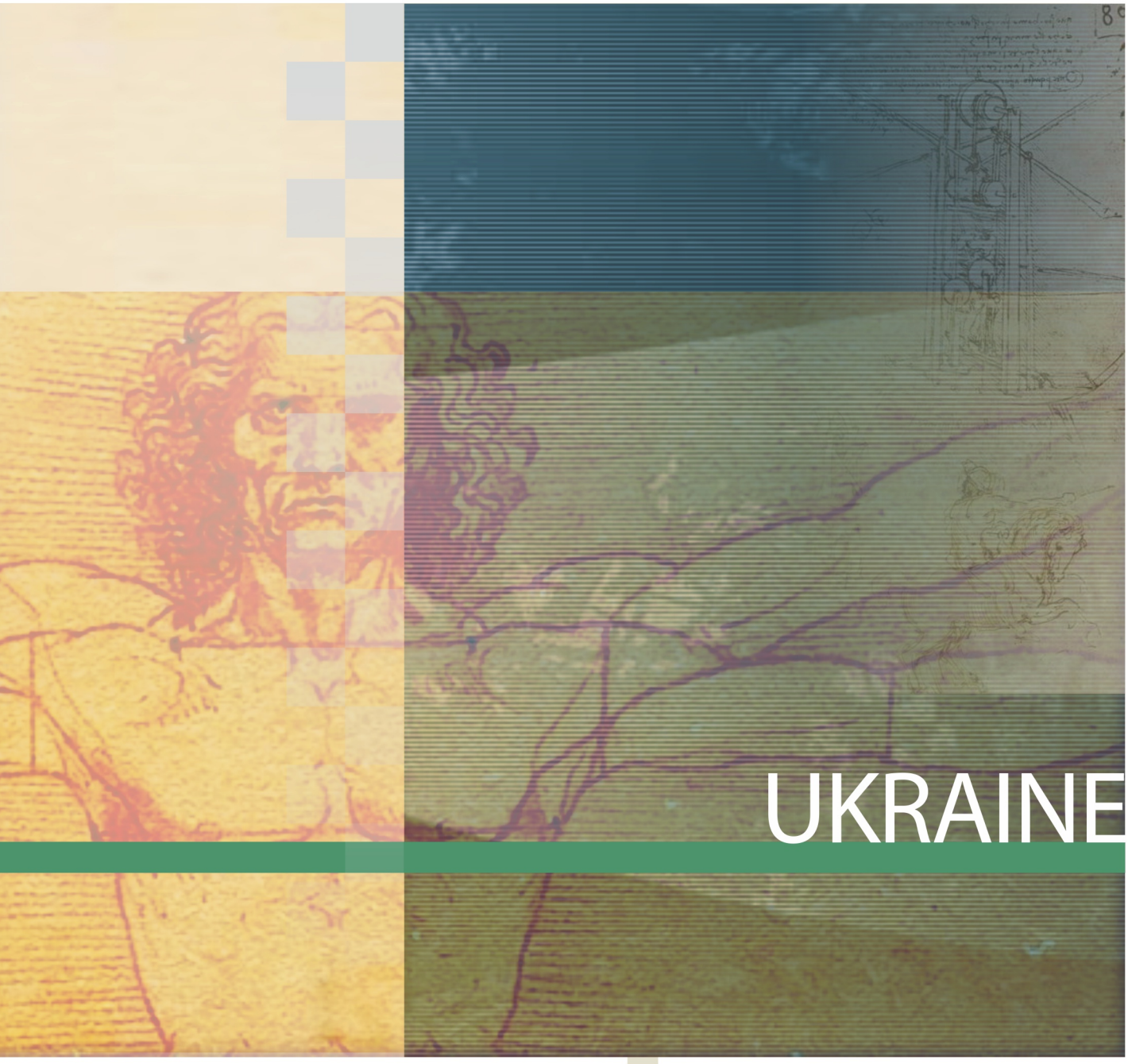
UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

# Innovation Performance Review



# UKRAINE

UNITED NATIONS

United Nations Economic Commission for Europe

# INNOVATION PERFORMANCE REVIEW OF UKRAINE

UNITED NATIONS
New York and Geneva, 2013

## NOTE

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# *FOREWORD*

In modern, competitive economies, knowledge-based innovation is the foundation for economic development. Sustained growth and improved living standards can only be obtained by increasing productivity and introducing new and better products and services that compete successfully in the global market.

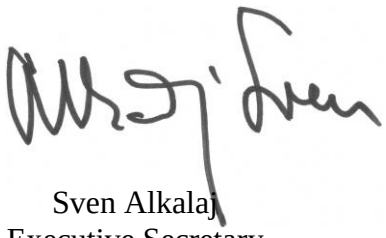
The *Innovation Performance Review of Ukraine* continues the series of national assessments of innovation policies initiated by the earlier Reviews of Belarus and Kazakhstan. These policy advisory exercises draw on the experience accumulated by the UNECE in the identification of good practices and policy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

This *Review* presents the outcomes of an advisory project undertaken at the request of the Government of Ukraine. 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 Ukraine 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* provides a comprehensive assessment of the factors that drive innovation, paying particular attention to the linkages and relations between the different components and actors of the national innovation system. This integrated approach is well suited to the complexities of innovation and reflects a broad understanding of the challenges faced by policymakers.

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 recommendations of previous Reviews have already played a positive role in informing new policy initiatives and have been followed by capacity-building activities to facilitate their implementation.

I would like to thank the Government of Ukraine 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.



Sven Alkalaj
Executive Secretary
United Nations Economic Commission for Europe

# *PREFACE*

The practical work on the *Innovation Performance Review of Ukraine* began in May 2012 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 9 to 16 September 2012 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 Ukraine.

The draft text of the *Review* was submitted for comments to the authorities of Ukraine 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 seventh session of the Committee on Economic Cooperation and Integration on 5 December 2012 with the participation of the *Review* team, the external reviewers, the members of a high-level delegation from Ukraine 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 Ukraine* 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: Mr. José Palacín (Chapter 1), Ms. Julia Djarova (Chapter 2), Mr. George Strogylopoulos (Chapter 3), Mr. Slavo Radosevic (Chapter 4), Ms. Anna Kaderabkova (Chapter 5), Mr. Hannes Leo (Chapter 6), Mr. Rafis Abazov (Chapter 7) and Mr. Christopher Athey (Annex). Mr. Igor Yegorov prepared a background document and provided inputs and comments to this Review. Mr. Malcolm Parry, Mr. Mathias Rauch and Ms. Suzanne Rosselet reviewed the first draft of the *Review* and provided relevant suggestions. Staff from the WIPO Innovation Division reviewed an early version of the recommendations and made useful comments. During the discussion at the Substantive Segment of the seventh session of the Committee on Economic Cooperation and Integration, Mr. Victor Shovkaliuk, Mr. Igor Mantsurov and Ms. Liudmyla Musina presented comments and suggestions on behalf of the delegation of Ukraine. Mr. Christopher Athey, Mr. José Palacín and Mr. Ralph Heinrich contributed to the overall editing of the publication, with Ms. Andrea Hegedus providing technical assistance.

The smooth work throughout the project was greatly facilitated by the helpful support and cooperation of the State Agency for Science, Innovation and Informatization of Ukraine which was the lead partner of UNECE in Ukraine in implementing this project.

We are also grateful for the assistance provided by the UNDP Office in Ukraine at various stages of this project.

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# *ABBREVIATIONS*

| | |
|---|---|
| ASFIMIR | Automated System of Formation of Integrated, Intergovernmental Information Resources |
| BEEPS | Business Environment and Enterprise Performance Survey |
| BERD | Business Expenditure on Research and Development |
| BSEC | Organization of Black Sea Economic Cooperation |
| CEIS | Concept of a Eurasian Innovation System |
| CIS | Commonwealth of Independent States |
| CMMI | Capability Maturity Model Integration |
| DCFTA | Deep and Comprehensive Free Trade Area |
| DG | Directorate General |
| EAPATIS | Eurasian Patent Information System |
| EBRD | European Bank for Reconstruction and Development |
| EECA | Eastern Europe and Central Asia |
| EIB | European Investment Bank |
| ENP | European Neighbourhood Policy |
| ENPI | European Neighbourhood and Partnership Instrument |
| ERA | European Research Area |
| EurAsEc | Eurasian Economic Community |
| FAO | Food and Agriculture Organization |
| FDI | Foreign Direct Investment |
| FISIM | Financial Intermediation Services Indirectly Measured |
| FTE | Full-time Equivalent |
| GCR | Global Competitiveness Report |
| GDP | Gross Domestic Product |
| GERD | Gross Expenditure on Research and Development |
| GMO | Genetically Modified Organisms |
| GUAM | Organization for Democracy and Economic Development |
| HEI | Higher Education Institution |
| IDCEE | Investor Day in Central and Eastern Europe |
| IFC | International Finance Corporation |
| IICNT | International Innovation Centre for Nanotechnologies |
| INTAS | International Association for promotion of cooperation with scientists from the Independent States of the former Soviet Union |
| IPRs | Intellectual Property Rights |
| IREX | International Research and Exchanges Board |
| ISL | Industry-Science Linkage |
| ISTC | International Science and Technology Centre |
| JSC | Joint Stock Company |
| JSO-ERA | Joint Support Office of Ukraine's integration in the European Research Area |
| KPI | Key Performance Indicator |
| LLC | Limited Liability Company |
| MEDT | Ministry of Economic Development and Trade |
| MES | Ministry of Education and Science |
| MESYS | Ministry of Education, Science, Youth and Sports |

| | |
|---|---|
| MIA | Management of Innovation Activities |
| MIP | Ministry of Industrial Policy |
| NAS | National Academy of Science |
| NIS | National Innovation System |
| NMS | New Member States (EU) |
| NPL | Non-Performing Loan |
| NTBF | New Technology-based Firm |
| OECD | Organisation for Economic Co-operation and Development |
| PPP | Public-private Partnership |
| R&D | Research and Development |
| RDI | Research, Development and Innovation |
| RTTN | Russian Technology Transfer Network |
| S&T | Science and Technology |
| SAINP | State Agency for Investments and National Projects |
| SASII | State Agency for Science, Innovation and Informatization |
| SAUII | State Agency of Ukraine on Investment and Innovation |
| SCSII | State Committee on Science, Innovation and Informatization |
| SFFR | State Fund for Fundamental Research |
| SIFCI | State Innovation Financial-Credit Institution |
| SIPS | State Intellectual Property Service |
| SCURPE | National Programme for Promotion of Small Entrepreneurship Support |
| SME | Small and Medium-sized Enterprises |
| STCU | Science and Technology Centre, Ukraine |
| STI | Science, Technology and Innovation |
| TACIS | Technical Assistance to the Commonwealth of Independent States |
| TFP | Total Factor Productivity |
| TO | Transfer Office |
| UAIB | Ukrainian Association of Investment Business |
| UEFA | Union of European Football Associations |
| UFES | Ukrainian Fund for Entrepreneurship Support |
| UkrISTEI | Ukrainian Institute for Scientific, Technical and Economic Information |
| UNCTAD | United Nations Conference on Trade and Development |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| VC | Venture Capital |
| VET | Vocational and Educational Training |
| WTO | World Trade Organization |

# *EXECUTIVE SUMMARY*

The *Innovation Performance Review of Ukraine* provides a critical examination of the national innovation system (NIS), 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*

The importance of innovation is recognized in many legal and policy documents, including at the highest level. However, a holistic consideration of the national innovation system, its various components and the relations between them, remains lacking. A narrow interpretation of innovation, which emphasizes technological aspects, prevails. The subsystems of science and innovation intermediaries receive greater policy attention, but there is less emphasis on the need to encourage innovation in the business enterprise subsystem, particularly with regard to SMEs as an important driver of economic dynamism. There is insufficient consideration of linkages between subsystems, including between the science and business sectors, which are key for the definition of a science, technology and innovation strategy.

There have been multiple innovation-related initiatives in Ukraine over recent years, reflecting the continued importance attached to innovation as a driver of growth and competitiveness. However, many of the legal and policy documents remain at a conceptual level, with insufficiently defined practical policy measures or instructions for further implementation. More attention to the appropriate sequencing of different proposed interventions is required.

Effective coordination is one of the main challenges in innovation governance. Despite the progress made by administrative reforms, the responsibilities of key actors are not yet clearly defined. Allocated resources are often not in line with the mandates received. Innovation-related activities are distributed across different public organizations but there is not a single coordinating body. While there is vertical coordination (from agencies to ministries and to the government), horizontal coordination mechanisms are weak or missing.

### *Framework conditions, innovation policies and instruments*

Innovation thrives in a favourable environment, where there is a shared perception of its importance and a general understanding of what it requires. A vibrant innovation culture is an important factor in the success of public initiatives promoting innovation, and should be a policy target in itself. However, despite some favourable conditions, including a well-educated population, this is an issue receiving insufficient attention in Ukraine.

Innovation is a multifaceted process upon which multiple government agencies and units exert an influence. In Ukraine, there is not a clear governance structure to arbitrate conflicts,

ensure the integration of different goals and define consistent agendas. This weakness contributes to the proliferation of inconsistent and poorly funded initiatives, and an inefficient complexity of legal rules.

Ukraine has adopted many innovation initiatives in the past. However, implementation has been uneven, due to the lack of necessary follow-up steps to give concrete expression to high-level objectives, including the provision of financial resources. The lack of engagement of key innovation actors in the design process has also undermined implementation. In addition, no systematic evidence has been collected on the innovation impact of past programmes to assess performance.

Ukraine is a large country, with varying resources and needs at the regional level. There have been some attempts in the past to incorporate an innovation dimension in regional policies but progress to date has been limited. Tapping into the potential for regional development demands more focused efforts. Innovation-based regional strategies require the creation of a basic infrastructure that increases the absorption capacity of less developed regions and facilitates collaboration and exchanges.

***Knowledge generation and absorption***

Public support for R&D is both low and insufficiently focused, resulting in efforts and resources being spread inefficiently. The relative importance of state programmes is limited, with their priorities not always reflected in thematic Research, Development and Innovation (RDI) programmes. The mobilization of private sector resources through coordinated public policy initiatives could provide an effective instrument for industrial restructuring in specific sectors, in line with state priorities defined in strategic policy documents.

FDI is a major driver of innovation through the import and adaptation of foreign technologies and business models. Ukraine has received significant FDI, but these inflows have not driven structural change or technological upgrading, given their sectoral composition. For Ukraine, the ability to absorb and diffuse foreign technologies is a key driver of innovation, but the potential of FDI to encourage innovation remains largely untapped.

Knowledge-generating institutions, such as research institutes and universities, often lack commercial orientation. For SMEs, the costs of developing relations with such organizations are rather high, and rigid frameworks for interaction do not fit their changing needs.

The design of appropriate policy measures seeking to reform the academic sector requires a thorough analysis of existing capacities and programmes. While there are some areas of strength, there is also a duplication and dispersion of efforts that should be addressed.

Supply-oriented interventions seeking to increase R&D, whether in the academic or business sector, have clear limitations as long as demand for innovation remains low which, as in other countries with economies in transition, is a key constraint for Ukraine.

***Industry-science linkages and collaboration in the innovation process***

A systemic evaluation of the current system of practices regarding industry-science linkages (ISLs) is the starting point to identify barriers and opportunities, understand the impact of

actions and measure changes over time. This comprehensive evaluation, which should be considered a learning rather than a judging process, is still lacking.

The commercialization of academic research faces up-front costs and requires development of a complex range of skills, which are expensive to acquire. Given the uncertainty of the expected returns and the financial constraints faced by these academic organizations, public support is required to overcome these difficulties.

The collaboration between science and business is hampered by the lack of information on opportunities and the high costs faced by organizations in the search for partnerships. The involvement of the public sector can facilitate the coordination of private initiatives and encourage closer links between industry and research.

Small-scale projects that aim to encourage relations between industry and science with limited resource requirements but potentially large demonstration effects are particularly appropriate in Ukraine, given financial constraints and governance challenges. Innovation vouchers are a useful instrument, given the limited administrative burden involved in their administration and their ability to target SMEs.

***Financing innovative entrepreneurs***

Ukraine has entrepreneurial talent and a relatively strong risk-taking attitude. These are major ingredients for any policy intervention seeking to promote innovative entrepreneurship. However, the survival rate of start-ups is low in comparison to advanced countries. Effective policy actions that improve this rate would create employment, diversify the industrial structure and stimulate competition.

Innovative companies and SMEs in general face particular difficulties when trying to raise finance, which remains a critical obstacle when starting a business. However, support programmes for SMEs are very limited and there are no public interventions targeting start-ups. Limited public resources and previous unsuccessful attempts to stimulate innovation by offering financial incentives help explain the current absence of financial mechanisms to encourage the development of innovative enterprises.

Ukraine has an emerging venture capital scene, which indicates the presence of entrepreneurial opportunities in the country. While this form of financing caters for the financial needs of only a small fraction of innovative SMEs, it is an important ingredient of the innovation system. However, the development of the venture capital industry requires the presence of other financial intermediaries and business services, together with a continuous supply of opportunities needing financing.

***The role of innovation in international economic integration***

Access to international knowledge will continue to play a critical role in the modernization of the Ukrainian economy. External markets can provide the necessary demand for innovative Ukrainian companies. Facilitating participation in the global networks through which information flows and ensuring that researchers, students and companies have full access to international cooperation mechanisms help create the framework conditions for innovation to flourish.

Participation in global innovation networks and regional partnerships is important to access the knowledge required to advance the country's competitive position and ensure the relevance of domestic efforts. Ukrainian scientists are increasingly engaged in various research collaboration initiatives within bilateral, regional and international frameworks. However, the potential for collaboration has yet to be fully realized due to bottlenecks in existing capacity regarding skills and access to information.

Ukraine has a favourable geographic location and well-developed cultural and economic relations with CIS countries, creating significant potential for cooperation opportunities, which could be exploited more fully. Despite a raft of ongoing initiatives, there remains scope for actions to provide a more solid institutional basis for common projects in various fields.

International visibility of innovation efforts is important to attract the interest of foreign partners and engage them in domestic initiatives. However, this requires coordinated efforts that present a coherent view of public programmes and allow synergies.

