous modernization and innovation efforts if they are to become or remain competitive. The lack of sufficiently developed R&D facilities may encourage closer cooperation with R&D institutions and increase the local demand for technology.

Customs Union membership will influence Kazakhstan's innovation system in a variety of ways. Firstly, a common certification system is being established. In the period to the end of 2011, around 47 technical regulations are expected to be passed, which will lead to further coordination and harmonization of standards.[120] Having obtained a certificate of compliance with the necessary rules, entrepreneurs gain automatic access to the common market. Kazakhstan is the only CIS country with membership in ILAC (International Laboratory Accreditation Cooperation), which implies international recognition and acceptance of test results carried out in Kazakhstan's laboratories.[121]

The Customs Union allows members to have "targeted imports", as described in the Law on Investment.[122] In general, it includes all technical equipment, its components and spare parts, resources and material imported exclusively for use in Kazakhstan, while implementing an innovation project registered with the national government. Such goods will be exempt from customs taxation.

Prospects for deeper regional integration

The Eurasian Innovation System being developed by EurAsEC could become one of the most effective institutional frameworks for S&T and R&D cooperation, as well as technology and knowledge transfer in the post-Soviet space. The intergovernmental decision "On Creation of a Concept of the Eurasian Innovation System" outlines a comprehensive framework that aims to foster knowledge-based and innovation-oriented economies. Following the declaration, the implementation of measures will be needed if there is to be a tangible impact on the socio-economic development of the EurAsEC countries.

While shaping the programme of cooperation between CIS countries in relation to innovation, Kazakhstan was responsible for preparing a concept for the Centre for Innovative Cooperation,[123] which underlines a strong interest in this policy area.

In order to boost the innovative development of Kazakhstan, Russia and Belarus, it is necessary to create an effective infrastructure that provides multiple linkages between executive authorities, business, and research units, and spurs on the formation of competitive

[119] Tsouz.kz (2011), http://www.tsouz.kz/index.php?option=com_content&view=article&id=231:-l-r&catid=65:2011-01-24-16-29-48&Itemid=84 (accessed 24 July 2011).
[120] Tsouz.kz (2011), http://www.tsouz.kz/index.php?option=com_content&view=article&id=1409:vyxod-na-mirovye-rynki-dlya-kazaxstanskix-tovarov-i-uslug-realnaya-vozmozhnost-&catid=64:-silk-way&Itemid=82 (accessed 24 July 2011).
[121] *Ibid*.
[122] Tsouz.kz (2011), http://www.tsouz.kz/index.php?option=com_content&view=article&id=231:-l-r&catid=65:2011-01-24-16-29-48&Itemid=84 (accessed 24 July 2011).
[123] http://www.uiis.com.ua/files/Program%20SNG.pdf (accessed 15 August 2011).

economic sectors. Box 13 provides details of a number of areas in which regional cooperation can play an important role in boosting innovation.[124]

The SCO is also an important platform for regional integration. Kazakhstan is fully engaged in the "SCO University", which aims to create a network of universities in SCO countries as well as in observer states (India, Iran, Mongolia and Pakistan). Training of highly qualified personnel at the SCO University should be carried out in priority areas of cooperation.[125] This could become an additional source of qualified R&D staff for Kazakhstan.

Over the next five to ten years, WTO accession seems likely, which would have a significant impact on the economy. The increased competition could act as a further stimulus for Kazakhstan's companies to innovate, while Kazakhstan's attractiveness to foreign investors may also increase due to improved perceptions, better market access, a more transparent legal framework and enhanced investment procedures.[126] At the same time, WTO membership would set significant limits to state support for industries and state regulation of projects with foreign capital participation.[127] On the other hand, reduced state protection may also boost incentives for Kazakhstan's firms to intensify their innovation efforts.

Integration processes provide Kazakhstan with opportunities to expand markets and increase its innovation capabilities. Competitive pressures will create stronger incentives to innovate. To take full advantage of these opportunities and address competitive pressures effectively, a strong policy response is required that supports further modernization and economic diversification.

Box 13. Kazakhstan's contribution to regional cooperative initiatives

1. Generation of knowledge, including the development of scientific organization and R&D resulting in new technologies and materials and use of up-to-date organizational methods to enhance the competitiveness of companies and foster the launch of innovative products.

A positive example of generation of knowledge and cooperation within EurAsEC is the launch of Kazakhstan's satellite "KazSat-2", built jointly with Russian specialists.[i] An agreement to create "KazSat-3"[ii] has already been signed.

2. Training of scientific and engineering personnel engaged in the management and development of innovation projects, products and services.