**Recommendations**

A number of recommendations and policy advice can be derived from the assessment of the innovation performance of Ukraine 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.

The Review recommends an integrated consideration of the various components of the **National Innovation System**, to identify weak elements and emphasize linkages between different subsystems as important policy targets. The notion of innovation should be broadened, recognizing that technology is only one dimension of the innovation process.

Attention should be paid to the business enterprise subsystem, in particular the promotion of innovative SMEs, commercialization of science (e.g. technostarters), industry-science linkages and the role of innovation intermediaries.

As part of a holistic, consistent approach to policy prioritization at the national level, the authorities should consider the development of a National Innovation Strategy of Ukraine as a single, comprehensive document that would integrate and replace many existing policy initiatives. As well as identifying the necessary policy measures, an important component of such a strategy will be to define how it will be implemented, monitored and evaluated, as well as assigning well-identified resources and responsibilities for the required tasks.

Given the level of coordination required between a range of ministries and agencies for effective action on innovation policy, the authorities could consider the establishment of a National Innovation Council, in order to promote a cross-sectoral and cross-departmental approach in the design and implementation of innovation policies. Representatives from the business and academic sectors could also be included as members, while the chairmanship role could be performed by a figure with wide national support to ensure general awareness and visibility of innovation initiatives in the country. The State Agency on Science,

Innovation and Informatization (SASII) could act as the Secretariat of this Council and coordinating unit in the policy implementation process.

As part of coordinated action to improve the **framework conditions for innovation**, the authorities should strengthen their efforts to encourage the development of an innovation culture, in particular through awareness, dissemination and communication initiatives. These could include supporting popular scientific radio and TV programmes and other forms of media to encourage interest in science and technology and its commercial applications, as well as the promotion of innovative entrepreneurs as positive role models through awards and other forms of social recognition. Training on innovation issues for managerial staff in public agencies, as well as educational programmes at different levels that underline the importance of innovation and intellectual property for economic development, could both play an important role.

Given the multiple government actors involved in innovation-related areas and the difficulties in tracking effective implementation, there is a need to **improve policymaking processes for innovation**. This would include a streamlining of policymaking, with better specified functions and responsibilities of ministries, agencies and other parties, and strengthened control over implementation through the creation of new mechanisms or by reinforcing existing structures. The latter could include an enhanced role for the State Agency on Science, Innovation and Informatization (SASII), which could be given more extensive powers, increasing its independence and providing it with specific performance indicators and budgetary resources to carry out these monitoring tasks.

The overall aim should be to improve the effectiveness of innovation policies by reinforcing key aspects of the policy cycle. This would include closer involvement of the private sector in the design of policies and programmes through well-established consultative processes, which could include clear communication regarding sources of finance in order to increase the credibility of policy actions. There is also a need to reinforce monitoring and evaluation procedures, which should be built into the design of public programmes, including through appropriate provision of the necessary resources to carry out these procedures. The outcome of these assessments should be used as the basis for corrective measures regarding existing programmes, and to make improvements in the design of new ones.

There is a need to enhance the contribution of innovation to regional development. The authorities should ensure that innovation policies and related programmes incorporate a regional dimension and that this is supported by appropriate financial and coordination mechanisms. These could include a well-defined consultation process that facilitates the alignment of national and regional policy objectives and the incorporation of regional aspects in design of the overall national innovation strategy. Also important will be the creation of institutional structures that facilitate coordination between regional and central interventions, including mechanisms for consultation and sharing of information, along with provision in central plans for the development of necessary infrastructures to support the implementation of regional strategies.

The Review recommends a number of possible actions to improve **knowledge generation and absorption**. Focused R&D efforts to address specific priorities and the problems of particular sectors would increase the effectiveness of policy initiatives and the ability to attract resources from the private sector, including through concerted actions that rely on

consultations between major stakeholders. Priority areas could include the food industry, energy efficiency, renewable energies and the ICT industry. One option the authorities could consider is allocating future increases in public R&D funding to thematic Research, Development and Innovation (RDI) programmes based on criteria of technical excellence and local relevance. Another option is the development of technology platforms linked to sectoral working parties for restructuring. Such technology platforms should be led by industry and define research priorities and action plans in a number of technological areas. State support could be confined to a coordination role, as well as thematic RDI programmes co-funded by the budget.

Ukraine's FDI promotion policy is generic and not focused on promoting innovation. The possibilities created by the establishment of the State Agency for Investment and National Projects could be used to ensure that sector-specific FDI promotion is integrated into sector- or technology-specific R&D and innovation support programmes. One possibility would be to link FDI that reduces energy intensity to sector-specific diffusion programmes for new energy technologies, reflecting energy efficiency's policy priority status. Foreign companies could be encouraged to set up R&D facilities in Ukraine, through closer alignment of FDI and innovation policies, while linkages between foreign companies and SMEs could be facilitated, including through actions aiming to enhance capacity in the domestic business sector.

The gap between ex-branch institutes and universities on the one hand, and enterprises on the other, could be bridged by the introduction of innovation vouchers. These would be given to enterprises and allow them to purchase different types of innovation services; including innovation audit, training, new business and service development, knowledge transfer projects and many others.

In order to strengthen the effectiveness and coherence of R&D policies, the authorities should assess the current situation and devise a robust evaluation system. An international benchmarking of Ukrainian R&D would be valuable, both as a whole and at the level of the major institutions (institutes of the Academy of Sciences, major universities and selected ex-branch institutes), to facilitate comparison with other countries in the region and EU member States. Systems of project evaluation and selection should be specifically tailored to the various types of projects and programmes (basic, applied, cooperative, innovation based programmes, etc.), with clear appraisal methodologies that are well understood by prospective applicants.

To address the barriers created by weak demand for RDI, public procurement could be used to drive technological development. This would stimulate technological innovation while providing public agencies with cost-effective, technical and scientific solutions to their needs. Procurement programmes designed to stimulate the demand for innovation should generally fulfil a number of prerequisites in order to be successful. They should specify goals and objectives without pre-judging the technical solutions; be open to both established and new companies; include a grant element and other forms of support for innovative companies to help them overcome potential problems with raising financing to develop technologies; and allow single company contracts without requirement for collaboration. Public procurement should also be run through open competition under rules that take into account the risky nature of innovation projects.

The Review emphasizes the important role of **industry-science linkages** (ISL) in the national innovation system. It is important to gain the necessary knowledge to design effective policy interventions and facilitate the activities of innovation stakeholders, and hence the authorities should promote a comprehensive evaluation of ISLs. The evaluation should be internal (at the level of key organizations) and external, carried out on a periodic basis and the results widely disseminated, so innovation stakeholders can assess their relative position within the system and the effectiveness of supporting policy measures. The results of the evaluation should provide the rationale for future policy changes, so these are understood by innovation stakeholders and a shared vision of future direction can emerge.

The creation of dedicated institutional structures to support research commercialization is necessary to address the challenges faced by research organizations trying to commercialize their outputs. Given the limited innovation budgets of these organizations, public funding of technology transfer and commercialization activities is needed, as significant time is required before these activities can generate a profit. One possibility is to grant subsidies for research commercialization activities. These could take the form of knowledge transfer grants or be provided as a small share of total research budgets. Another option is to subsidize the costs of obtaining patent and other forms of intellectual property rights protection, or allow grant recipients to use research funds to pay for IP-related costs. It is also important to provide training to technology transfer offices, in particular on a variety of IP-related issues, including patent application, copyright and industrial design registration, and the negotiation of licensing contracts with companies, as is facilitating access to legal and patent services providers when these functions are outsourced.

The authorities should actively promote collaboration measures between different innovation actors, seeking permanent changes in their behaviour. The scope of public intervention could involve varying resource commitments and target different areas. These could include strategic collaboration between different organizations, where a condition for funding is that both science and industry stakeholders are involved. This type of intervention may target a key technology or promote centres of excellence that support the development of joint research structures between firms and industry. Cluster-based interventions, which aim to strengthen linkages between start-ups, companies, and research organizations in a particular sector or region, could also be supported. Specific measures could include funding for joint projects or the improvement of framework conditions, including physical infrastructure, human capital and internationalization platforms. Also important is the development of matchmaking and other intermediary services, and platforms for interaction between research organizations and providers of finance and business, through information services, exhibitions and supporting the formation of networks.

The authorities could address weak collaboration between the science sector and small companies with the introduction of a voucher scheme, which should target small and medium sized enterprises that have difficulties in accessing external expertise, or which do not consider such expertise as sufficiently beneficial in the short term. Vouchers for the purchase of innovative solutions to SME problems should be allocated on the basis of clear principles.

The Review provides a number of recommendations to improve opportunities for the **financing of innovative entrepreneurs**. Overall framework conditions have a strong influence on the development of start-ups and SMEs, shaping the impact of other policy interventions. The authorities should make focused and sustained efforts to improve the legal

and regulatory environment for start-ups and SMEs. Legislation should be tailored to improve the ease of doing business, with an emphasis on timely interventions with significant practical impacts for businesses, including reducing administrative burdens and red tape, standardizing procedures and lowering the costs of doing business. Efforts should also be made to encourage female entrepreneurs, who are less likely to start a business but display high success rates, and could be specifically targeted by awareness raising or training initiatives. Reforms to business legislation could facilitate the entry/exit of firms, support start-ups and encourage the development of venture capital firms, in line with international best practice and with a view to reversing the observed trend of companies being established abroad. These actions could be documented in an annual progress report, with monitoring and evaluation against milestones and key performance indicators (KPIs).

Public support is necessary to address the financing problems of innovative companies. A new Fund to support small innovative businesses, although limited in size, would have positive effects by facilitating the development of start-ups and helping them to attract private financing. There is also a need to consider other funding possibilities.

The Fund to support small innovative businesses should be initially of a limited size. Once it has a proven track record of successfully supporting innovative SMEs, resources could be increased. A fund that is run well, with stringent but transparent criteria to select companies, could attract a good quality deal flow and would also encourage private sector interest in the companies being financed. As innovation goes hand-in-hand with risk, it is crucial that there be a tolerance of failure. Funding should be stable, preferably in the form of a contribution to the capital of the Fund to support small innovative businesses, so risks can be managed on a portfolio basis, without requiring a positive outcome for every project financed. Given the limited resources available and the need to enhance the credibility of interventions in this area, it would be useful to engage international know-how in the administration of the Fund to support small innovative businesses. One option would be to establish such a fund under a twinning agreement with a well-established development bank or European funding organization.

The authorities could also provide further impetus to the development of the venture capital industry in Ukraine. To this end, continued efforts to improve framework conditions for SMEs will be important, in order to increase potential investment opportunities. Engagement of the private sector in public technology programmes through close consultation or public-private partnerships would ensure that venture capitalists have better information on potential commercialization opportunities. Encouraging the emergence of business angel financing would be a way of exploring small scale opportunities that can be developed further by venture capital firms. This could be done by supporting the formation of business angel networks and the creation of platforms for communication with research organizations and universities.

**International cooperation** can contribute to enhance innovation performance through multiple channels. Ukraine has a well educated population, but continued improvements in human capital and the ability to retain local talent are ongoing challenges. One way to address this issue is to continue to build on measures that facilitate the international mobility of graduate students, young researchers and educators. These could include taking advantage of existing EU programmes, developing new forms of cooperation through regional integration initiatives and establishing mechanisms of collaboration with the private sector through

shared sponsorship and corporate-sponsored scholarships. Developing R&D programmes and encouraging spin-offs, including with the participation of foreign partners and private investors, also has potential to create long run employment opportunities for returning students and researchers. Improving the process of attracting foreign experts, scholars and qualified personnel through immigration policies and work permits should also be a priority, along with grants to attract internationally-renowned academics in priority fields, and finalizing the standardization of the educational system in accordance with the Bologna Process (mutual recognition of diplomas, academic credits, etc.)

International cooperation in science can be encouraged by strengthening coordination mechanisms and the circulation of information. Engaging in these exchanges requires specific linguistic and managerial skills that can be developed through appropriate training. Internet-based platforms could be developed to enhance skills in international research collaboration, including managerial and administrative aspects related to grant applications, research collaboration and commercialization of research projects. Improved access to international science publications and provision of foreign language translation and other support for articles to be published in international journals, as well as developing English language skills among the scientific community, would be helpful in this regard. There is also potential to introduce a web portal to facilitate access by the R&D community to scientific, technical and educational information and communicate international opportunities for exchange and cooperation. Promoting the emergence of a network of private business and non-profit NGOs to provide training services in preparation for grants and fellowship competitions and legal, managerial and administrative aspects of international collaboration should also be a policy objective, along with developing programmes of cooperation with foreign investors to train local staff and transfer international best practices.

The authorities should build on existing initiatives and common traditions to derive greater benefit from bilateral and regional economic cooperation in areas related to innovation. This could be realized by strengthening R&D and S&T linkages with similar programmes in the CIS, and championing those programmes and projects where Ukrainian institutions and scientists have potential to become regional leaders and centres of excellence. It will be important to facilitate the integration of the emerging innovation infrastructure into various regional and international networks in the CIS, EU and BSEC, as well as to promote the establishment of joint educational and training programmes in the field of higher education by establishing dual diploma/degree programmes or joint graduate programmes with major international universities.

The authorities should build on the growing network of cooperation with international partners to ensure increased recognition of the potential for cooperation by implementing new measures. This could include, for example, identifying or developing a single national flagship project that would be promoted internationally, as a rallying point and catalyst for the interest of foreign partners. Improving coordination between different R&D and innovation programmes, and identifying elements that would benefit from international cooperation, would also be of value, so these can be communicated in a consistent and unified way to foreign partners. To the same end, a communications strategy could be developed for the promotion of national goals among key partners, along with a national branding campaign to promote Ukraine as an attractive investment location. Finally, it will also be important to implement a monitoring and evaluation system to assess the impact of integration initiatives.

# *Chapter 1*

# *RECENT ECONOMIC AND INNOVATION PERFORMANCE*

Ukraine is a lower middle income economy, according to the World Bank classification, with a GDP per capita of around $3,700 in 2012 ($7,200 on a purchasing power parity basis). The country enjoys a favourable geographic position, has a well-educated labour force and a large domestic market.

The breakup of the Soviet Union led to a deep and prolonged contraction in output, prompted by trade disruption and the financial destabilization that ensued. Following a return to growth, economic performance was good in the period 2000-2008, with real GDP posting an average annual expansion of around 7%. However, falling exports and difficulties in accessing finance as a consequence of the global financial crisis resulted in a sharp contraction in output in 2009, followed by a tepid recovery. Commodity-based goods dominate the exports base, which has been a source of vulnerability in the current downturn.

Technological modernization and innovation would facilitate export diversification, reduce energy intensity and increase productivity. The development of new competitive advantages building on the economic potential of the country would provide more stable growth sources.

## 1.1 Economic structure

Services dominate economic activity, accounting for an increasing share of GDP (Table 1). By contrast, the relative importance of agriculture has declined significantly, reaching 8.5% in 2012, against 13% in 2002, although its share has recovered somewhat from a low of 6.6% of GDP in 2007, partly driven by higher prices for agricultural commodities. The share of manufacturing, which had remained relatively stable in the expansion period preceding the 2008-2009 crisis, has fallen significantly, as this export-oriented sector has suffered from adverse external conditions. Ferrous metallurgy is the largest manufacturing branch, accounting for more than one quarter of total output, being closely followed by the food industry.

Services account for the bulk of employment. Agriculture remains an important source of employment, with a share of around 10% of the total, while one quarter of the workforce was occupied in the industrial sector in 2011.

Ukraine is a large country with significant regional disparities. In 2010, income per capita in the city of Kiev was seven times greater than in the lowest income oblast (region), Chernivtsi. For Dnipropetrovsk, the industrial region with the highest income per capita, this ratio was around three. The bulk of GDP is concentrated in the industrial eastern part of the country, with the city of Kiev together with the Donetsk and Dnipropetrovsk regions accounting for more than 40% of national GDP.

**Table 1. GDP composition by sector, shares in per cent, 2002-2011**

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, hunting, forestry and fishing | 13.0 | 10.9 | 10.8 | 9.2 | 7.5 | 6.6 | 6.9 | 7.2 | 7.6 | 8.5 |
| Extractive industry | 4.4 | 4.1 | 3.6 | 4.1 | 4.1 | 4.4 | 5.7 | 4.5 | 6.1 | 6.7 |
| Manufacturing | 17.9 | 18.6 | 18.6 | 19.7 | 20.1 | 19.9 | 17.4 | 15.5 | 14.6 | 12.8 |
| Electricity, gas and water | 5.1 | 4.6 | 3.6 | 3.4 | 3.4 | 3.2 | 3.0 | 3.5 | 3.2 | 3.5 |
| Construction | 3.4 | 3.8 | 4.2 | 3.7 | 3.9 | 4.2 | 3.1 | 2.4 | 3.0 | 2.9 |
| Trade and catering | 10.9 | 11.8 | 11.9 | 12.7 | 12.6 | 13.2 | 13.8 | 14.2 | 15.2 | 15.6 |
| Transport and communications | 12.2 | 13.1 | 12.4 | 10.7 | 10.3 | 9.7 | 9.2 | 10.6 | 10.3 | 10.2 |
| Education | 4.8 | 5.2 | 4.7 | 4.7 | 4.8 | 4.6 | 4.6 | 5.4 | 5.1 | 4.8 |
| Health | 3.3 | 3.4 | 3.2 | 3.2 | 3.3 | 3.1 | 3.1 | 3.8 | 3.9 | 3.5 |
| Others | 15.6 | 16.0 | 19.3 | 18.3 | 19.5 | 22.2 | 24.0 | 25.7 | 23.3 | 21.1 |
| FISIM[i] | -1.4 | -1.6 | -1.5 | -1.7 | -2.4 | -3.1 | -3.9 | -5.6 | -4.2 | -3.5 |
| Net taxes | 10.9 | 10.1 | 9.3 | 12.0 | 12.9 | 11.9 | 13.1 | 12.8 | 11.9 | 14.0 |
| **GDP** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

*Source:* State Statistics Service of Ukraine.
[i] Financial Intermediation Services Indirectly Measured.