Kazakhstan is reforming its school education system, with progressive implementation of a 12-year model for schooling, and convergence with European standards. Moreover, R&D staff has been trained in compliance with European practices for more than ten years, meaning procedures of certification differ from those of Belarus and Russia.[iii] Potentially,

[124] Intergovernmental decision "On Creation of a Concept of the Eurasian Innovation System", 11 December 2009, St. Petersburg.
[125] http://www.eduweek.ru/index.php?option=com_content&view=category&layout=blog&id=2&Itemid=3&lang=en (accessed on 15 August 2011).
[126] Presidential Institute of Strategic Research of the Republic of Kazakhstan (2008), Kazakhstan in the System of World Economic Processes, Almaty, p. 162.
[127] *Ibid*.

Box 13. Kazakhstan's contribution to regional cooperative initiatives *(continued)*

Kazakhstan's experience could be applied while shaping common EurAsEC educational standards.

3. Protection of intellectual property rights (IPR) and development of an IPR regime encouraging the design and manufacturing of innovative products.

Kazakhstan signed the Agreement on Common Principles of Regulation for the Protection and Enforcement of Intellectual Property with Russia and Belarus.[iv] This document aims to harmonize regulatory principles in the field of IPR. This would enhance the protection of Kazakhstani goods within the common economic space. However, IPR protection remains an important yet unclosed chapter in the negotiations of Kazakhstan's WTO accession.

4. Development of innovative entrepreneurship.

5. Financing of innovation, fostering development of public-private partnerships that support joint research cooperation of public organizations and private businesses in the field of setting up and implementing innovative projects based on venture capital.

6. Information support of innovation, systematization (codification) of information in its practical use and commercial application.

7. Scientific and technical assessment of innovative projects, evaluation of conditions for commercialization and technology transfer.

8. Development of contractual relations between all agents involved in R&D cooperation, innovation processes and technology transfer.

9. Introduction of technical regulations and standards, product certification and quality management systems.

[i] http://ria.ru/science/20110716/402599171.html (accessed on 15 August 2011).
[ii] http://smi2.ru/Messi78/c684400/ (accessed on 15 August 2011).
[iii] http://www.naric.kz/node/23 (accessed on 15 August 2011).
[iv] http://www.e-cis.info/news.php?id=369 (accessed on 15 August 2011).

8.3 Recommendations

Kazakhstan has embraced international cooperation to gain access to new knowledge, identify good policy practices and develop contacts that should result in improved innovation performance. Many initiatives are being carried out by different institutions. However, synergies across different actions are not being fully explored and the exploration of different options is not always accompanied by follow-up actions.

Recommendation 8.1

Building on the extensive experience accumulated so far, the authorities should strive to develop an integrated strategy for international cooperation in R&D and innovation that:

- *Establishes clear goals and priorities, given particular consideration to private sector development and ensuring that SMEs are also targeted as beneficiaries;*
- *Identifies and supports cross-border linkages with interventions in other innovation-related programmes to reinforce the consistency and impact of policy actions, in particular in areas targeting an upgrade in the capabilities of firms; and*
- *Addresses coordination and information exchange issues between different national agencies involved in promoting international cooperation in R&D and innovation.*

Creative and skilled workers are essential for an innovative economy. Kazakhstan has put in place programmes such as Bolashak that make an important contribution to the improvement of skills, facilitating access to international education. The potential of international cooperation to contribute to human capital development and provide the necessary skills to support innovation could be developed further, paying attention to the multiple options available, including also mobility of researchers and the use of foreign workers.

Recommendation 8.2

The authorities should strengthen efforts to further upgrade human capital and skills through international cooperation. A number of measures could be considered that seek to:

- *Increase the focus of EU-Kazakhstan programmes on improvement of skills and mobility of professionals;*
- *Continue and strengthen the support to the international mobility of Kazakhstan post - doctoral and senior researchers through the existing Bolashak programme;*
- *Encourage further the mobilization of foreign expertise through appropriate immigration and work permit policies targeting researchers and qualified personnel, including the possible introduction of a special visa regime; and*
- *Developing programmes of cooperation with foreign investors to train local staff.*

Kazakhstan has a good track record of participating in international research cooperation initiatives. However, capacity bottlenecks, concerning both intermediating organizations and researchers, constrain involvement in international projects.

Recommendation 8.3

The authorities should consider introducing measures facilitating the participation of researchers in international innovation initiatives, such as:

- *Granting support services to researchers, including training for the preparation of proposals, facilitating communication with both the domestic scientific community and international researchers, including the strengthening of the user-oriented capacities of the National Centre for Scientific and Technical Information in these areas;*
- *Recognizing the initiatives of research on international cooperation, including those that do not lead to successful projects, as a factor in professional appraisals; and*
- *Providing better access to international science journals and develop English skills among the research community (recommendation 4.1).*

The increased importance of recent regional integration initiatives, in particular those within the Commonwealth of Independent States and the Eurasian Economic Community, creates the institutional prerequisites for closer collaboration in innovation-related areas, resulting in an increase in innovation capacities. Traditional links with neighbouring countries suggest a significant potential in this area. However, in terms of implementation, there is still room for considerable improvement and the existing potential is not fully explored. There is not yet a clear national strategy that seeks to exploit the opportunities created by these integration processes. Institutions, particularly at the subnational level, are not fully equipped to facilitate linkages in this regional context.