Gross fixed investment as percentage of GDP fell sharply after the 2008 crisis (Table 2). In 2009-2011, this ratio averaged 18%, sharply down from 24% observed in 2003-2008. The share of consumption, by contrast, has increased significantly in the last decade. Net external demand (exports minus imports) was positive in 2002-2005 but a widening deficit emerged afterwards. The gap narrowed somewhat after the financial crisis of 2008, as imports declined more sharply than exports, before widening once again in 2011.

**Table 2. Composition of GDP, final consumption, shares in per cent, 2002-2011**

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|
| Consumption | 75.4 | 75.4 | 71.2 | 76.5 | 78.1 | 77.5 | 80.1 | 84.7 | 84.5 | 85.5 |
| *- Private* | *57* | *56.4* | *53.6* | *58.3* | *59.7* | *59.6* | *62.2* | *64.5* | *64.2* | *67.3* |
| *- Public* | *18.4* | *19.0* | *17.6* | *18.2* | *18.4* | *17.9* | *17.9* | *20.2* | *20.3* | *18.2* |
| Gross fixed capital formation | 19.2 | 20.6 | 22.6 | 22 | 24.6 | 27.5 | 26.4 | 18.3 | 18.1 | 18.6 |
| Changes in inventories | 1.0 | 1.4 | –1.4 | 0.6 | 0.1 | 0.7 | 1.5 | –1.3 | 0.3 | 2.1 |
| Net external demand | 4.4 | 2.6 | 7.6 | 0.9 | -2.8 | -5.7 | -8 | -1.7 | -2.9 | -6.2 |
| *- Exports of goods and services* | *55.1* | *57.8* | *63.6* | *51.5* | *46.6* | *44.8* | *46.9* | *46.4* | *50.8* | *54.4* |
| *- Imports of goods and services* | *–50.7* | *–55.2* | *–56.0* | *–50.6* | *–49.4* | *–50.5* | *–54.9* | *–48.1* | *–53.7* | *-60.6* |
| **GDP** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

*Source:* State Statistics Service of Ukraine

## 1.2 The public sector

Economic activity is largely in the hands of the private sector, which accounted for 60% of GDP, according to latest estimates from the European Bank for Reconstruction and Development.

The State Privatization Programme for 2012-2014 envisages further declines in the share of the state-owned sector to 25-30% of GDP. The State retains important interests in the industrial, energy and power generation sectors. Besides these holdings, the public sector remains an important influence on economic activity, as general government expenditure represented 47% of GDP in 2012, up from 37% in 2001. This large increase has been largely driven by the growth of wages and pensions. Government consumption accounted for 20% of GDP in 2009-2011.

Public debt has risen rapidly in recent years, partly to offset the reversal of private capital flows that accompanied the financial crisis of 2008-2009. Public debt reached 36% of GDP by the end of 2012, up from 12% in 2007.

## 1.3 Economic performance

The Ukrainian economy expanded rapidly in the period 2001-2008 (Table 3). Such positive performance was driven by institutional reforms and a favourable external environment, which included a cumulative improvement in the terms of trade of 50% over this period, largely driven by sharply increasing prices in the steel, chemical and agricultural commodities sectors. However, export revenues declined by 45% in 2009, as commodity prices collapsed.[1] The deterioriation in the external economic environment exposed domestic weaknesses and resulted in a sharp contraction of GDP in 2009, which fell by 15%. The stabilization of the international economy contributed to the cyclical recovery seen after this dramatic contraction.

**Table 3. GDP and its components: annual percentage change**

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| GDP | 7.4 | 7.6 | 2.3 | -14.8 | 4.1 | 5.2 |
| Consumption | 13.4 | 14.5 | 10.1 | -12.2 | 6.4 | 10.7 |
| Investments | 17.9 | 26.5 | 1.8 | -57.4 | 13.9 | 21.9 |
| Exports | -5.8 | 2.8 | 5.7 | -22.0 | 3.9 | 2.2 |
| Imports | 8.3 | 23.9 | 17.0 | -38.9 | 11.3 | 16.8 |

*Source:* State Statistics Service of Ukraine

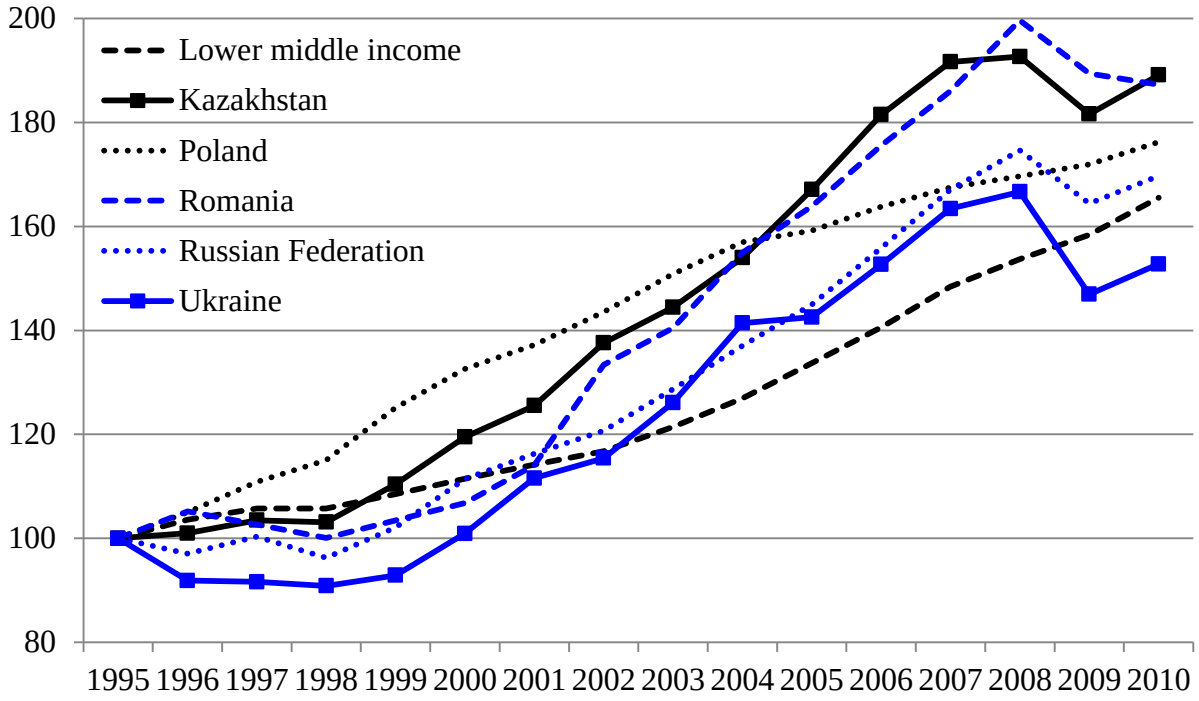
While export growth was a major contributor to growth in 2000-2004, it was domestic demand, boosted by favourable terms of trade, an expansive fiscal policy and rapid credit growth, which was the main driver of economic expansion in 2005-2008. Output plummeted in 2009, driven by a sharply worsened external environment, including lower prices for major

[1] World Bank (2010), Ukraine Country Economic Memorandum: Strategic Choices to Accelerate and Sustain Growth, Washington D.C.

exports, lack of access to international capital markets and the transition to market pricing of gas imports. Despite sustained growth since, the economy has not yet recovered from the sharp contraction experienced.

While Ukraine's economy has a relatively low level of productivity, there is huge potential for improvement and technological upgrading. Overall, productivity has risen significantly over the past 25 years. Following a period when productivity fell in the late 1990s, there was catch up with comparator economies, with productivity growth significantly higher than the average for other lower middle income countries. However, the financial crisis of 2008-2009 was a major setback, reversing much of the progress that was made in the previous decade, and has hit Ukraine harder than most comparator economies (Figure 1).

**Figure 1. Real GDP per person employed (1995 = 100)**




*Source:* Own calculations based on World Bank Development Indicators (GDP per person employed, constant 1990 PPP $)

Total Factor Productivity (TFP) played an important role in economic expansion prior to 2005. It was the main driver of growth in the manufacturing sector over the first decade of the 21st century, but this has declined since 2004. In the agricultural sector, productivity has been low and declining, with limited modernization and modest FDI inflows.[2] Only the service sector has seen increasing employment, together with some improvement in productivity.

The role of industrial upgrading in driving growth prior to 2008 was very limited. Productivity gains were driven by within-firm productivity improvements, and much less by

[2] World Bank (2010), pages 33-34.

new entry and reallocations among industries and sectors.[3] Labour shedding at existing firms was the main source of job destruction. New entrants were not an important source of productivity gains. Such analysis suggests that processes of "creative destruction" in the Ukrainian economy are weak, and that facilitating entry and exit could generate significant productivity gains (Chapter 3). As Ukraine appears to have reached the limits of productivity growth based on within-firm productivity improvements by shedding labour, future growth will depend to a greater extent on technological upgrading and capacity to innovate that results in more sophisticated exports.

The current account balance showed a large surplus in the first part of the last decade, peaking at 10.7% of GDP in 2004. However, the worsening of the external environment and domestic demand that remained buoyant, fuelled by an expansionary fiscal policy, led to the emergence of mounting imbalances. The current account deficit as a share of GDP reached around 6% in 2012.

Rapid growth, the impact of food prices and increases in utilities prices have contributed to inflationary pressures. Inflation has declined but remains relatively elevated, declining to an annual average of close to 9% in 2009-2012, from around 16% in 2006-2008.

## 1.4 Labour force and education

Ukraine's population has been shrinking since 1993, declining by an average 0.5% annually in the period 2005-2012. The economically active population fell by 3.4% over the period 2000-2011, while employment grew by 0.7% over the same period, driven by higher rates of employment. However, the crisis of 2008-2009 was accompanied by employment destruction, which temporarily halted the trend decline in the unemployment rate seen over the previous decade. The more recent period has seen a recovery in the labour market, leading to a fall in the unemployment rate to 7.4% by September 2012. Nonetheless, negative demographic trends are resulting in a rapidly aging profile.

Ukraine has a well-educated labour force. According to UNESCO statistics, the gross enrolment ratio in tertiary education was 79, reaching 89 for females, in 2010. 38% of the population aged 25 years and older has tertiary education (39.7% for females). These ratios are among the highest in the region and compare well with those of more developed countries. The share of students working in science and development (26%) is also relatively high.

Despite these positive educational indicators, firm-level data from the latest EBRD / World Bank Business Environment and Enterprise Performance Survey (BEEPS) shows that the share of firms that report the lack of appropriate skills as a problem is around ten percentage points higher than the regional average. The problem is particularly acute among companies that are growing.

## 1.5 International economic relations

Foreign direct investment was low in the period 2000-2004, averaging 2.2% as a share of GDP. This ratio rose sharply to 8.7% in 2005 as a result of two large transactions in the steel

[3] World Bank (2008), Unleashing Prosperity. Productivity Growth in Eastern Europe and the Former Soviet Union, Asad Alam et al, Washington D.C.

and banking sectors. In 2009-2011, net FDI accounted for around 4% of GDP annually. Despite the increase, FDI has remained relatively low in relation to the more advanced countries in Central and Eastern Europe.

In trade, Ukraine is an open economy, with external trade turnover accounting for around 90% of GDP in 2011 (Table 4). Changes in the external environment have a significant impact on economic activity, which is vulnerable to external price and demand shocks.

**Table 4. External trade of Ukraine, 2004-2011**

| | | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|
| $ billion | Exports | 32.7 | 34.2 | 38.4 | 49.3 | 67.0 | 39.7 | 51.4 | 68.4 |
| | Imports | 29.0 | 36.1 | 45.0 | 60.6 | 85.5 | 45.4 | 60.7 | 82.6 |
| | Balance | 3.7 | -1.9 | -6.7 | -11.3 | -18.6 | -5.7 | -9.3 | -14.2 |
| % GDP | Exports | 50.3 | 39.7 | 35.6 | 34.5 | 37.2 | 33.9 | 37.7 | 41.4 |
| | Imports | 44.7 | 41.9 | 41.8 | 42.5 | 47.5 | 38.8 | 44.5 | 50.0 |
| | Balance | 5.7 | -2.2 | -6.2 | -7.9 | -10.3 | -4.9 | -6.8 | -8.6 |

*Source:* State Statistics Service of Ukraine

There has been little change in export structure over the past decade. Observed shifts have been to some extent explained by price fluctuations in key exports such as steel and agricultural products. Metallurgy dominates exports, and accounted for 28% of the total in the first eleven months of 2012. Exports of agricultural and food products have remained resilient throughout the crisis, accounting for 25% of total exports in this period. Mineral products and chemicals are also important exports. Altogether, this defines a concentrated export structure dominated by low value-added goods where price volatility is a source of vulnerability.

The CIS is the largest trading partner, accounting for an average 36% of exports and 44% of imports over 2009-2011. Over the same period, the EU shares were 26% and 32%, respectively. While Ukraine is able to export more sophisticated products to CIS markets, its machine building products have not been upgraded over time to penetrate other markets successfully.[4] Asia is an important destination for Ukrainian exports, accounting for 28% of the total.

## 1.6 Key innovation indicators

### *Inputs*

Despite the policy interest in innovation, the ratio of gross domestic expenditure on R&D as a share of GDP shows a persistent declining trend for the last fifteen years, with only a brief period of stabilization in the early 2000s. In 2011, the ratio fell to 0.79% of GDP, down from 1.1% ten years earlier. This is a level similar to Belarus, Poland and Croatia. In the years following the 2008-2009 crisis, R&D expenditures have showed some resilience in comparison with gross fixed investment, which suffered a sharp contraction relative to the

[4] World Bank (2010), Ukraine Country Economic Memorandum. Strategic Choice to Accelerate and Sustain Growth, Washington D.C.

pre-crisis period. R&D expenditures were equivalent to 4.8% in 2009-2011 of gross fixed investment, in comparison to 3.6% in the three preceding years.

The structure of financing of R&D shows that a large share is accounted for by public funding, which represented 40.7% of the total in 2011 (excluding services). In contrast, the domestic business sector (own and borrowed funds) provided only 32.6% of the total. The growth in foreign sources of R&D financing has been remarkable, with a share of 25.8% in 2011, up from 15.6% in 2008.

Development and commercialization account for the bulk of R&D spending (48% in 2011) but this share has been declining in recent years, while basic research has increased (21% in 2011, against an average of 16% in 2000-2005). The business sector is the main performer of development and commercialization activities (almost 90% of the total in 2011), but its recent weakness helps explain the overall fall in the share of this type of R&D. Physics and mathematics (7.4%), agriculture (5.7%) and biology (3.4%) are the scientific fields which attract most R&D spending, according to 2011 statistics.

### *Outputs*

Available statistics prepared on the basis of national definitions show some deterioration in innovation performance over the last decade, as both the share of innovative products in industrial activity and the prevalence of innovative activities among companies have declined. The importance of innovative products has declined; innovative products having been around 6-7% of total industrial output in the early 2000s, before falling sharply from 6.7% in 2007 to only 3.8% in 2011.[5] However, there has been some recovery in the number of enterprises introducing new products (12.8% in 2011, up from 10.7% in 2009). Sectors which display higher rates of innovation include coke and refined petroleum products (39.4%), engineering (24.5%) and chemical and petrochemical industries (24.0%).

Ukraine has conducted two surveys of innovation activities that follow the EU Community Innovation Survey methodology. The latest survey was carried out in 2011, covering the period 2008-2010. In comparison with the first survey covering 2006-2008, the share of innovative enterprises grew by three percentage points to 21%. This was a result of an increase in the number of enterprises introducing organizational and marketing changes, which was the most prevalent form of innovation, involving 13% of all enterprises. By contrast, there was a decline in the number of companies engaged in technological innovation.

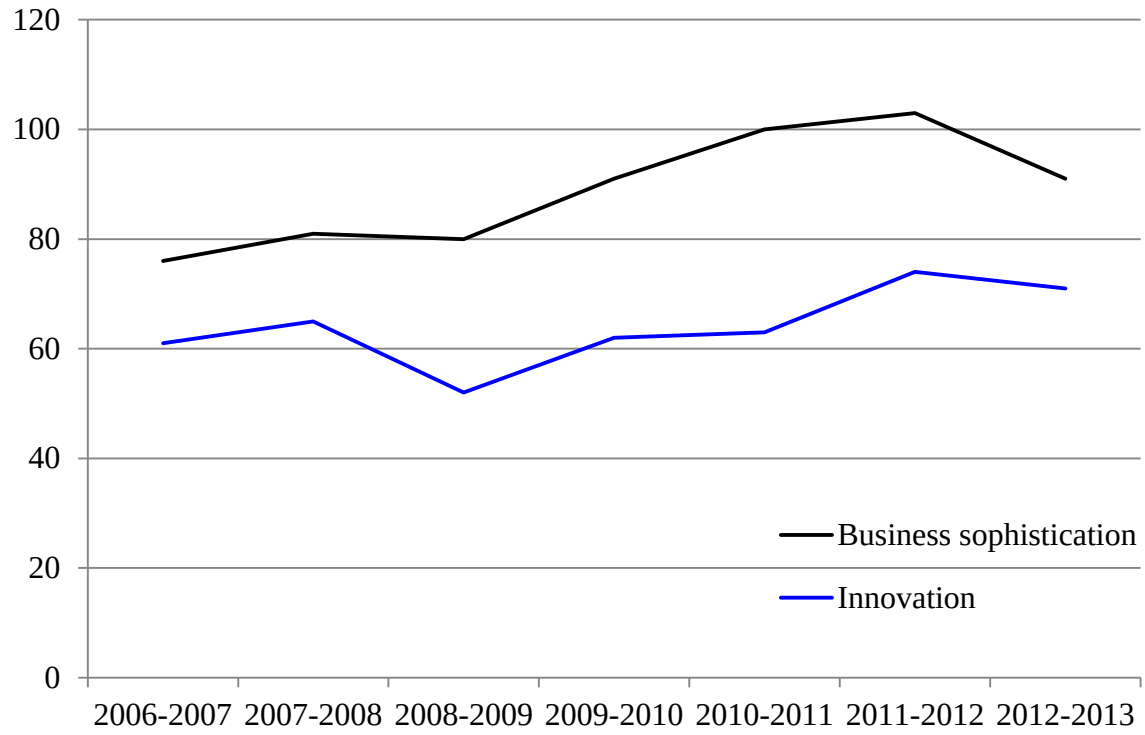
### *Global competitiveness and innovation indicators*

The World Economic Forum's Global Competitiveness Report provides an assessment of 12 "pillars of competiveness" for a large group of countries, ranking them across multiple dimensions. Ukraine is considered to be at the efficiency-driven development stage, where innovation and sophistication factors have a still limited role in determining the value of the overall competitiveness index in comparison with more advanced economies.

[5] Research and Innovation Activity data (1990-2011), State Statistics Service of Ukraine.

There has been some progress in business sophistication and innovation since the 2008-2009 financial crisis, but the latest issues of the Global Competiveness Report show some deterioration in the rankings, in particular regarding business sophistication. By contrast, there is some limited improvement regarding technological readiness, which provides an assessment of the economy's ability to absorb existing technologies. Ukraine moved from 83rd position in the 2010-2011 report to 81st in 2012-2013 (Figure 2).

**Figure 2. Business innovation and sophistication: WEF rankings**




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

# *Chapter 2*

# *NATIONAL INNOVATION SYSTEM AND INNOVATION GOVERNANCE*

Chapter 2 firstly presents some basic concepts that will be used in the Innovation Performance Review of Ukraine. Secondly, it provides an assessment of the main components of the national innovation system (NIS) of Ukraine, including the key policymaking institutions. Finally, the chapter provides a number of conclusions and recommendations to improve the functioning of the NIS and its governance.

## 2.1 Some basic concepts

Innovation is the successful commercial application of knowledge, be it in new or improved products or services, or new or improved business or production processes. Innovation creates new and better remunerated jobs, as well as better and cheaper products for consumers. In the medium to long term, innovation is the single most important driver of sustainable economic development.

Innovation is a cumulative process, in which the new springs in large measure from a smart recombination of the old, and where even disruptive innovations typically build on existing knowledge and experience. Drawing on what already exists and combining or adapting it in new ways is a key capability for successful innovators, at both the individual and national levels. In fact, importing proven ideas from abroad and adapting these to local requirements is arguably the most significant innovation channel in terms of volume – particularly for countries with economies in transition, which are not at the technology frontier.

Curiosity, creativity and ingenuity are at the heart of all innovation, and they are part of human nature. However, not all countries are equally good at reaping the fruits of human ingenuity by transforming it into economically relevant innovation. In fact, international benchmarking exercises suggest that differences in the capacity to innovate can be vast.[6] This is because, in the modern economy, innovation requires much more than a good idea. It is a complex, time consuming, often expensive and always risky process. Because of this, it requires sustained cooperation between different actors with complementary capabilities.

No single innovative company typically possesses all the necessary skills and resources required throughout the innovation cycle. For instance, a company may have to acquire some knowledge and technology critical to its business from other companies or from academic institutions. The company will also need to raise finance, including from institutions with expertise in innovation (e.g. business angels and venture capitalists), with a sufficiently long investment horizon and the required risk appetite. Such investors will also need to share the project risks in an efficient way. Bringing together the partners best suited to jointly carry out

[6] For instance, the difference in the Global Innovation Index of the World Intellectual Property Organization between the best and worst performing members of the European Union is almost 30 points on a scale of 0-100, or 65 places out of 141 countries ranked.

the project may require intermediaries, e.g. to match technologies developed in academic environments with the companies able to commercialize them.

Such collaboration requires well-defined contractual relations, often underpinned by intellectual property rights, none of which is automatic. Innovation and the many forms of collaboration that sustain it must be nurtured by a legal and regulatory environment that facilitates risk taking and long-term investment, and actively supports establishment and up skilling of the various actors in the innovation process. This is the key challenge for innovation policy, and helps explain differences in innovative capacities across countries.

***National innovation system***

Many definitions of a national innovation system have been proposed. For the purposes of this Review, we will define a national innovation system as the institutions, actors, laws, regulations and policies that together enable innovation within a country.[7] We speak of a national innovation *system* because its elements *complement* each other, so that the whole has a greater effect than the sum of the effects which the constituent parts would have individually. In other words, each element of a well-functioning national innovation system makes the other elements more effective. Figure 3 provides a schematic overview.

Given that innovation is about bringing better products and services to market, the market for innovative products and services is the first key element of the system. On the one hand, innovative companies can create their own markets through astute marketing and advertising. On the other hand, unmet demand for innovative products and services is a key "pull factor" for innovation. This demand may come from end consumers or from other companies with a need for innovative solutions to their own business problems. Indeed, leading companies increasingly draw on their customers to generate ideas for new and improved products.

However, in national environments where innovative activity is initially low, a lack of demand for innovative products may prove a critical bottleneck. From a policy point of view, there may be a role for government to stimulate such demand through public procurement policies, or through subsidies for business investments in innovative technologies.

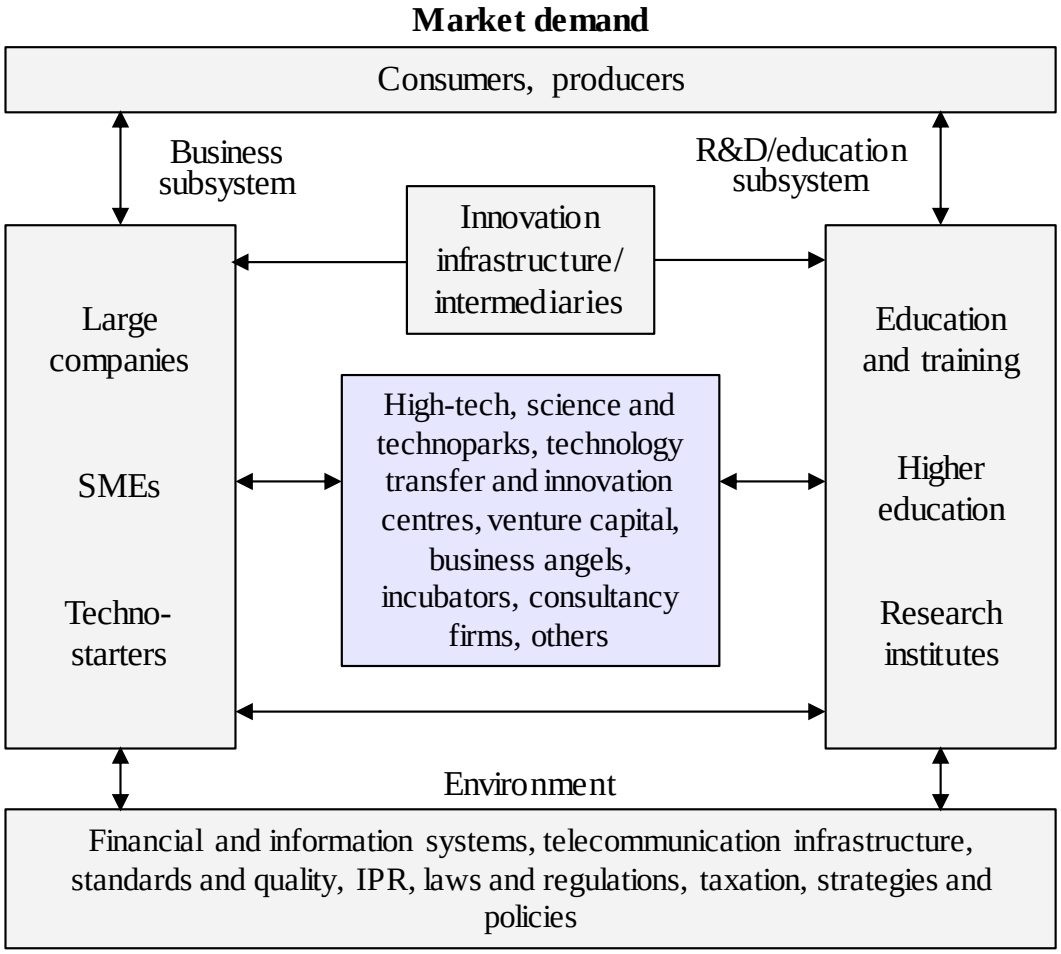
The business sector, including large companies, established SMEs and new innovative start-ups, plays a dual role in the market for innovative products, as customer and supplier. It is at the core of the innovation process. Even today, much innovation comes out of the research and development laboratories of large enterprises. However, the innovation process is becoming increasingly open and collaborative, with dynamic SMEs becoming more important. Leading innovative companies increasingly look outside for opportunities to access the knowledge and technology needed in their own businesses, as well as for opportunities to sell or license some of their own non-core technologies to outside partners.

An increasingly crucial element of a well-functioning national innovation system is therefore collaboration between innovative companies. Large companies, for instance, may spawn whole "ecosystems" of innovative SMEs around them by procuring innovative solutions to design or engineering problems, or by providing technological platforms on which others can

[7] Bearing in mind that innovation increasingly requires cooperation across national borders, a subject that is addressed in chapter 7 of this Review.

create their own products. Another example is the innovative company which focuses exclusively on research and development, and contracts out the manufacturing and marketing of the resulting products and services to others. These interactions can be thought of as taking place on (formal or informal) markets for technological and knowledge exchange, which are important elements of innovation systems.

**Figure 3. Base model of a national innovation system**




*Source:* Adapted from: C. Freeman (1987), National systems of innovation: the case of Japan, in: Technology Policy and Economic Performance, London, Printer Publishers.

During the innovation process, successful businesses not only cooperate with one another, but also with academic research institutions. Many governments provide significant financial support to academic institutions. In some countries, these institutions also raise significant resources from the private sector. On the one hand, these institutions provide a resource that is critical to the innovation process in the form of highly qualified engineers and other professionals, without whose human capital no innovation would be possible. On the other hand, they also undertake research with potentially important commercial applications. A key challenge for the innovation system is to create the conditions for the commercialization of this research, by encouraging academic institutions to participate in the marketplace for

technology and knowledge, and encouraging cooperation between academic institutions and the business sector.[8]

Sustaining such cooperation, both within the business sector and particularly between business and academia, requires an effective innovation infrastructure and a host of specialized intermediaries dedicated to match-making, financing, advising, and providing the legal expertise to underpin contracts. Innovation policy has a crucial role to play in creating this infrastructure and the favourable conditions for establishment of such intermediaries.

All these are crucial to the functioning of the innovation system, because what makes the system effective is precisely that the various elements work together effectively, and this requires not only vibrant demand for innovative products, strong innovative companies, and a strong academic research base, but also strong linkages within and between these spheres.

Last, but not least, innovation, like all economic activity, depends on a supportive general business environment that facilitates entrepreneurship and therefore innovation. Corporate law, labour law (ease of hiring and firing), tax law, intellectual property laws, administrative burden, transport and IT infrastructures, and anti-corruption measures all determine whether it is attractive to undertake the risky long-term investments necessary for innovation. Creating a supportive business environment is therefore an important policy objective.

***Effective governance***

An effective national innovation system does not arise spontaneously. Each of the elements outlined above depends for its effectiveness on the other elements being developed. For instance, creating an innovative start-up company and growing it into a sustainable business providing significant employment is much easier when outside financing and risk sharing is available as opposed to relying on internal sources of finance. This interdependency between the elements of the innovation system can create "chicken-and-egg" problems. For instance, a lack of innovation infrastructure or intermediaries can prevent new innovative companies from emerging, and at the same time the lack of new innovative companies can limit the prospects for such infrastructure and intermediaries to be sustainable.

The role for innovation governance lies in overcoming these problems by coordinating policy support for an effective national innovation system. As such, innovation governance is a horizontal policy priority. Its aim is to coordinate more traditional sectoral industrial policies and science and technology policy to ensure coherent implementation of the overall innovation strategy. The precise way in which this horizontal policy coordination is achieved varies from country to country.[9] There may be high level bodies providing strategic frameworks, single ministry or governmental bodies assigned coordination roles, or

[8] In a well-functioning innovation system, this cooperation is a two-way process, where businesses employ university/academy graduates and commercialize technologies and knowledge from academic research, and academic institutions receive funding, as well as inspiration for new research, from the business community.

[9] For definitions of innovation governance, as well as examples of governance arrangements in different countries see: OECD (2005), Governance of innovation systems: Volume 2: Case studies in innovation policies, Paris; European Commission (2001), COM 428 final, Brussels. P. Boekholt (2004), Ensuring policy coherence by improving the governance of innovation policy, Trend Chart Policy Workshop, Brussels, 27-28 April 2004.

decentralized decision-making assigned to many ministries/departments, depending on their scope and scale of responsibility and control.

In particular for large countries such as Ukraine, the coordination of policies at the national, regional and local levels is an important aspect of innovation governance. At the same time, given increasing internationalization, innovation governance must also ensure that the elements of the national innovation system are able to support national enterprises, academic institutions and innovation intermediaries in cross border cooperation.

## 2.2 Assessment of the national innovation system of Ukraine

There are two main factors which positively influence innovation activities within the national innovation system: the free market and entrepreneurship. It is important that policies support the creation of an environment that reinforces market efficiency and entrepreneurship for both the business and the science sectors.

***Ukraine as a market economy***

Innovation goes hand in hand with entrepreneurship and the market economy, with each element reinforcing the other. Nonetheless, these represent necessary but not sufficient preconditions for an environment conducive to innovation.

Ukraine began the privatization process in the early 1990s, along with the introduction of laws and regulations that would stimulate the development of small businesses. For around a decade, successive Ukrainian governments adopted policies targeting the development of market mechanisms in the country. In December 2005, the European Union (EU) announced that it recognized Ukraine as a market economy.

The markets, both internal and external, are among the most powerful pull factors for innovation. For an emerging market economy such as Ukraine, attraction of foreign investment is essential. Ukraine encourages foreign trade and investment, and has consequently given rights to foreigners to purchase businesses and property, repatriate revenue and profits, and receive compensation in the event of their property being nationalized. However, the recent global financial and economic crisis has taken its toll, with investors less willing to take risks. Nonetheless, while the overall environment for business activities remains challenging, there has been some recent progress in the World Bank's Doing Business 2013 survey rankings, discussed in greater detail in chapter 6.

Complex laws and regulations, poor corporate governance and weak enforcement of contract law by courts are discouraging not only foreign investors but also national companies. Shortcomings in the business environment are particularly damaging for SMEs, and prevent Ukraine from reaping the full benefits from its entrepreneurial potential.

***Entrepreneurial potential of Ukraine***

Research conducted in 2010 by the Institute of Sociology of the National Academy of Sciences of Ukraine provides evidence of untapped entrepreneurial potential in the country that could result in greater numbers of SMEs. According to these figures, around half the population would like to start their own business, answering "yes" or "rather yes" when asked

if they would like to start their own business (Table 5). The share of potential entrepreneurs is higher among those already in business (enterprise owners and individual entrepreneurs), while the percentages of engineers, scientists or educators, qualified workers and, in particular, students who are interested in starting their own business are all promising for development of the SME sector. There are relatively more potential entrepreneurs among the population below 30 years of age (Table 6), and an enabling environment would help these young people realize their ambitions at home rather than abroad

**Table 5. Expressed willingness of population to start own business,[i] per cent**

| Would you like to start your own business? | Head of enterprise | Engineer | Scientist or educator | Medium or large enterprise owner | Small enterprise owner or ind. entrepreneur | Qualified worker | Agricultural worker | Student or Ph student | Registered unemployed | Sample |
|---|---|---|---|---|---|---|---|---|---|---|
| No | 10.0 | 18.4 | 20.2 | 5.0 | 1.5 | 19.8 | 37.1 | 1.2 | 11.8 | 28.6 |
| Rather no | 5.0 | 12.6 | 14.6 | 0.0 | 3.0 | 8.5 | 5.7 | 5.8 | 11.8 | 9.1 |
| Hard to answer | 20.0 | 11.5 | 16.9 | 0.0 | 1.5 | 16.1 | 22.9 | 7.0 | 11.8 | 13.1 |
| Rather yes | 20.0 | 28.7 | 19.1 | 5.0 | 17.9 | 22.2 | 25.7 | 29.1 | 29.4 | 18.7 |
| Yes | 45.0 | 28.7 | 29.2 | 90.0 | 76.1 | 33.5 | 8.6 | 57.0 | 35.3 | 30.5 |
| Number of respondents | 20 | 87 | 89 | 20 | 67 | 248 | 35 | 86 | 17 | 1788 |

[i] Not all but selected occupations are included.

*Source:* Based on Institute of Sociology (2010), Ukrainian society – 2010 (Opinions, evaluations and living conditions of Ukrainian population). Institute of Sociology of the National Academy of Sciences of Ukraine.

**Table 6. Expressed willingness of population to start own business by age group, per cent**

| Would you like to start your own business? | < 30 years | 30-55 years | >55 years | Sample |
|---|---|---|---|---|
| No | 8.1 | 18.9 | 60.7 | 28.5 |
| Rather no | 4.2 | 10.2 | 10.7 | 9.2 |
| Hard to answer | 9.3 | 15.4 | 11.5 | 13.1 |
| Rather yes | 25.3 | 22.0 | 7.9 | 18.7 |
| Yes | 53.1 | 33.6 | 9.1 | 30.6 |
| Number of respondents | 356 | 938 | 504 | 1798 |

*Source:* Based on Institute of Sociology (2010), Ukrainian society – 2010 (Opinions, evaluations and living conditions of Ukrainian population). Institute of Sociology of the National Academy of Sciences of Ukraine.