Recommendation 8.4

Innovation policies should be strengthened through better alignment with regional integration initiatives, in particular those within the Commonwealth of Independent States and the Eurasian Economic Community. The authorities could consider promoting and consulting with partner countries participating in regional integration initiatives measures, such as:

- *The elaboration of a strategy for the promotion of innovation in a regional context, which exploits and evaluates scientific collaboration with neighbouring countries, and other countries where strong traditional links exist, and connects it with trade patterns and increased opportunities for foreign investment. This may include explicit technological and innovation targets;*
- *Promoting joint technology-based projects with countries where strong traditional links exist, such as Russia, Belarus and Ukraine, among others, in specific sectors that would benefit from the ongoing integration drive;*
- *Including regional integration aspects in institutional or organizational innovation policy actions, including, for example the envisaged creation of subnational entities involved in innovation support activities;*
- *Facilitating the emergence of regional networks of incubators and technoparks and developing meeting platforms for interactions and cooperation;*
- *Strengthening cooperation between higher educational institutions of the Commonwealth of Independent States and the Eurasian Economic Community; and*
- *Reciprocal opening up of national innovation support schemes to sustain innovation projects involving cross-border collaboration with partners from countries participating in regional integration initiatives.*

The Customs Union increases competitive pressures, not only for firms, but also for R&D institutions. This challenge is also an opportunity, if the capabilities to meet future customer demands are improved, including through higher innovation activity. However, there is a shortage of empirical evidence on the impact of the customs unions, which would allow the development of tailored policy instruments.

Recommendation 8.5

The authorities should implement an adequate monitoring and evaluation system to facilitate an informed and deeper analysis on the impact of the Customs Union and other integration initiatives on Kazakhstan's economy and innovation system. Targeted studies will also contribute to the continuous improvement of economic and innovation policies pursued by the government. All results should be made available to the public. The research could be carried out under the auspices of the newly established Ministry of Economic Integration, but closer cooperation linkages should be developed with existing entities inside and outside of Kazakhstan that perform research in the same or related areas.

Annex

PROSPECTIVE INNOVATION-DRIVEN INVESTMENT PROJECTS AND INFORMATION SOURCES

1 Priority focus areas for innovation activity

The State Programme for Accelerated Industrial Innovative Development (SPAIID) of Kazakhstan for 2010-2014 specifies a number of priority areas where public investment is likely to bring forward opportunities for investors:

- Diversification of production in "traditional industries", e.g. extractive, chemical and nuclear industries;
- Development of industries based on domestic demand, e.g. machinery, pharmaceutical and construction industry/ building materials;
- Supporting industries with export potential, e.g. agriculture, light industry and tourism; and
- Developments oriented towards the economic future, e.g. ICT, biotechnology, space activities, alternative energy and nuclear energy.

These priorities reflect the goal of ensuring balanced, sustainable economic development through diversification and increased competitiveness. Meeting the goals set within the framework of the SPAIID will require significant investment in specific fields to support the goals of the programme, to increase energy efficiency and reduce dependence on natural resources. The SPAIID sits within the wider context of the Strategy for Industrial and Innovative Development of the Republic of Kazakhstan 2003-2015, which targets sustainable development through economic diversification from extraction-based industries and long-run transition to a service and technology-based economy.

Areas considered as priority in the innovative development of the country include the chemical, pharmaceutical and biotechnology industries, agro industry, transport, tourism, space technology, information and communication technologies, extractive industries, the uranium industry, light industry, defence and engineering.

Besides this overall orientation of state priorities, there are also investment preferences granted up to specified values for projects in certain priority areas, which were listed in detail in resolution 436 of the Government of the Republic of Kazakhstan, dated 8 May 2003 (Box 14).