### *The business enterprise subsystem*

A low level of innovation can be observed in industrial enterprises of all sectors, ownership structures and sizes. The most frequently cited type of innovation is the purchase of equipment and software. The share of innovative enterprises is higher among large enterprises compared to SMEs (Chapters 4 and 5). Barriers to innovation mentioned by industrial enterprises in their reporting forms to the State Statistics Committee of Ukraine were: lack of own finances (80.1% of industrial enterprises); up-front costs of innovation (55.5%); insufficient state financial support (53.7%); economic risk (41.0%); poor legal base (40.4%), length of time before return on investment (38.7%); and customers' lack of financial resources (33.3%). In addition, 20.0% of enterprises cited lack of qualified personnel; 19.7% – lack of cooperation with research institutes / other enterprises; 17.4% – lack of information about consumer markets; 17.3% – lack of information about innovative products; 16.0% – low demand for innovation; and 15.5% – unwillingness of the enterprise itself to innovate.[10]

### *The role of SMEs*

SMEs are an important driver of economic dynamism, and may be associated with significant innovation activities. The number of small enterprises per ten thousand people increased from 44 in 2000 to 75 in 2009 (Table 7). Small enterprises (across sectors) were those employing not more than 50 people, and with a gross annual income less than UAH 70 million (fixed at €500,000 per annum until 2009). The small business sector also includes individual entrepreneurs ("physical persons"). It should be noted that the legislation was changed in 2012, with a "micro" enterprises definition being added as firms with less than ten employees.

**Table 7. Dynamics of small enterprise[i] development in Ukraine**

| Year | No of small enterprises per 10 000 people | Small enterprises' employees as share of total (%) | Small enterprises' share of volume of products & services (%) |
|---|---|---|---|
| 2000 | 44 | 15.1 | 8.1 |
| 2001 | 48 | 17.1 | 7.1 |
| 2002 | 53 | 18.9 | 6.7 |
| 2003 | 57 | 20.9 | 6.6 |
| 2004 | 60 | 20.2 | 5.3 |
| 2005 | 63 | 19.6 | 5.5 |
| 2006[ii] | 72 | 23.5 | 18.8 |
| 2007 | 76 | 23.7 | 18.1 |
| 2008 | 72 | 24.3 | 16.3 |
| 2009 | 75 | 25.2 | 16.6 |
| 2010 | 70 | 26.3 | 14.2 |
| 2011 | 70 | 26.6 | 13.1 |

[i] Banks, farms and budget organizations excluded.
[ii] From 2006, data based on definition of small enterprise in accordance with Law No 523-VI "On introduction of changes to some legal acts of Ukraine on issues of regulation of entrepreneurial activity", 18 September 2008.
*Source:* State Statistics Committee of Ukraine, 2010. Last modified 1 July 2010.

[10] EU Project (2011), "Enhance Innovation Strategies, Policies and Regulation in Ukraine", Innovation policy: European benchmarking for Ukraine volume 1, eds. G. Rumpf, G. Strogylopoulos and I. Yegorov, exhibit 5.

Although the number of small enterprises increased during the 2000s, profitability remained comparatively low, with more than one third of small enterprises reporting losses. However, many Ukrainian small businesses operate partially in the shadow economy and the reported data may not be reliable. Most small enterprises operate in "Trade, repair of vehicles, household appliances" (61.5%) and "Real estate operations, engineering and services to business" (11.2%). "Industrial manufacturing" and "Construction" contributed 9.2% and 8.5%, respectively.

Many transition economies show a similar pattern, with a dominance of trade-based businesses and a limited manufacturing sector. Another feature of the Ukrainian SME sector is the prevalence of sole traders. These two features combine to produce a limited platform of innovative SMEs in Ukraine. Public policies are required to support the sector's development generally, and in particular innovative SMEs.

Ukraine has adopted numerous national and regional programmes to support small entrepreneurship, although implementation remains difficult. The National Programme for Promotion of Small Entrepreneurship Support (SCURPE) sets the following objectives:

- Improvement of the normative and legal base in the sphere of entrepreneurial activities;
- Formation of a single state regulatory policy in the sphere of entrepreneurship;
- Improvement of financial, credit and investment support of small enterprises;
- Promotion of creation of infrastructure for small enterprise development; and
- Implementation of regional policy to promote small enterprise development.

The national programme is a framework document in accordance with which regional programmes are elaborated and approved by regional authorities every two years. Regional authorities report to the SCURPE on the results of programme implementation on: financing of regional programmes, financial and credit support to small enterprises, resource and information supply to small enterprises, development of business support infrastructure (Table 8) and improvements in the system of education and training for small enterprises.

While many NGOs and professional associations have a stated intention to stimulate and promote innovation, only recently have some sought to play a more active role in innovation policy.

***The subsystem of science and education***

Ukraine has a strong education system and a highly educated population, with more than 70% of adult Ukrainians possessing a secondary or higher education. Ukraine has around 900 colleges and universities, of which the most important are in Kiev, Lviv and Kharkiv. The number of tertiary graduates in science and technology per 1,000 persons aged 20-29 increased over the past decade, from 41.2 in 2004 to 49.1 in 2010, although the number of graduates in natural sciences and engineering declined as a share of the total. There is also a growth trend in PhD and doctoral degree numbers, with PhDs growing from 59,000 in 2000 to 84,000 in 2010, and Doctors of Sciences from 10,300 to 14,400, respectively.[11,12] State

[11] I. Yegorov (2011), Erawatch Country Report 2011: Ukraine (forthcoming), pp. 29-30.

support (mainly grants) are available, and help maintain the attractiveness of obtaining a scientific degree. Incentives exist for Ukrainian scientists to go abroad, and while leaving the country was a particular trend during the 1990s, short stays abroad are currently more popular.

Additionally, Ukraine has preserved significant scientific resources as a legacy from the planned economy, although many lack a clear commercial orientation under market conditions. There are some 1,255 institutions active in academic and applied research and development in Ukraine, with total funding for this amounting to UAH 9.59 billion in 2011. In the same year, 134,700 people were employed by scientific institutions, of which over 20,000 held the equivalent of doctoral degrees. However, the number of researchers has declined by between 1% and 5% annually since the mid-1990s (Chapter 5).

The two main pillars of the academic research and development system are the Academies of Sciences and the so-called branch institutes, a legacy of the centrally planned system. The system of the National Academies of Sciences of Ukraine comprises six state academies of sciences: the National Academy of Sciences, National Academy of Agrarian Sciences, National Academy of Medical Sciences, National Academy of Pedagogical Sciences, National Academy of Legal Sciences and the National Academy of Arts. Approximately 75% of the National Academies' potential resides within the National Academy of Sciences of Ukraine, although the Academy has more than 200 research establishments, largely in the areas of natural and technical sciences. Institutes from the National Academy of Sciences have often formed the basis for Ukraine's most successful technoparks.

The research activity of the Academy is financed largely by the state, while its research institutes receive approximately three quarters of their funding directly from the state. This level of financing does not guarantee effective development but provides a basis for the survival of research institutes. In recent years, the number of employees in the Academies has stabilized, while the number of research institutes doubled. The share of the Academies of Sciences in the total financing of R&D as well as their share of total employment in the research sector have increased over recent years.[13]

The Academy is independent of the Ministry of Education and Science, but coordinates its activities with the Ministry. Additionally, the Ministry invites representatives of the Academy when it launches any programme for fundamental research. The Academy has a strong voice in the State Fund for Fundamental Research, while the research institutes of the National Academy of Sciences remain a major source of scientific and technological potential in Ukraine. A number of successful innovative enterprises have emerged as spin-offs from the institutes.

[12] Ukraine has preserved a Soviet-type, two level system for the highest scientific degrees, comprising candidates of sciences and doctors of sciences. These groups are considered together when comparing with numbers of PhD holders in other countries. Candidate of sciences is roughly equivalent to a PhD, requiring a Masters degree, 3-4 additional examinations, a dissertation publicly defended before a specialized scientific council and at least 5 publications. Doctors of sciences require additional scientific experience, at least 20 publications in leading Ukrainian journals or individual books, with public defence also obligatory.

[13] I. Yegorov (2009), Post-Soviet science: Difficulties in the transformation of the R&D systems in Russia and Ukraine, Research Policy, volume 38, issue 4, pp. 600-609.

During the Soviet era, branch institutes enjoyed leading positions in the Ukrainian research system. In some cases, the collapse of the old branch structure of the Soviet type economy resulted in new linkages developing between research institutes and industrial companies, particularly with foreign enterprises. Some applied research institutes and design bureaus were transformed into relatively small research or production companies and science-based SMEs. Their future remains uncertain and depends heavily on the development of domestic manufacturing industries and state policy towards innovative SMEs. Without clear demand signals from industry and, in some cases, without sufficient financial support, research institutes will struggle to retain their best staff and update their technical base.

In contrast to the Academies and branch institutes, only a few universities have been carrying out substantial research projects. Only the two biggest universities in Kiev (Taras Shevchenko National University and the National Technical University of Ukraine "Kyiv Polytechnic Institute") have research budgets in excess of UAH 35 million (€5 million). Total expenditure on R&D for all Ukrainian universities does not exceed UAH 300 million (€42 million). The majority of universities have no research capacities (approximately 170 of them, fewer than half, performed some research during 2005-2011), and university professors are typically fully occupied with teaching duties.

The main challenges for the science and education subsystem are to maintain capacity through adequate funding and modernization, as well as to increase relevance for innovation by improving cooperation with the enterprise sector.

State budget funding for academic R&D declined throughout the 1990s and early 2000s. Some of this reduction in funding reflected adaptation of the system inherited from the past to the needs of an independent country with a market economy. However, the cuts were so large that, for a time, almost all research budgets were spent entirely on wages and essential running costs, such as utilities. As a result, investments in new scientific equipment were postponed, and the share of modern research equipment declined several fold in many research institutes, with almost half of existing equipment written off. Some institutes were obliged to cease the regular scientific experiments needed for research projects. For example, the only experimental reactor in the Institute for Nuclear Physics was terminated in the first half of 1990s due to lack of funds to cover electricity bills, limiting possibilities to verify theoretical results – a situation mirrored at other institutes of the natural sciences. Another consequence of funding cuts has been a reduction and ageing of the scientific labour force during transition.[14]

Symptomatic of the weak linkages between the science and education subsystem on the one hand and the enterprise sector on the other is the fact that Ukrainian industry is not able or willing to provide adequate employment for all graduates, and that academic research institutions are not the most important partners for innovative enterprises. At present, innovative enterprises cooperate more with suppliers and clients, while universities, research institutes and consulting companies are less typical as innovation cooperation partners.

[14] B. Malitskiy, L. Kavunenko, N. Isakova, O. Krasovska and V. Gryga (2005), Functioning and prospects of development of the National Academy of Sciences of Ukraine, STEPS Centre, Kiev. Original: Ukrainian.

***The subsystem of innovation intermediaries***

The support infrastructure caters for SMEs in general, and makes specific provision for innovative enterprises, including technoparks and innovation centres. However, the degree to which these establishments lead to increased innovative activities by SMEs is unclear.

**Table 8. Business support infrastructure organizations in Ukraine**

| Business support infrastructure organizations | Number |
|---|---|
| Business centres | 440 |
| Business incubators | 70 |
| Technoparks | 41 |
| Leasing centres | 795 |
| Investment and innovation centres | 3168 |
| Information and consulting organizations | 3157 |
| Entrepreneurship support funds[i] | 252 |

*Source:* On results of the implementation of the National Programme for Promotion of Small Entrepreneurship Support in 2010 (SCURPE)

[i] Including 98 regional centres, of which 34 funds established with participation of the Ukrainian Fund for Entrepreneurship Support, UFES.

Ukrainian technoparks are associations of leading research and development institutes, universities, and scientific, technological and industrial enterprises of high innovation potential. The first Ukrainian technoparks appeared in 2000 following adoption of the Law of Ukraine on Technological Parks, with eight technoparks in operation today. The Law on Special Regime of Investment and Innovation of 1999, applying to technoparks, contributed to foster innovation and utilize the capacity of research institutes, such as the E.O. Paton Institute of Electric Welding of NAS, Institute of Physics of Semiconductors of NAS, and Institute of Mono-crystals of NAS. Although this support mechanism initially worked well, as the tax and customs benefits increased with the number of technoparks, the law was suspended in March 2005. At present, innovation projects of the existing technoparks do not enjoy any special benefits.

## 2.3 Innovation governance

***High-level coordination***

The highest level of governance comprises the Parliament and relevant parliamentary committees, and the President, including his administration. The Cabinet of Ministers, the ministries and the state agencies constitute the second level, while the third level consists of the recipients of R&D funding, including state supported academies of sciences and their institutes, which are independent of any ministry and play a specific role in the Ukrainian R&D and innovation system.

The Parliament of Ukraine (Verkhovna Rada) primarily approves the regulatory framework within which the science and technology system operates. In addition, Parliament is required to define the basic principles and directions of public policy in the fields of innovation and technology activity, and approve priority directions of national goal-oriented programmes of S&T and innovation development. Two committees within Parliament are especially

important for formulating and implementing R&D and innovation policy: the Committee on Education, Science and Innovation and the Committee on the Budget.

The President of Ukraine has the highest executive power, and controls the activities of the Cabinet of Ministers. The President also has the right to create various commissions and advisory councils, which elaborate recommendations for the executive authorities in the area of S&T and innovations. The best known of these is the S&T Policy Council, although it was not active during the previous presidency of 2005-2009.

The Cabinet of Ministers exercises control over the establishment and operation of the public administration system in the fields of science, technology and innovation, and determines priorities in S&T and innovation. The Cabinet also develops strategies for science, technology and innovation development, and considers proposals from the ministries regarding the effective use of funds from the State Budget of Ukraine, in order to improve the system of science administration, training and certification. The functions of the Cabinet of Ministries were reformulated and reduced following the presidential elections in 2010.

***Ministries and agencies***

There is no single ministry, agency or other body responsible for coordinating research policy in Ukraine. The key ministry responsible for S&T policy is the Ministry of Education and Science (MES), which distributed around 14% of the state's R&D budget over the past decade to end users (universities and research institutes), albeit for part of this period as the Ministry of Education, Science, Youth and Sport. In addition, the MES has direct control over one fifth of all research establishments. It is important to note that the National Academy of Sciences of Ukraine,[15] along with MES, is a key player in decision-making on science policy. These organizations along with the Ministry of Economic Development and Trade (MEDT) are able to formulate science policy under formal control of the Cabinet of Ministries or Presidential Administration.

The MES has several departments that deal with science policy. The Ministry also oversees several branch research institutes, along with the bulk of R&D in the university sector. The State Agency for Science, Innovation and Informatization is subordinated to this Ministry.

The Ministry of Industrial Policy (MIP) has been one of the biggest actors in the field of R&D and innovation policy, supervising over 300 research institutes and design bureaus. However, the Ministry provides very limited R&D funding. Other ministries also have relatively small budgets, and must rely on external customers, rather than the state budget, to finance their institutes.

MEDT has a specialized Department of Investment, Innovation and Public-Private Partnership, which resulted from an administrative reform combining various tasks in one Department, but the primary focus of its work is on public-private partnerships.

[15] Institutes of the National Academy of Sciences of Ukraine receive almost half of the state R&D budget directly from the Cabinet of Ministries, not through any specific ministry.

### *Research institutes*

The majority of research institutes work under the supervision of a ministry or state-sponsored academy of sciences. Almost every ministry or state agency has a department, responsible for administering scientific and innovative activities within its jurisdiction and the level of scientific and technological development of its respective industries. They determine directions for the development of S&T potential; supervise and control the activity of subordinate research organizations; participate in setting national priorities for S&T development, state science and technology programmes; and conclude government contracts. They initiate and implement sectoral programmes of S&T development; arrange development and production of competitive products based on innovative technologies; make proposals with regard to enhancing economic mechanisms fostering S&T development in the relevant industries; and execute other functions according to the laws of Ukraine.

In contrast to the research institutes, the university sector and private non-profit organizations play a less significant role in the Ukrainian research system.

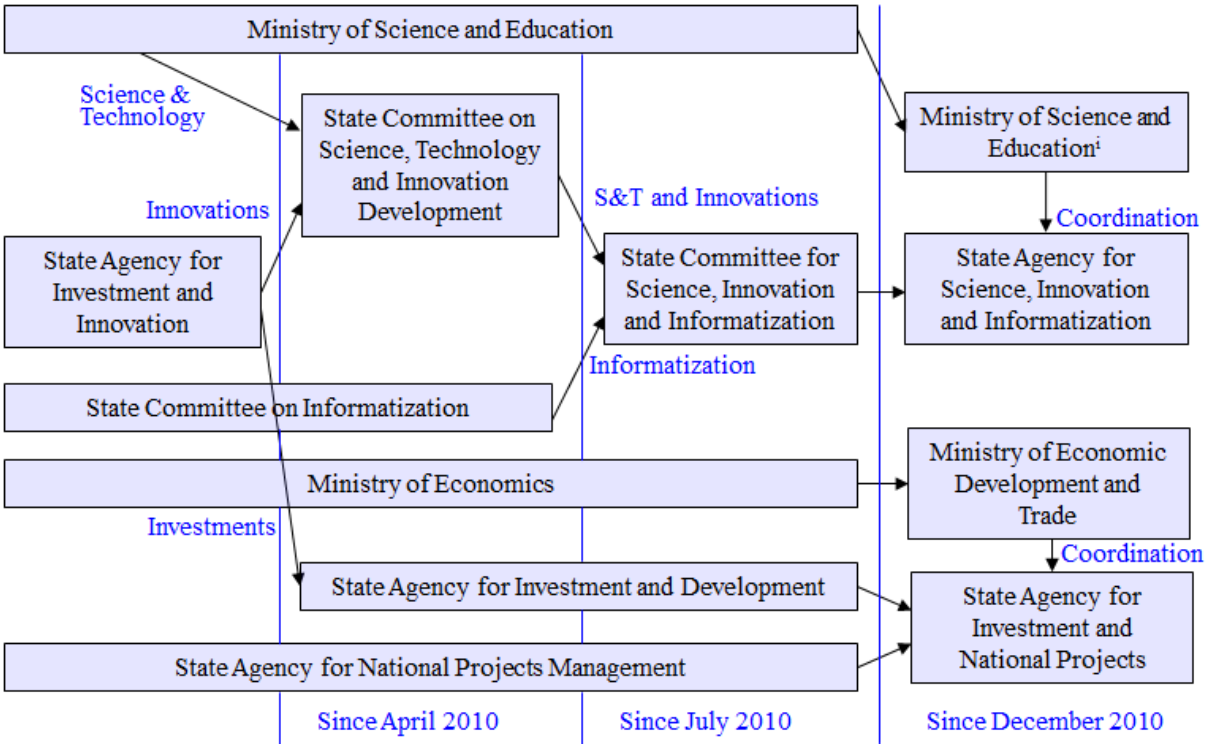
### *Recent reforms*

On 16 December 2010, Presidential Decree No. 1085/2010, changed the landscape of executive power substantially. As a result, almost all state bodies were restructured within two months. The number of central ministries and agencies was reduced from 111 to 64. Some were merged, while others were liquidated, seeing their functions redistributed among remaining ministries and agencies. The most important change in the area of innovation was the creation of the new State Committee on Science, Innovation and Informatization (SCSII), recently renamed State Agency for Science, Innovation and Informatization (SASII) (Figure 4).