Box 14. Investment Preferences under the Law on Investment

According to Article 13 of the Law on Investment of 2003, upon contract with the "authorized agency" (the Investments Committee, which falls under the Ministry of Industry and New Technologies), the following preferences are granted:

- **Customs duties exemptions** on imported equipment and components required for the investment project approved by the contract, for a period of up to five years;
- **Government in-kind grants** may also be provided by the authorized agency, in agreement with other relevant public sector bodies. These may include free use of public sector land and property or other assets, which may include machinery and equipment or computer technology. Such assets may be transferred to the investor upon fulfilment of the contract;
- **Investment tax preferences**. The **main condition** for the granting of such investment preferences is that the investment is in one of the priority activity areas, as stipulated by Decree No. 436 of May 8, 2003. There are around 250 priority activities at the three digit classification level of economic activities. Targeted sectors include agriculture, manufacturing, electricity and gas, waste, transport, telecommunications, tourism, education, human health activities and residential leasing; and
- **Administrative requirements** for receiving investment preferences include submitting an application to the "authorized agency", along with documents to assess the investor's financial, technical and institutional capacities. These include a business plan, estimated costs, proof of finance and other financial statements and work programme.

2 Public sources of information on investment and innovation projects

KAZNEX INVEST

Kazakhstan has one of the strongest records in the region in terms of attracting foreign direct investment. While much FDI was initially oriented towards the mineral and extractive industries, as early as 1997 the Law on State Support of Foreign Direct Investment sought to promote investment to develop other sectors of the economy,[128] with investment preferences granted to investments in priority areas of activity, defined by a government approved list,[129] while also offering a range of safeguards to foreign investors.

Since 1998,[130] there has also been a Foreign Investors' Council, chaired by the President of the Republic of Kazakhstan, which acts as an advisory body to promote direct dialogue between the Government of Kazakhstan and foreign investors in order to efficiently address key issues related to their investment activities in the country and to improve the investment climate of Kazakhstan.[131] This represents a forum at the highest level, which has a mandate to make

[128] http://www.kazembassy.org/
[129] See Article 14 of the Law on Investment, 2003.
[130] Established Order number 3985 of the Head of State (30 June 1998).
[131] http://www.fic.kz/content.asp?parent=1&lng=en&mid=10 (accessed on 15 September 2011).

recommendations to the President and Government on matters relating to investment and economic development, as well as to analyse in greater detail policy issues raised by the President.

JSC "National Agency for Export and Investment KAZNEX INVEST"[132] (hereafter, KAZNEX INVEST) has the dual objectives of boosting inward investment and export promotion in support of economic diversification.

As part of its remit to increase foreign direct investment, KAZNEX INVEST periodically publishes a compendium of projects in search of foreign investment. At the time of writing, the most recent of these, available online in English and Russian, contained a total of 106 projects. These projects typically had some degree of pre-secured financing from either public or private investors.

Investment opportunities are typically available across a range of sectors, with varying degrees of external financing required. The greatest number of projects was to be found in the agro-industrial, chemical, petrochemical & pharmaceutical, energy and building materials sectors. Large-scale projects were found across all sectors, although the agro-industrial sector tends to be characterized by a larger number of smaller-scale investment projects. The median level of external financing sought across all sectors was 85%, suggesting a relatively high level of financing requirements, although somewhat lower in the metallurgical, chemical, petrochemical & pharmaceutical and agro-industrial sectors. For certain sectors (e.g. tourism), the figures were skewed somewhat by a number of very large, early stage projects seeking 100% external financing. Many of the investment projects were either modernization or infrastructure-based, but are still likely to have certain innovative characteristics, including the use of imported technology new to the country.

The National Investment website (www.invest.gov.kz) was created in December 2010 to provide foreign investors information on Kazakhstan, including in relation to specific projects, the investment climate in the country, changes in investment legislation and incentives to investors, as well as other aspects related to investment activity.

KAZNEX INVEST also offers a web-based service making announcements to publicize certain types of events and investment opportunities, including competitive tenders for public services. Competitive tendering and the subsequent formation of public-private partnerships is one way of stimulating innovation in the provision of public services, and the Kazakhstan Public-Private Partnership Centre has recently been established to further this objective.

The agency also promotes a range of export and investment-related activities,[133] including sectoral trade fairs in key areas such as health, banking, food, agriculture, manufacturing, infrastructure and tourism. During 2010-2011, KAZNEX INVEST organized 28 international business forums, as a result of which were signed 190 memoranda and agreements worth over US$10 billion. There are a range of informational services offered to potential investors, including, for example, a summary of the preferences offered to investors under current legislation[134] and a "Guide for Investors".[135] The company has also carried out studies on the

[132] Falling under the auspices of the Ministry of Industry and Trade.
[133] http://www.kaznex.kz/napr/export/meropriatia/
[134] http://www.kaznex.kz/napr/invest/pref.php
[135] http://www.kaznex.kz/napr/invest/service.php

comparative conditions of investment, special economic zones and the financial mechanisms to attract investments, among others.