Despite this progress, responsibilities of the key actors remain insufficiently well defined, and this remains one of the major challenges for innovation governance in Ukraine. There are several state ministries and agencies that play a role in supporting innovation activities, but competences overlap and are not always clearly defined, while some agencies have insufficient resources to conduct innovation policy effectively.

Low and unstable levels of financing represent another major challenge for innovation policy in Ukraine, with the Ministry of Finance often unenthusiastic about subsidies for innovation, or more specifically state funding for inherently risky activities. While this is consistent with a core function of finance ministries in almost all countries, awareness at the highest policy level that innovation involves risks where state involvement is permitted and even required is needed in Ukraine. Without such awareness, policies will continue to lack adequate state financial support, which has already weakened as a result of the economic and financial crisis of 2008-2009. There are numerous examples in EU countries of the State assuming a share of the risks implicit in innovation activities. State aid regulations in the EU make provisions for this, particularly where policies concern SMEs, academia and R&D units and the links between them.

**Figure 4. Recent reforms in innovation governance**




*Source:* Ministry of Education, Science, Youth and Sport of Ukraine, 2012.

[i] Note that the Ministry of Education, Science, Youth and Sport (MESYS) existed from December 2010 until February 2013, with the Ministry of Science and Education inheriting its key functions of relevance to innovation policy following presidential decree No. 102/201328 of 28 February 2013.

A third major challenge for innovation governance in Ukraine is the plethora of laws, presidential decrees, regulations and programmes that were supposed to stimulate innovation and competitiveness in the national economy (Chapter 3). This makes it difficult to determine priorities and to govern innovation processes at the state level. Moreover, many government documents remain conceptual, without detailed implementation and monitoring measures, while related judicial controversies often hinder the implementation of laws and regulations.

These three challenges are interrelated, and collectively responsible for the significant gap between innovation policy intentions and actual implementation. On the one hand, overlapping competencies and a lack of high-level coordination partly explains the proliferation of laws, regulations, and programmes, and the often unclear or contradicting priorities in innovation policy. On the other hand, the creation of so many programmes with conflicting priorities means it is often challenging for individual programmes to raise sufficient financial support.

## 2.4 Recommendations

The importance of innovation is recognized in many legal and policy documents, including at the highest level. However, a holistic consideration of the national innovation system, its various components and the relations between them, remains lacking. A narrow interpretation of innovation, which emphasizes technological aspects, prevails. The subsystems of science and innovation intermediaries receive greater policy attention, but there is less emphasis on the need to encourage innovation in the business enterprise subsystem, particularly with regard to SMEs as an important driver of economic dynamism. There is insufficient consideration of linkages between subsystems, including between the science and business sectors, which are key for the definition of a science, technology and innovation strategy.

*Recommendation 2.1*

*Innovation policy would benefit from an integrated consideration of the various components of the national innovation system. This holistic approach should result in the identification of weak elements and an emphasis on linkages between different subsystems as important policy targets. The notion of innovation should be broadened, recognizing that technology is only one dimension of the innovation process. The authorities should pay special attention to:*

- *The business enterprise subsystem, in particular the promotion of innovative SMEs;*
- *The commercialization of science (e.g. technostarters);*
- *The linkages between science and industry through policy measures that target collaboration between these two subsystems; and*
- *The role of innovation intermediaries, with due consideration to the particular needs of small innovative enterprises.*

There have been multiple innovation-related initiatives in Ukraine over recent years, reflecting the continued importance attached to innovation as a driver of growth and competitiveness. However, many of the legal and policy documents remain at a conceptual level, with insufficiently defined practical policy measures or instructions for further implementation. More attention to the appropriate sequencing of different proposed interventions is required.

*Recommendation 2.2*

*The effectiveness of Ukraine's policy efforts in the area of innovation has been undermined by the lack of a consistent vision that includes concrete steps to implement it. The authorities should consider the development of a National Innovation Strategy of Ukraine as a single, comprehensive document that would integrate and replace many existing policy initiatives. Such a document would encourage a consideration of the impact of any measures in the national innovation system as a whole. This National Innovation Strategy would:*

- *Set up clear national priorities for the promotion of innovation and identify the policy measures to realize this strategy; and*
- *Define how the strategy will be implemented, monitored and evaluated as well as assign well-identified resources and responsibilities for these tasks.*

Effective coordination is one of the main challenges in innovation governance. Despite the progress made by administrative reforms, the responsibilities of key actors are not yet clearly defined. Allocated resources are often not in line with the mandates received. Innovation-related activities are distributed across different public organizations but there is not a single coordinating body. While there is vertical coordination (from agencies to ministries and to the government), horizontal coordination mechanisms are weak or missing.

*Recommendation 2.3*

*Innovation policy involves many different ministries and agencies, which requires a concerted effort to coordinate actions in an effective way. The authorities could consider the establishment of a National Innovation Council, in order to promote a cross-sectoral and cross-departmental approach in the design and implementation of innovation policies. In the organization of the work of the National Innovation Council:*

- *In addition to ministries and government agencies, representatives from the business and academic sectors could also be included as members;*
- *The chairmanship role could be performed by a figure with wide national support to ensure general awareness and visibility of innovation initiatives in the country; and*
- *The State Agency for Science, Innovation and Informatization (SASII) could act as the Secretariat of this Council and coordinating unit in the policy implementation process.*

# *Chapter 3*

# *FRAMEWORK CONDITIONS, INNOVATION POLICIES AND INSTRUMENTS*

This chapter provides an overview of the conditions that support innovation, including the general features of the business environment. It introduces the strategies and recent programmes developed to promote innovation at the national and subnational (regional) levels. The chapter assesses the policy initiatives undertaken in terms of their relevance and effectiveness given the overall framework conditions 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*

Innovation is greatly influenced by wider economic framework conditions, and in particular those relevant to entrepreneurship and the degree of economic competition.

Ukrainian companies work in an environment that remains difficult, with complaints about high taxes and an ineffective government bureaucracy. However, the latest World Bank Doing Business report (2013) shows some improvement (Chapter 6), particularly with regard to the ease of starting a business.

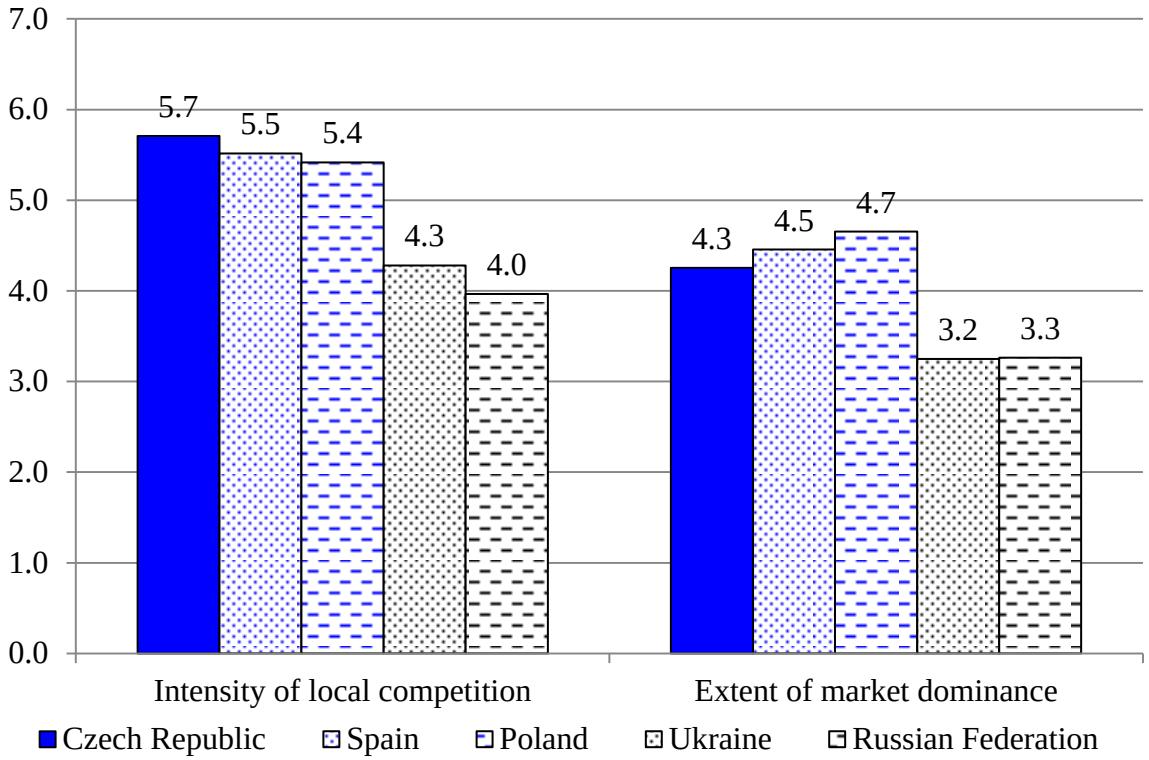
However, local competition remains weak, with the lack of this endogenous pressure delaying technology acquisition. Large enterprises do not act as drivers for technological upgrading of the economy. A subjective assessment by the business community in Ukraine confirms weak local competition and domestic markets dominated by a limited number of business groups. This, coupled with limited pressure to export due to relatively large and growing domestic markets (with the exception of a few industries where local markets are small, such as metallurgy and aerospace), has led to fewer incentives to innovate compared to other countries (Figure 5).

From the perspective of technological upgrading, these conditions limit the role for new technology-based firms to act as drivers of restructuring, as the usual major source of demand for new technologies – large firms – are not generating sufficient demand for local innovation, technology and knowledge-intensive services. Research on knowledge-intensive firms in the EU new member States shows such companies to be strongly oriented towards local markets, and that in cases where they export, their main markets are not developed EU countries but other emerging economies.[16,17]

[16] S. Radosevic, M. Savic and R. Woodward (2010), Knowledge based entrepreneurship in Central and Eastern Europe: results of a firm level based survey, In F. Malerba (ed.) Knowledge-Intensive Entrepreneurship and Innovation Systems, Routledge, pp.198-218.

[17] S. Radosevic, Science-Industry Links in CEE and CIS: Conventional Policy Wisdom Facing Reality, Science and Public Policy, June 2011, Vol. 38, No. 5: pp.365-378.

**Figure 5. Local competition and market dominance, selected countries, 2012-2013**




*Source:* WEF GCR Database
*Note*: Intensity of local competition: How would you assess the intensity of competition in the local markets in your country? [1 = limited in most industries; 7 = intense in most industries]
Extent of market dominance: How would you characterize corporate activity in your country? [1 = dominated by a few business groups; 7 = spread among many firms]

### *Human capital*

Ukraine has a well-educated labour force and a substantial number of S&T graduates. However, academic R&D organizations and businesses lack qualified personnel to effectively manage innovation development and commercialization processes, although there have been longstanding specializations in innovation management and commercialization (under varying titles), at both the candidate of sciences and doctor of sciences levels. A new initiative was launched by the Ministry of Education and Science in March 2007 with the introduction of a new specialty at universities named "Management of Innovation Activities" (MIA). In 2011, MIA was taught to full-time Masters students at 16 Ukrainian state and two private universities.

Low levels of remuneration in the R&D sector, both compared to other sectors of the Ukrainian economy as well as to other countries, have been recognized as a barrier to the implemementation of S&T policy in Ukraine. Along with greater efforts to channel funds to national S&T priority areas outlined in the "Conception of reform of the system of governance and financing of S&T activities", adopted by the Cabinet of Ministers in October 2012 and discussed in greater detail in the next section of this chapter, there are also efforts to

make the sector a more attractive employment destination. Decision No. 957[18] of the Cabinet of Ministers was also issued in October 2012, and allows bonuses in state research institutes (including those of the National Academy of Sciences) to reach 100% of basic salaries from 1 January 2013 – an increase from the current 50% limit.

Another measure, by Cabinet decree in 2012 and effective from 1 January 2013, is the establishment of special extra monthly salary payments for professors and senior researchers working within institutions of the National Academy of Sciences to increase their salaries by 33% and 25%, respectively. Similar increases in basic salary levels are also foreseen for holders of doctorate degrees (25% of base salary), as well as for candidates for Doctor of Science degrees (15% of base salary). The intention of these measures is to help preserve qualified research personnel within research institutes. If coupled with a redistribution of funding that is allocated on a more competitive basis in priority fields, such reforms have potential to support delivery of national policy priorities.

### *Innovation culture*

Ukraine was the first of the CIS member countries to legally define the concept of innovation culture, which is referred to as "a component of innovation potential characterizing the level of educational, overall cultural, social and psychological readiness of a person and society as a whole to accept and creatively implement the ideas of economic development on the basis of innovation"[19]. In addition, the Verkhovna Rada set "the development of innovation culture of society"[20] as one of the strategic priority directions of innovation activities of Ukraine for 2003-2013. It should be noted that the importance of innovation for national economic development has been confirmed in subsequent legal documents issued by the President.

However, despite this legal recognition, awareness of innovation issues and the recognition of their importance remain limited among policymakers and the population at large.

## 3.2 Innovation strategy and programmes

### *Legal framework for innovation*

Within the Ukrainian leglislation, innovation is defined by the Law “On innovation activities” (No. 40-IV of 4 July 2002, with subsequent amendments), which also provides definitions of innovation activities, innovation products and innovation projects. Meanwhile, the Law “On priority directions of innovative activity in Ukraine” (No. 3715-VI of 8 September 2011, with subsequent amendment) defines the legal, economic and organizational principles to develop an integrated system of priorities for innovation and its implementation in Ukraine. It seeks to promote an innovative model of economic development by focusing state resources on priority directions of scientific and technological modernization of production and increasing the competitiveness of domestic products on both domestic and foreign markets.

[18] “On changes to decisions of the Cabinet of Ministers No.48 of 31 January 2001 and No. 488 of 8 May 2001”.
[19] Article 2, Act of Ukraine “On Priority Directions of Innovation Activities in Ukraine” – The Verkhovna Rada Journal, 2003, No. 13, p. 93.
[20] Article 7, *ibid*.

These definitions also served as the basis for the structure and contents of the "Strategy for innovation development of Ukraine for 2010-2020 in conditions of global challenges". This strategy, although widely discussed, including during special parliamentary hearings in July 2009, and approved in principle, has not been passed through Parliament as an official legal document. In terms of data collection and monitoring, the State Statistics Service of Ukraine is applying methodologies in line with the Oslo Manual to the collection of data on innovation, including innovation in enterprises.

There is a complex legal environment with more than 80 different legal documents determining S&T and innovation activities in Ukraine. This multiplicity of programme documents, which determine the strategic directions of innovative development in Ukraine, makes it difficult to determine priorities and control innovation processes at the state level. While simplification and harmonization of the legal environment has been a priority in recent years, strategy and governance of the national innovation system remain fragmented and relatively ineffective, with the roles, responsibilities and financial obligations of the various state bodies being insufficiently well-defined. There are also important legislative acts (e.g. Law on Technoparks, Law on Innovation Venture Funds) that have yet to be considered or passed by Parliament, [21] presumably outcompeted by other, more pressing legislative priorities.

Over 200 innovation programmes that are officially entitled to state financing were launched during the period 1998-2010. However, more than half have not received financing due to a lack of corresponding procedures during the parliamentary approval phase, together with the rigidities of state budgeting. The financing approved by the Parliament is therefore often not allocated for disbursement.

Ukraine is a republic with a presidential-parliamentary system of government. Presidential acts play an important role in formulating state policy. The Presidential Decree "On measures aimed at the provision of effective implementation of the Programme of Economic Reforms for 2010-2014: Wealthy Society, Competitive Economy, Effective State"[22] was issued on 21 December 2010. This decree assumed that a comprehensive Plan of National Development with a specific chapter on "Development of S&T and innovation spheres" would be elaborated in early 2011. Proposed stages of this plan for reforms to S&T and innovation are outlined in box 1:[23]

Rather than such a plan, the Cabinet of Ministers of Ukraine issued Decree No. 389 (2 February 2011), reiterating key positions of the Presidential Decree in the form of the State Programme of Investment and Innovation Activities. Some ideas have received further development in this document. For instance, it is assumed that the energy consumption per unit of GDP will be reduced by 20% by 2014.

[21] I. Yegorov (2011), Erawatch Country Report 2011: Ukraine (forthcoming: European Commission).
[22] Presidential Decree No. 1154, 21 December 2010, "On measures aimed at the provision of effective implementation of the Programme of economic reforms for 2010-2014 'Wealthy society, competitive economy, effective state'".
[23] http://www.president.gov.ua/docs/Programa_reform_FINAL_1.pdf

**Box 1. Plan for "Development of S&T and Innovation Spheres" (2010)**

**First stage – 2010-2011:**

- Determination of principles of public-private partnership in the S&T and innovation spheres;
- Determination of principles and mechanisms of provision of state support for investment in innovation activities; and
- Negotiations with the EU on joining the ERA.

**Second stage – until end 2012:**

- Development of infrastructure for innovation activities;
- Implementation of mechanisms of state support for innovation activities;
- Increasing financial independence of research institutes and universities in utilization of research funds received from clients;
- Transition to international criteria of evaluation of the research results and scientists, optimization of the structure of the state research system; and
- Increase of the budget share of expenses on applied R&D.

**Third stage – until end 2014:**

- Renovation of equipment in research institutes and universities;
- Indicators of success:
  - Growth in the share of innovative enterprises from 10.7% to 25%; and
  - Increase of Gross Expenditure on Research and Development (GERD) from 0.95% to 1.5%.