Reflecting government priorities, a particular focus of the agency's current activities is export promotion, along with capacity-building activities related to the Customs Union with Belarus and Russia. Certain sectors have received particular attention for investment promotion. For example, a joint Kazakh-Canadian seminar "Investment opportunities of agriculture in Kazakhstan" took place this year under the auspices of the Investment Forum in Kazakhstan, a companion event to the EBRD Annual Meeting held in Astana in May 2011.[136]

Parasat National Scientific and Technical Holding

Parasat has a key interest in promoting innovation in Kazakhstan, and its website contains a range of useful information for potential investors in innovative projects. As a public holding, it can take a long-term, strategic view in relation to innovation.

Its subsidiaries include:

- JSC "National Centre for Scientific and Technical Information of the Republic of Kazakhstan";
- "Centre of Earth Sciences, Metallurgy and Enrichment";
- JSC "National Centre of Information";
- JSC "SPC" Phytochemistry" (International scientific-industrial holding company);
- LLC "Institute of Geography";
- LLC "Institute of Geological Sciences. KI Satpayev ";
- LLC "Institute of Hydrogeology and Environmental Geoscience. UM Akhmedsafin";
- LLP "Physical-Technical Institute";
- LLC "Institute of Seismology"; and
- LLP "Altai Geological - Ecological Institute".

One of Parasat's main objectives is the planning and implementation of innovative projects, introducing modern domestic and foreign technologies in priority sectors and attracting private investment, including through public-private partnerships.

Parasat has a range of projects with potential for joint implementation involving the development of advanced technology and opening new production facilities.[137] For many of these key projects, Parasat is looking for private investors as partners, across different sectors including:

- Metallurgy;
- Environmental protection;
- Renewable energy;
- Seismology; and
- Energy efficiency.

[136] http://www.kaznex.kz/anons/1903/
[137] See http://www.parasat.com.kz/index.php?id=4 for more details of projects in various sectors.

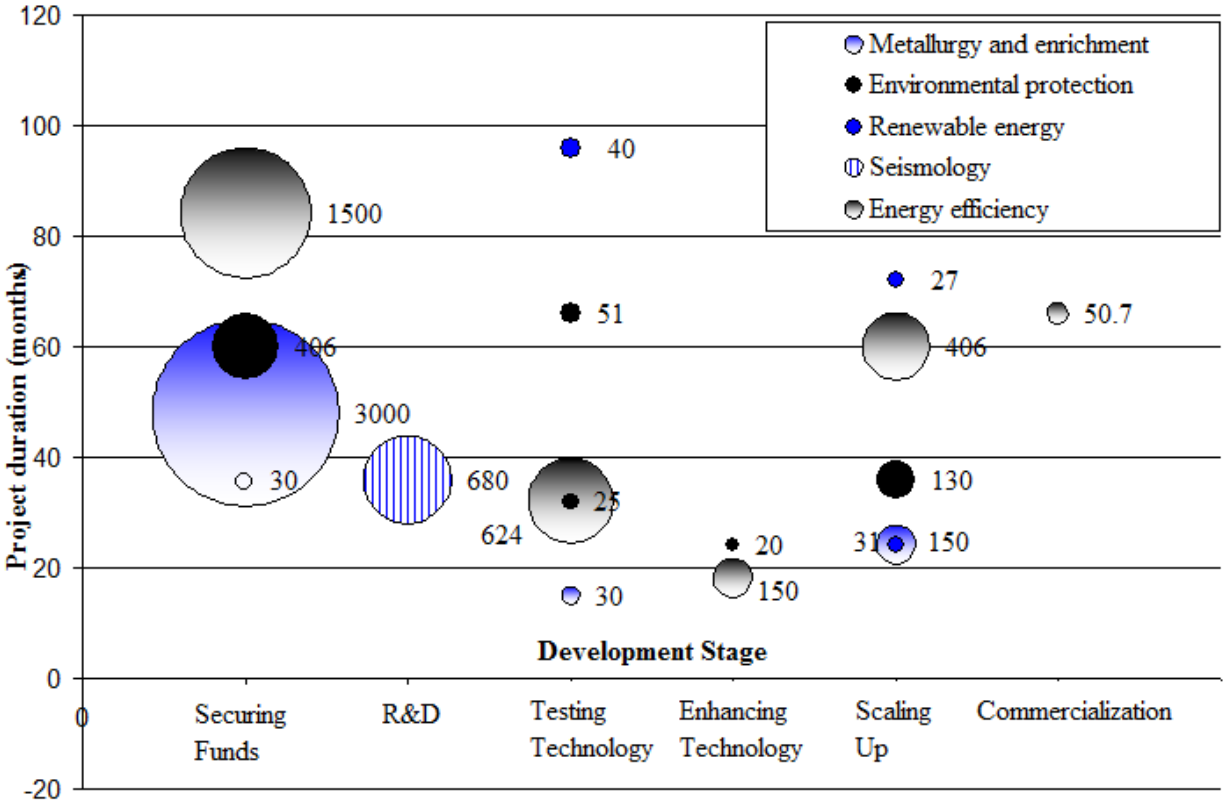
Figure 18 illustrates the scale, duration and current stage of projects across those various domains for which information[138] was available at the time of the Review.

Metallurgy and Enrichment

Projects in this field typically relate to the more efficient use of the existing resources (e.g. projects for rhenium and tellurium extraction from lead production by-products, white carbon black extraction from by-products of phosphorous production, reprocessing of lead-containing materials), as well as projects involving primary extraction of resources.

Some of the minerals which can be extracted from waste materials, or extracted at the same time as other raw materials, are scarce and in high demand - although prices may be volatile. Tellurium, for example, has a range of applications in the semiconductor and electronics industries, as well as in a range of other applications. Rhenium is another scarce resource for which there is demand in the nuclear, aerospace, petrochemicals and energy sectors.

Figure 18. Parasat "Investing in Innovation"[139]



Note: Size of data points and labels indicate scale of project in millions of US dollars.
Projects with the largest scale financing requirements tend to be concentrated at the earlier stages, with later stage projects close to commercialization typically having more modest funding requirements. Investment projects are being promoted by Parasat across a range of sectors.

[138] Relevant information on scale, duration and development stage was available for approximately half of the 30 or so projects being promoted as of August 2011.
[139] http://www.parasat.com.kz/index.php?id=4 (accessed on 15 August 2011).

In cases of primary extraction, increasing environmental concerns are likely to lead to considerable demand for innovation to facilitate extraction in ways that impact less heavily upon the environment.

The size of the projects covers a wide range - from as little as KZT 30 million (around US$200,000) to over KZT 2 billion (roughly US$14 million), with varying degrees of external financing being sought.

Environmental Protection

Projects included mercury decontamination of soil, recycling of mercury-containing products and the application of new techniques of waste water filtration for agricultural, industrial, household and drinking purposes. Project costs were in the range KZT 20 million (US$140,000) to KZT 130 million (around US$900,000).

Seismology

Improved seismological monitoring and "early warning" systems are an area of significant public investment at the present time in Kazakhstan. Investment projects in this area include improved real-time monitoring (project with an estimated investment cost of KZT 400 million, or US$2.7 million), and the creation of back-up capacity for the collection and processing of seismic data if facilities in seismically-active areas are damaged (estimated cost of KZT 680 million, or around US$4.6 million). Relevant subsidiaries in this area include the Institute of Seismology and the Physical-Technical Institute.

Renewable Energy

There is a growing emphasis placed on renewable energy generation as a means of reducing environmental impact and reducing dependence on traditional energy resources. However, current energy prices in Kazakhstan are low by international standards and this, together with high levels of uncertainty, leads to relatively weak market mechanisms to trigger the necessary investment. The intervention of the government to facilitate pilot and larger-scale projects can be used to trigger innovation in an area that is likely to be a source of "green growth" for the future.

One large-scale initiative is the joint Kazakh-Kyrgyz project "Silicon-Alatau", which looks to harness significant existing reserves of raw materials to extract polycrystalline silicon with the ultimate objective of producing thin-film solar modules. This is a long-term, vertically-integrated project with a time scale of seven to eight years, seeking external financing of around US$40 million. Partners from Kyrgyzstan and other countries are likely to be involved, with players from Kazakhstan including JSC Kazatomprom and the SEZ PIT "Alatau IT City".

Related initiatives include vertically-integrated manufacturing of silicon solar cells in the SEZ PIT solar cluster, including the development of components for photovoltaic cells, to produce an estimated capacity of 70MW per annum. This involves international cooperation with German companies, with Parasat's role being through the Physical-Technical Institute.

Energy efficiency & reduction of energy costs

This area offers a more balanced range of investment projects in terms of funds required, with fewer projects requiring large-scale up-front infrastructure investment in comparison with the renewable energy sector. The technology may also be more tested, or may involve process innovation rather than wholly new technology. Nevertheless, given the importance of demonstration effects in triggering energy saving innovations, the impact of public activities in this area can be substantial.

Projects in this area range from around KZT 50 million (US$0.3 million) for commercialization of relatively small-scale, tested technologies, to larger projects with costs of up to KZT 400 million (US$2.7 million). Larger-scale projects include the use of thermal generators as water heaters and for heating systems of buildings, and the application of heat pump installations in heating systems - both projects supported by JSC "Science Foundation". There is also a public investment programme planned involving the use of LED lighting on public premises and for street lighting and traffic lights. The first phase of this project is expected to have costs of around KZT 300 million (US$2 million), with scope for wider roll out.