Considering the Law "On priority directions of innovative activity in Ukraine" (No. 3715-VI) in greater detail, this determines so-called "strategic" and "mid-term" priorities in the innovation sphere for 2011-2021. While strategic priorities were not clearly defined in this document, mid-term priorities include:

- New technologies for energy transmission, energy saving, and technologies for utilization of renewable energy;
- New technologies in transport, space and defence areas;
- New materials, including nanotechnologies;
- New technologies in agriculture;
- New pharmaceutical substances;
- Broad utilization of environmental technologies; and
- ICT and robotics.

These priorities formed the basis for development of specific state goal-oriented programmes. However, 28 of these programmes were cancelled in mid-2011, and very few new programmes were initiated over the past year. Among those cancelled was the national

foresight-type programme, leading to uncertainty regarding how strategic priorities will be selected and formulated without corresponding foresight activity.

Two of the state goal programmes that were maintained included the Programme for the Development of the System of Information and Analytical Support of State Innovation Policy Implementation, originally approved in 2008.[24] It was designed for three years with a total budget of UAH 10.5 million. The key goal of the programme is to create effective instruments of monitoring of the state innovation policy at the level of central government and on the level of regions. Initially, there were plans to establish special groups at the state and regional levels, which could collect data, conduct surveys and prepare analytical materials on the situation in innovation sphere. These groups were to work under the guidance of the Ministry of Economy of Ukraine. Some basic instruments for assessing innovation activities were developed and proposed to the MEDT.

The second programme is the "Programme of Creation of Innovation Infrastructure in Ukraine".[25] It was designed for five years with a budget of UAH 280 million. It was assumed that the Programme would receive financing from various sources: from the state budget (UAH 104 million), local budgets (around UAH 80 million), and other sources (private business and international donors: UAH 96 million). The government hoped to attract investors to create technology transfer centres for small businesses within this Programme. Private companies were to benefit from the use of newly-created elements of infrastructure through the provision of various services and products to innovation companies and by obtaining certain privileges, including access to cheaper (subsidized) bank loans, information and expertise from state research centres. Unfortunately, neither programme received adequate financial resources in the period 2009-2012.

Several other programmes were initiated during the second half of 2009 to beginning of 2010, which were approved by the Parliament, including the Programme on support of nanotechnologies. The Parliament also passed the new State Goal-oriented Space Programme for 2008-2012. The main aim of the programme is to integrate the activities of enterprises and research institutes in the space sector and to utilize R&D results more effectively to support sustainable development and national security. The state budget provides for minimal financing of UAH 1.46 billion per five-year period. A substantial share of funding comes from alternative sources controlled by government (UAH 1.035 billion) and foreign customers (UAH 3.0 billion).[26]

The Cabinet of Ministers of Ukraine also approved a special goal-oriented programme on energy saving through the development of new lighting systems and a number of other energy-saving technologies. However, programme financing was sufficient for only modest support of initial preparations during 2009-2011. The Cabinet of Ministers of Ukraine has also approved new (temporary) rules for licensing products based on genetically modified organisms (GMO) and utilization of these products in Ukrainian territory.

[24] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=439-2008-%EF
[25] http://zakon1.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=447-2008-%EF
[26] http://www.nkau.gov.ua/nsau/catalogNEW.nsf/160776743F0D4A37C3256BB30050B196/6FAF7E382FEEA2A2C225726D00425D75?OpenDocument&Lang=U

In 2011-2012, Ukrainian authorities created several expert working groups that started work on redrafting existing laws related to S&T and innovation. New drafts of the Law "On innovation activity", the Law "On higher education" and the Law "On S&T activities" were prepared. However, only one of these had been passed to the Parliament as of May 2012. A group of experts has been working on a draft Innovation Strategy to 2020 for Ukraine since the end of 2011 for submission to the Parliament via the Council of Ministers, but this had yet to be completed at the time of writing. There have been some concrete initiatives, including the creation of a special institute for expertise of S&T projects in 2012. The creation of a state-sponsored fund to support small innovative business was announced (Chapter 6), but no financial resources have yet been allocated.

The "Conception (Guidelines) for reform of governance and financing of scientific and S&T activities" was approved by the Government on 19 October 2012. This document determines key directions for future reforms but needs to be supplemented with further legal documents to specify concrete initiatives.[27]

***State financing and management of S&T***

As discussed in relation to innovation projects, while much state financing of R&D is provided in the form of block grants to institutions, there has been a gradual shift towards more competitive means of financing.

In particular, in October 2012, the Cabinet of Ministers approved the "Conception of reform of the system of governance and financing of S&T activities",[28] the purpose of which is to increase the efficiency of state financing in the S&T sphere, and management of S&T activities.

Implementation of the Conception will require changes in management practices within R&D organizations, the majority of which are state controlled. There is also the intention to increase substantially the level of competitive financing through grant schemes, and create conditions for attracting private financial resources in to the R&D sphere. Special attention will be paid to the state S&T programmes, which will be based on the national S&T priorities. According to the Conception, the share of these programmes in total state financing of R&D will be doubled over the period 2013-2017. There is also the intention to work more closely with the EU in various R&D projects. As well as the currently low share of funding (6-7% of total funding of research and S&T activities)[29] channelled towards the state target S&T programmes affecting delivery, which this Conception will seek to address, low remuneration in the R&D sector was recognized as a significant barrier to implementation. Decision number 957 of the Cabinet of Ministers, also adopted in October 2012 and discussed in the previous section of this chapter, seeks to address the issue of remuneration in the sector.

[27] http://www.kmu.gov.ua/control/uk/publish/article?art_id=245708801&cat_id=244274160
[28] Decision 780-p.
[29] Retrieved November 2012:
http://www.kmu.gov.ua/control/uk/publish/article?art_id=245708801&cat_id=244274160

### *Innovation projects*[30]

The state provides financial support for specific innovation projects, selected on a competitive basis and undertaken by commercial companies or R&D organizations, which play a major role in driving innovation policy implementation in Ukraine. In contrast, general R&D support is largely provided through traditional "block grants" and institutional financing, although increased use has been made of competitive processes over recent years.

Innovation projects are selected on the basis of the Law on Expertise and the Law on Innovation Priorities. According to these Laws, the following projects and programmes are subject to evaluation by experts:

- State S&T programmes;
- International S&T projects, which are undertaken in Ukraine in accordance with international agreements between Ukraine and other countries;
- Branch and inter-branch S&T and innovation programmes; and
- Innovation programmes and projects of state-level importance.

Criteria for selecting innovation projects include:

- Relevance according to national priorities in the S&T and innovation spheres defined by the Parliament every five years;
- Practical implementation of new, high-tech or energy-saving technologies or competitive products;
- Appropriate financial indicators;
- Technical characteristics have to meet high standards;
- Absence of legal problems; and
- Enterprise needs to meet eligibility criteria.

Large and complex projects are considered by a special Inter-ministerial Commission, which includes representatives of different ministries and state agencies. The Commission has different sections, which are responsible for different sectors of the economy (engineering industry, agriculture, etc.). More straightforward projects are evaluated by commissions at the level of the relevant Ministry or Agency.

### *Regional innovation programmes*

Ukraine is a large and diverse country but regional policy on innovation is very much centralized. The regional structure consists of the Autonomous Republic of Crimea (ARC), 24 "oblasts" or regions, and two cities with the status of region (Kiev and Sevastopol).

The Law "On Encouragement of Development of Regions" came into effect in 2006, laying out the legal, economic and institutional principles for state regional policy. This was followed by approval of the State Strategy of Regional Development through 2015 in July 2006. Enhancing competitiveness of the regions is the main goal of this Strategy, which also

[30] INNO-Policy TrendChart (2011), Innovation Policy Progress Report: Ukraine 2011, Brussels.

incorporates an innovation dimension, seeking the restructuring and diversification of the economies of the regions on the basis of new technologies.

Regional policy is based on long-term development programmes. There are few specific mechanisms for the implementation of innovation policy, which is instead considered as a component of the overall development programmes. However, all regions were asked in 2006 to develop regional innovation plans. While most regions did this, very few were able to move to the implementation stage due to lack of financing from the central government or inability to provide local financing (with the exception of Donetsk and Kiev). These plans ended in 2010 or 2011, and new ones will be developed. The role of innovation in development has been a subject of controversy in some cases, as in Kiev.

It should also be noted that, in policy coordination terms, article 10 of the Law "On innovation activities" does, however, provide the right to local state administrations and executive bodies of local governments to engage businesses, institutes and organizations in their respective territories, by mutual consent, with a view to foster innovative development.[31] However, as in other areas of innovation policy, the limiting feature is often funding rather than lack of legal instruments. According to the Budget code of Ukraine, the source of financing of regional innovation programmes is not earmarked and must come from a general regional development budget that is typically restricted to construction, major repairs and reconstruction of social and cultural facilities, municipal property, housing and communal services.[32]

Nonetheless, despite the measures taken to date, attempts to incorporate an innovation dimension in regional programmes have not been generally successful, with existing initiatives hampered by a lack of financing, targets that are too broad and the absence of monitoring mechanisms.

***Incentives as policy instruments***

Besides direct funding, various incentives have been used to promote innovation in Ukraine. In 1999-2005, tax incentives for technoparks included the exemption of custom duties on imports of material and equipment, tax credits and lower interest rates on loans. These benefits were abolished in 2005, as the new government blamed some technoparks for unlawful activities. As a result, no new projects were started in 2005-2008 and the activities of technoparks declined. Although certain incentives were later reintroduced, the economic crisis of 2008-2009 caused an even more dramatic decline in technopark activities. As a result, total financing of technopark projects in 2010 stood at around one eighth of financing at the peak in 2007.[33] The Ukrainian Parliament has considered but not yet agreed on how to provide further policy support for technoparks, with specific legislative provisions likely to be made in relation to R&D and innovation.

With regard to science parks, there is a working university-based science park at the National

[31] EU project (2011) "Enhance Innovation Strategies, Policies and Regulation in Ukraine", Innovation policy: European benchmarking for Ukraine volume 3, Kiev, page 25.
[32] EU project (2011) "Enhance Innovation Strategies, Policies and Regulation in Ukraine", Innovation policy: European experience and recommendations for Ukraine volume 2, page 162.
[33] Unpublished report of the State Agency for Science, Innovation and Informatization, February, 2012, Kiev.

Technical University Kyiv Polytechnic Institute (KPI) in 2007, with an annual turnover of around €1 million and with plans for fourteen associated branches at the regional level. The Government has expressed its intention to create similar science parks at other Ukrainian universities, but to date generalized incentives have not been sufficiently strong for university officials and inventors to take the initiative. The special Law on KPI Science Park (Law on the Scientific Park "Kyevska Politechnika", No. 523-V of 22.12.2006) allowed university staff to use R&D results, financed by the state, for commercial purposes, although the responsible authority (usually the financing agency) may claim these results in certain cases, as stipulated by Article 7 of this law. [34] Amendments to the Law "On state regulation of activities in the field of technology transfer" have followed in 2012 (Chapter 5) and are more generally applicable, being in part based upon earlier experience with this special Law on KPI Science Park. For example, the potential exclusions stipulated in Article 11 of this law are similar to those of Article 7 of the special Law on KPI Science Park, and both may be considered to be in the Bayh-Dole Act tradition.[35] Although it is too early to evaluate the impact of this legislative change, the positive experience of the KPI Science Park under its own special law suggests there is potential for considerable progress if these more generally applicable changes are fully implemented. Although no further science parks had been created in the country at the time of writing, this may be a reflection of current economic conditions. In the longer run, recent clarifications concerning intellectual property rights are likely to have beneficial effects in terms of incentives, as uncertainties around property rights have contributed to the reluctance of university personnel to work actively towards commercialization through spin-offs. In practice, university researchers have preferred to work on contracts with foreign or domestic customers, which in many cases are not registered officially through universities.[36]

There are currently no specific tax benefits for R&D activities, or even an agreed qualified definition of R&D expenditures, with the new Tax Code entering into force in 2011 having introduced no significant, generalized incentives for R&D.[37] However, R&D institutes (but not innovative companies) do benefit from some particular advantages. For example, R&D institutes do not have to pay VAT on contracts concluded with state-owned organizations or ministries, and all contracts within state development programmes benefit from VAT exemption. Research organizations also have the right not to pay custom duties on imported scientific equipment or materials, particularly where there is no possibility of producing them in Ukraine. Research and development organizations may receive certain other financial incentives, depending on the specific legal regulations that apply.[38]

While, as discussed previously, a lack of funding provision at the regional level has generally limited the development of regional innovation policies, there have been examples of

[34] Article 7 specifies that property rights to technology produced at the park belong to the park or its partners, except in cases where property rights are limited by the responsible state authority, with valid motivations including: defence or state security; results that should be used in the public interest; or the state authority being responsible for implementation in final production.
[35] The Bayh-Dole Act, adopted by the USA in 1980, allowed knowledge creators to pursue ownership of an invention in preference to the government, even where the research was funded from state resources. It has inspired similar leglislative changes in a number of countries.
[36] I. Yegorov, Erawatch Country Report 2011: Ukraine (forthcoming).
[37] I. Yegorov (2011), Erawatch Country Report 2011: Ukraine (forthcoming: European Commission), page 35.
[38] These incentives are regulated by special laws, such as the Law on Science Parks (2009) or Law on Higher Education.

successful private sector led initiatives, although typically with appropriate policy incentives. The Donetsk region, for example, had a positive experience of industrial upgrading and transfer of foreign technologies, which was significantly supported by the Law "On special economic areas and special regime of investment activity in Donetsk region".[39]

## 3.3 Assessment

The design and implementation of innovation-related programmes face some specific challenges in Ukraine.

The parliament defines basic principles and directions of public policy in the field of innovation and technology activity, and approves priority directions of S&T and innovation development in Ukraine. There have been a large number of innovation-related laws (around 80 during 1992-2011), which resulted in a complex and unstable legal framework. In addition, there is no efficient vertical coordination between the organizations responsible for policy formulation and those responsible for implementation of these policies (Chapter 2). Programmes are developed by ministry, state committee and agency staff with limited involvement of other stakeholders from the private sector or academia.

Funding remains a key issue in policy implementation. Programmes adopted and announced by parliament often fail to receive the projected resources. The provisions of the annual budget law take precedence over the prior funding commitments envisaged in such programmes, which may receive only a fraction of the resources originally foreseen. The lack of appropriate and stable funding is one of the key shortcomings of innovation policies in Ukraine, as widely recognized by innovation stakeholders. Funding for projects is typically at a relatively low level – in the better funded programmes, for example, the financing of individual projects has typically been in the €15,000-18,000 range (2007, 2009 data).[40]

In advanced countries, research organizations often need to demonstrate cooperation with private enterprises in order to receive public funding from research and innovation programmes for their projects. By contrast, in Ukraine, enterprises participate in less than 1% of state Science and Technology (S&T) and innovation programmes. Mechanisms to facilitate close collaboration between the public and private sectors in the area of innovation are still missing (Chapter 5).[41]

Programme management, monitoring and evaluation are important factors in ensuring policy effectiveness. However, such aspects are insufficiently robust in Ukraine. According to current legislation, the state body that funds a programme appoints a programme director with little effective influence over implementation. Overall, there is a weak management structure where control over key variables, including funding, is missing.

[39] EU project (2011) "Enhance Innovation Strategies, Policies and Regulation in Ukraine", Innovation policy: European experience and recommendations for Ukraine volume 2, page 162.
[40] Information on implementation of the key positions of the Law "On Scientific and S&T Activities" - Letter of the Ministry of Education and Science of Ukraine to the Committee on Science and Education of the Parliament of Ukraine, 20 May 2010, No.1/10-1225.
[41] O. S. Chmyr, Yu. F. Shkvorets and I. Yegorov, Public-private partnership in S&T and innovation spheres in Ukraine: theoretical background and practical problems of implementation in Ukraine, Nauka i Naukovedenie 2012, No.3, pp.34-45.

Not all projects are evaluated, and relevant indicators (e.g. key parameters of new technologies, economic viability or commercial usage of technology) are sometimes absent in state programmes. In many cases, neither interim nor final programme results are monitored or evaluated with respect to budget spending, achievement of objectives, or quality.

The gap between normative and real policy remains a major challenge for innovation policy. Despite a large number of policy documents aiming to regulate or articulate policy objectives in relation to R&D and innovation, their impact is relatively marginal. In Ukraine, innovation is a largely financed by the business sector. In 2000, the share of self-financing stood at 79.6%, and was 87.8% in 2005. In recent years, this share has been lower – standing at 59% and 52.9% in 2010 and 2011, respectively. The remainder was covered by foreign (mainly Russian) contracts, and by loans. In contrast, the contribution of the state budget has been marginal throughout the entire period, standing at around 1% at the time of writing.[42] This may be compared to the EU where, during the period 1998-2000, just over one third (35%) of all industrial enterprises with innovation activity received some form of public funding, while the corresponding proportion for enterprises in the service sector was 19 %.[43] Hence, the current situation could be described as "innovation policy without innovation programmes".

It is difficult to identify the root cause(s) of this situation. However, negative past experiences in relation to Free Economic Zones and large-scale abuse of tax breaks, or differing views on the effectiveness of technopark support during the 1990s have both certainly played a role. The political philosophies that have prevailed over the past 20 years together with competing views regarding policy priorities have also been important. The impact of the global economic and financial crisis on Ukraine has raised awareness that without industrial and technological upgrading, future growth is not guaranteed. This, together with large-scale initiatives in neighbouring countries (e.g. Skolkovo), has led to a more fertile ground for reconsidering the policy options for innovation.

However, this does not mean that certain other policies do not operate as (dis)incentives for innovation. Innovation policy in Ukraine is *de facto* present through local content requirements, policy in relation to technical regulations, industrial policy and FDI policy. The problem is that their technology or innovation objectives are either counterproductive to technology diffusion (local content rules for renewable energy), absent (FDI) or are not clearly spelled out (technical regulations) (Chapter 4).