National Science Fund[140]

The National Science Fund was founded in 2006 with a primary implementation role for the State Programme of Scientific Development of Kazakhstan for the period 2007-2012. Since 2008, it has been a member of the National Scientific and Technological Holding "Parasat", with involvement in projects cutting across a range of sectors.

The National Science Fund operates largely by providing financial support to research teams, organizations and companies involved in promising, early stage research and development activities with potential for commercialization. Its remit extends to providing legal and financial advice as well as acting as a co-investor in scientific and technical projects. It is involved in projects with other organizations falling under the remit of "Parasat", as well as third parties.

Other sectors

Given the scope of Parasat's activities, there are a number of potential innovative projects in other sectors. Examples include: piloting commercialization of traditional health remedies in the Karaganda region; roll-out of e-learning in schools; and development and introduction of a quality assurance system for scientific papers.

Agriculture

Concerns around food security and volatility in commodity prices over recent years, coupled with the current low levels of agricultural productivity, imply considerable investment potential in the agricultural sector in Kazakhstan. There is a key role to be played by knowledge transfer in boosting innovative performance.

[140] See http://www.science-fund.kz/?post=2&lang=rus for further information.

Kazagroinnovation

JSC "Kazagroinnovation" was created in 2007 on the basis of research institutes previously falling under the Ministry of Agriculture. It targets the commercialization of technologies developed in the relevant research institutes, collaborating with foreign partners to develop, manufacture and deliver to the market competitive products based on domestic and foreign licenses, and finally to directly import foreign expertise where this is lacking in Kazakhstan.[141]

International collaboration is seen as a means of modernizing the agricultural sector through knowledge transfer, and conducting joint scientific research with leading international partners. Partners include international research centres, the UN Food and Agricultural Organization (FAO), the European Union (through the 7th Framework Programme), and the World Bank, which is providing support for knowledge dissemination and staff training. Previous cooperation with national authorities has included the Kazakh-Israeli Agricultural Research Foundation, Kazakh-German agrarian and political dialogue and a memorandum of understanding and cooperation with the Australian Centre for Plant Functional Genomics. Cooperation with a range of other countries is ongoing, including Argentina, France and Brazil, and within the CIS.

There is also important cooperation with international research institutes, including the International Center of Agricultural Research on Dryland Areas (ICARDA) and the International Maize and Wheat Improvement Center (SIMMYT), seeking to develop new varieties of crops with higher productivity, with a particular focus on water conservation. Such technologies hold great potential for the sustainable development of Kazakhstan's rich agricultural resources.

Extension services

Extension and advisory services[142] are key focus areas of activity for Kazagroinnovation. The two main ways in which these are currently realized are through training for farmers in the use of modern technologies, and giving them advice on technological issues.[143] There are a number of extension centres in operation across Kazakhstan, with online, telephone and in-person support being made available to farmers. Such services may be considered useful sources of information, both for potential new investors in Kazakhstan's agricultural sector, as well as for existing producers looking to upgrade their production capabilities. They have a rich source of technical expertise in the research institutes upon the basis of which Kazagroinnovation was formed. At present, there are eight regional centres for knowledge dissemination located in Almaty, Akmola, Kostanai, Karaganda, South Kazakhstan and East Kazakhstan regions, one of which was created in collaboration with the University of Hohenheim, Germany.[144]

[141] See http://www.agroinnovations.kz for further information.
[142] See http://www.agroextension.kz/ for further information.
[143] Agricultural Extension and Advisory Services Worldwide project, facilitated by the International Food Policy Research Institute. See http://www.worldwide-extension.org/ for further information.
[144] http://www.agroextension.kz/ (downloaded 15 February 2012).

Samruk-Kazyna: investment in infrastructure

Samruk-Kazyna National Welfare Fund plays a central role in investing in the nation's infrastructure. The majority of its projects relate to upgrading and modernization, rather than being innovation specific. Investment projects implemented in 2011 include:[145]

- Freight wagon manufacturing at LP "Taman" in Ekibastuz;
- Production of rail rolling stock at Patentes Talgo SL in Astana Special Economic Zone;
- Construction of hydro power plants on the river Charyn (Almaty region);
- Construction of single-track railway Zhetygen - Korgos, Almaty region; and
- Construction of a new Caspian railway line, facilitating access to the Russian rail network.

These are large-scale infrastructure projects, rather than innovative projects in their own right. However, investment in such infrastructure is likely to provide demand "pull" for innovation in the domestic supply chains, in particular taking into account the policy commitment to increase R&D spending by this state holding. In addition, better infrastructure improves framework conditions for future economic and innovative activity. Infrastructure investment is also needed to boost Kazakhstan's economic competitiveness, attracting investment. Where foreign partners are involved in investment projects, there are likely to be learning effects that trigger innovation.

Projects in the process of being implemented are focused on the areas of energy (modernizing generative capacity, including hydro power and investment in the grid), the rail industry, extractive industries, and a range of other activities including pharmaceutical production.[146]

Invest Nauka (Invest Science)

This project provides an online communication platform[147] seeking to improve linkages between scientific researchers and the business community by promoting research results, improving the uptake of research outputs in industrial and technological processes. There is a dual objective of increasing the awareness of researchers concerning the needs of the business community in Kazakhstan, with the website including databases of both ***technology offers*** and ***technology requests***. This forms part of the Innovation Promotion Network, with partner organization projects in Belarus, the Czech Republic, India, Russia, Serbia and Ukraine.

The ***technology offers*** service provides details of new technologies and developments being proposed by Kazakh scientists for commercialization. Developers registered with *Invest Nauka* can propose new technologies via an online registration process. So far, only domestic technology offers are available on the platform, although potential investors can browse similar databases of the partner organizations in the other countries mentioned above.

[145] http://www.samruk-kazyna.kz/page.php?page_id=19&lang=1
[146] http://www.samruk-kazyna.kz/page.php?page_id=3493&lang=3&parent_id=2750&menu_id=2758
[147] http://www.invest.nauka.kz

Table 26. "Invest Nauka": Technological offers and requests

Offers		Requests	
Domain	**Project count**	**Domain**	**Project count**
Automation	0	Agro-industrial Complex	2
Biotechnology	4	Biotechnology	0
Mining	4	Mining and Metallurgy Complex	1
Light Industry	0	Mechanical Engineering	2
Engineering	1	Instrumentation	0
Medicine	1	Food Industry	1
Metallurgy	7	Furniture Manufacturing	0
Environment	0	Oil and Gas Industry	3
Food Industry	0	Medicine	0
Instrument	0	Construction & Building Materials	3
Software	0	Coal Industry	0
Agriculture	1	Transportation & Communications	1
Construction	0	Chemical & Petrochemical	1
Transportation	0	Textile Industry	0
Chemical Industry	3	Energy Complex	1
Energy	9		

Source: http://www.invest.nauka.kz, August 2011.

3 Sources of information for private investment projects

National Innovation Fund

The National Innovation Fund (NIF) plays a key role in early-stage financing, including business incubation, of innovative investment projects, bringing projects closer to the commercialization stage. In 2010, 113 technological projects applied for business incubation, with 36 approved for implementation.[148] A greater volume of applications were received in 2011. A range of non-repayable innovation grants are also available to fund development work, high-risk research and feasibility studies, as well as the patenting of intellectual property and purchase of new technology.

The National Innovation Fund has contributed to the creation of venture capital funds,[149] with negotiations also underway to jointly create regional venture funds with akimats. The NIF is currently in partnership with four venture capital funds in Kazakhstan, established with local investors as public-private partnerships. Increased activity in the area of business incubation may also facilitate private investor activity by boosting the supply of innovative projects.

[148] http://www.mint.gov.kz/index.php?page=news&itemid=272
[149] http://www.mint.gov.kz/index.php?page=news&itemid=267

Commercialization offices

Following a competition held by the National Innovation Fund among research institutes and universities, seven universities and two research institutes were selected[150] for establishment of offices for the commercialization of innovations, spread across five regions of Kazakhstan.[151] This initiative was launched in recognition of a priority need to improve the implementation of research results in Kazakhstan, in particular through improving science-industry linkages. These technology commercialization centres could serve as important contact points for potential investors searching for innovative investment projects.

Kazakh Public-Private Partnership Center

Recently founded under the auspices of the Ministry of Economic Development and Trade, the Centre for Public-Private Partnerships (PPPs) performs economic appraisal of investment projects carried out through concessions or with public funding, and seeks to increase capacity and technical expertise for the implementation of PPPs.

A robust framework for implementing PPPs is one way of attracting greater domestic and foreign investment in the delivery of public infrastructure, with the new approaches and process innovations that this may bring.

[150] Results announced in July 2011.
[151] http://www.invest.nauka.kz/news/detail.php?ELEMENT_ID=1686

Innovation Performance Review

The Innovation Performance Review contains the findings of a participatory policy advisory service undertaken at the request of the national authorities. It considers possible policy actions aimed at stimulating innovation activity in the country, enhancing its innovation capacity and improving the efficiency of the national innovation system.

This publication is part of an ongoing series highlighting some of the results of the UNECE Subprogramme on Economic Cooperation and Integration. The objective of the Subprogramme is to promote a policy, financial and regulatory environment conducive to economic growth, knowledge-based development and higher competitiveness in the UNECE region.