The most significant constraint for policy design in Ukraine remains the "implementation black hole", i.e. the significant gap between laws on paper and actual implementation. Laws are too often either not implemented, or initial objectives are not adhered to or changed during implementation. Measures that are either administratively demanding or with significant public subsidy have been particularly vulnerable to rent-seeking and misuse of public funds. Still, there is space for low-cost policy measures that could avoid the dangers of weak administrative capacity and rent-seeking, provided there is consensus on the need and priority of innovation support and technological modernization. The main obstacle to this is the very narrow current understanding of innovation and innovation-based growth as solely increasing the share of production accounted for by new high technology firms (Chapter 2 and 4).

[42] *Ibid*.
[43] Eurostat (2004) Innovation in Europe, Results for the EU, Iceland and Norway Data 1998–2001, page 25.

## 3.4 Recommendations

Innovation thrives in a favourable environment, where there is a shared perception of its importance and a general understanding of what it requires. A vibrant innovation culture is an important factor in the success of public initiatives promoting innovation, and should be a policy target in itself. However, despite some favourable conditions, including a well-educated population, this is an issue receiving insufficient attention in Ukraine.

*Recommendation 3.1*

*The authorities should strengthen their efforts to encourage the development of an innovation culture, in particular through awareness, dissemination and communication initiatives, which could include:*

- *Support to popular scientific radio and TV programmes and other forms of media to encourage interest in science and technology, and commercial applications;*
- *Promotion of innovative entrepreneurs as positive role models through awards and other forms of social recognition;*
- *Training managerial staff in public agencies on innovation issues; and*
- *Educational programmes at different levels that underline the importance of innovation and intellectual property for economic development.*

Innovation is a multifaceted process upon which multiple government agencies and units exert an influence. In Ukraine, there is not a clear governance structure to arbitrate conflicts, ensure the integration of different goals and define consistent agendas. This weakness contributes to the proliferation of inconsistent and poorly funded initiatives, and an inefficient complexity of legal rules.

*Recommendation 3.2*

*Given the multiple government actors involved in innovation-related areas and the difficulties in tracking effective implementation, the authorities should strengthen their efforts to:*

- *Streamline policymaking and improve the definition of functions and responsibilities of ministries, agencies and other parties; and*
- *Strengthen control over implementation through the creation of new mechanisms or by reinforcing existing structures. This could include an enhanced role for the State Agency for Science, Innovation and Informatization (SASII), which could be given more extensive powers, increasing its independence and providing it with specific performance indicators and budgetary resources to carry out these monitoring tasks (see recommendation 2.3).*

Ukraine has adopted many innovation initiatives in the past. However, implementation has been uneven, due to the lack of necessary follow-up steps to give concrete expression to high-level objectives, including the provision of financial resources. The lack of engagement of key innovation actors in the design process has also undermined implementation. In addition, no systematic evidence has been collected on the innovation impact of past programmes to assess performance.

*Recommendation 3.3*

*The authorities should aim to improve the effectiveness of innovation policies by reinforcing key aspects of the policy cycle. In particular, they should consider:*

- *A closer involvement of the private sector in the design of policies and programmes through well-established consultative processes, which could include clear communication regarding sources of finance in order to increase the credibility of policy actions; and*
- *Reinforcing monitoring and evaluation procedures, which should be built into the design of public programmes, including through appropriate provision of the necessary resources to carry out these procedures. The outcome of the assessments should be used as the basis for corrective measures regarding existing programmes, and to make improvements in the design of new ones.*

Ukraine is a large country, with varying resources and needs at the regional level. There have been some attempts in the past to incorporate an innovation dimension in regional policies but progress to date has been limited. Tapping into the potential for regional development demands more focused efforts. Innovation-based regional strategies require the creation of a basic infrastructure that increases the absorption capacity of less developed regions and facilitates collaboration and exchanges.

*Recommendation 3.4*

*In order to enhance the contribution of innovation to regional development, the authorities should ensure that innovation policies and related programmes incorporate a regional dimension and that this is supported by appropriate financial and coordination mechanisms. In particular, the authorities could consider:*

- *A well-defined consultation process that facilitates the alignment of national and regional policy objectives and the incorporation of regional aspects in design of the overall national innovation strategy;*
- *The creation of institutional structures that facilitate coordination between regional and central interventions, including mechanisms for consultation and sharing of information; and*
- *Provision in central plans for the development of necessary infrastructures to support the implementation of regional strategies.*

# *Chapter 4*

# *KNOWLEDGE GENERATION AND ABSORPTION*

This chapter presents the roles of the business sector and the science and technology system in the generation and absorption of knowledge in Ukraine. It concludes with some selected policy issues and recommendations.

## 4.1 The business sector

The majority of Ukrainian firms, like most firms in other countries with economies in transition, operate "behind the technology frontier".[44] This means they are not world leaders technologically, and their growth is based on non-R&D sources of productivity gains and the diffusion of embodied knowledge from elsewhere as opposed to knowledge generation. These firms can be very innovation active, but with innovations that are new to the firm or country, rather than new to the world market.

Innovation policy needs to be tailored to the position of Ukraine relative to the technology frontier because the institutions and policies that support "locally new" innovation through imitation, adoption and adaptation are not necessarily the same as those that favour "globally new", leading-edge innovation.[45]

The share of expenditure on R&D and other intangibles increases with the level of economic development, with innovation expenditures in countries at earlier stages of development tending to focus on imported equipment and its successful operation, with a limited intangible (R&D) component.

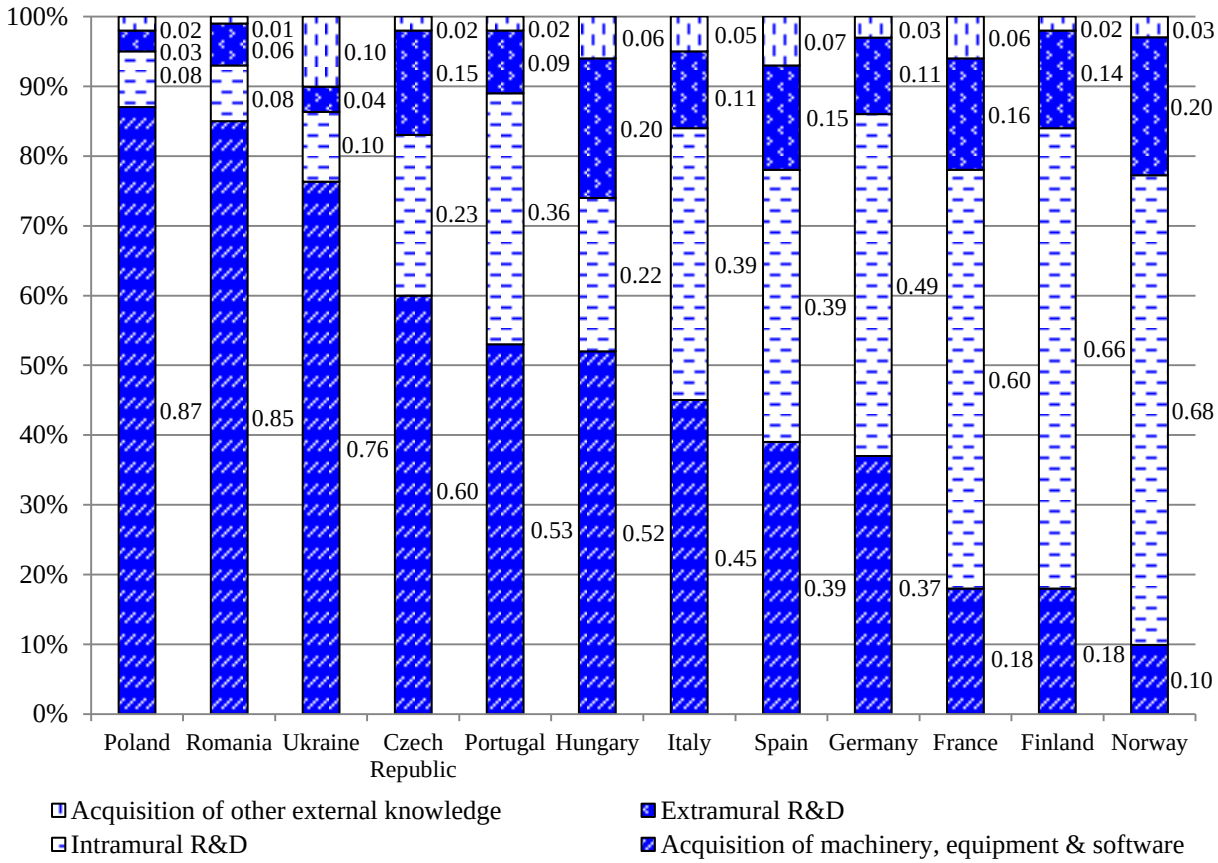
Innovation activities in countries behind the technology frontier, such as Ukraine, focus mainly on the adaptation of machinery, equipment and software. The share of expenditure on machinery, equipment and software in total innovation expenditure in Ukraine is within the normal range for the EU new member States (Figure 6).

An equipment-based approach to innovation at the enterprise level leads to a lower level prioritization of knowledge protection, which will be largely in the form of know-how rather than intellectual property (patents). Know-how is generally related to the efficient operation and adaptation of newly introduced equipment rather than R&D-based innovation, meaning that patent protection, registered trademarks and industrial design copyrights are viewed as less important. Eurostat data on modes of innovation protection show that innovation in EU

[44] B. Majcen, S. Radosevic, M. Rojec (2009), Nature and determinants of productivity growth of foreign subsidiaries in Central and East European countries, Economic Systems, vol. 33(2), pp.168-184, June.
[45] P. Aghion, H. Harmgart and N. Weisshaar (2011), Fostering growth in CEE countries: a country-tailored approach to growth policy, In Radosevic and Kaderabkova (eds) Challenges for European Innovation Policy. Cohesion and Excellence from a Schumpeterian Perspective, Edward Elgar, Cheltenham.

new member states (NMS) is mostly unprotected.[46] Comparable data for Ukraine are not available, but indirect evidence of the limited role of patents in leading Ukrainian firms suggests a similar situation.

**Figure 6. Structure of innovation expenditures in selected countries, 2008**




*Source:* EU Innovation Survey, Eurostat; Science and Innovation Activity in Ukraine, State Statistics Service of Ukraine, Kiev, 2012.
*Note:* Data for Ukraine from 2010, all other countries: 2008.

Finally, more than half of enterprises in NMS are "non-R&D innovators".[47] Hence, it would be inappropriate for policy to focus *exclusively* on encouraging R&D investment and supporting restructuring towards R&D-intensive industries as a way of achieving growth and employment, given that a high proportion of firms in countries like Ukraine innovate without investing in R&D. In fact, there is widespread evidence that high growth firms are not exclusively found in high technology sectors.[48] While some new technology-based firms (NTBFs) can indeed prove to be high-growth, many exhibit below average rates of growth. It is better to view NTBFs not as independent sources of growth, but as an important category of

[46] Table 2.3, *ibid*.
[47] Figure 5, A. Arundel, C. Bordoy and M. Kanerva (2008), "Neglected innovators: how do innovative firms that do not perform R&D innovate? Results of an analysis of the Innobarometer 2007 survey No. 215", INNO-Metrics Thematic Paper.
[48] M. Henrekson and D. Johansson (2010), Gazelles as job creators: a survey and interpretation of the evidence, Small Business Economics (2010) 35: 227–244.

firms in the knowledge and innovation system of the economy. They are more likely to operate as "knowledge brokers" and "specialized suppliers" rather than major employers or generators of added-value in their own right.[49] As suppliers of knowledge-intensive services or specialized components, they are in fact very much dependent on non-high tech firms.

Thus, innovation is not only about high technology, and innovative enterprises can be found in low as well as high technology industries. It is therefore important to understand the drivers of innovation in all enterprises. In this respect, policy should not ignore the potentially large number of innovation active firms in non-high technology sectors and their range of innovation and productivity challenges, but should focus on all potential innovators.

Still, the proportion of innovative enterprises in Ukraine is very low. Only 21% of Ukrainian enterprises innovate, placing Ukraine at the bottom of the comparator group of EU new member States (Table 9). However, Ukraine compares much more favourably in terms of the proportion of SMEs innovating in-house, with a higher share than in a number of EU new member States. Innovation surveys show a lower frequency of innovation among small firms, particularly in comparison to large enterprises. However, this gap is small in the case of Ukraine, with 18.4% of SMEs innovating in-house compared to 21% innovative enterprises at the aggregate level. The corollary of this is that large Ukrainian firms are actually lagging more in terms of frequency of innovations than SMEs. While the cause of this is not clear, it may be related to the delayed process of privatization and/or delayed restructuring.

**Table 9. Proportion of SMEs innovating in-house versus aggregate share of innovative enterprises**

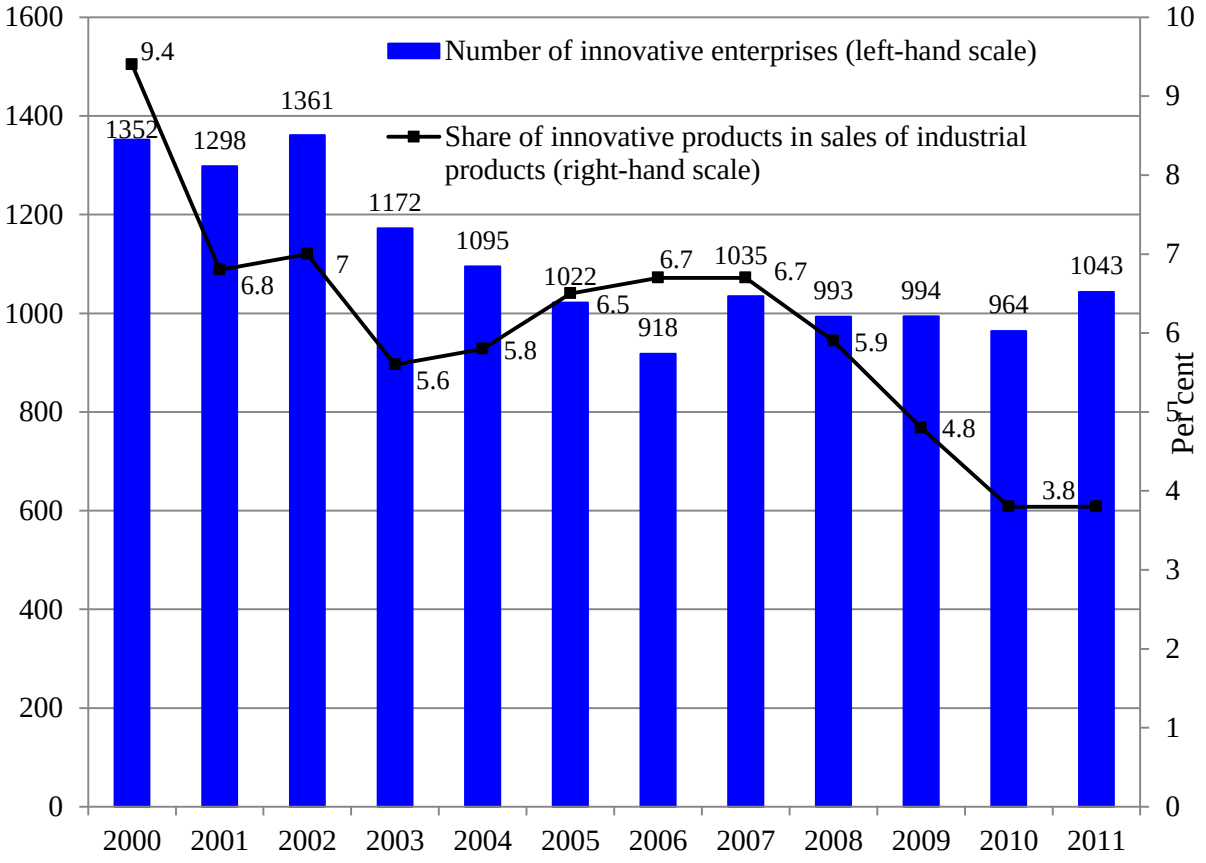
| | **SMEs innovating in-house** *Share of total (%), 2004-2008* | **Proportion innovative enterprises** *Share of total (%),2008* |
|---|---|---|
| Germany | 46.2 | 79.9 |
| Austria | 39.2 | 56.2 |
| Finland | 37.8 | 52.2 |
| Estonia | 37.1 | 56.4 |
| Portugal | 33.7 | 57.8 |
| EU | 31.7 | 51.6 |
| Czech Republic | 29.8 | 56.0 |
| France | 29.1 | 50.2 |
| Spain | 24.4 | 43.5 |
| **Ukraine** | **18.4** | **21.0** |
| Romania | 16.9 | 33.3 |
| Poland | 16.8 | 27.9 |
| Slovakia | 16.3 | 36.1 |
| Bulgaria | 16.1 | 30.8 |
| Hungary | 13.0 | 28.9 |

*Source:* Eurostat (online data code: inn_cis6_type). Science and Innovation Activity in Ukraine, State Statistics Service of Ukraine, Kiev, 2012 (for Ukraine).

[49] S. Radosevic, Science-Industry Links in Central and Eastern Europe and the Commonwealth of Independent States: Conventional policy wisdom facing reality, Science and Public Policy, June 2011, Vol. 38, No.5, pp.365-378.

While table 9 shows the share of innovative enterprises in Ukraine to be at the lower end of a ranking of comparator countries, there is limited evidence of a significant change in this trend, as the number of innovative enterprises in Ukraine has oscillated around 1,000 enterprises for the last decade (Figure 7). More worrying is the trend of declining innovation intensity or commercial relevance of innovation, revealed by the declining share of sales of industry that are innovation based. Except for a short period of increase from 2003 to 2006, innovation intensity declined from 9.4% to 3.8% of sales of industry during the period 2000-2011. This suggests that a relatively limited group of innovative enterprises are carrying out a lower volume of commercially relevant innovation activities, and that technology upgrading is relatively stagnant. Within-industry innovation that is new to the market is largely concentrated within chemistry and petrochemicals, machine building and mining. Innovation new to the enterprise is concentrated in the food, wood processing and metallurgy sectors.

**Figure 7. Number of innovative enterprises and share of innovative sales in industry, 2000-2011**



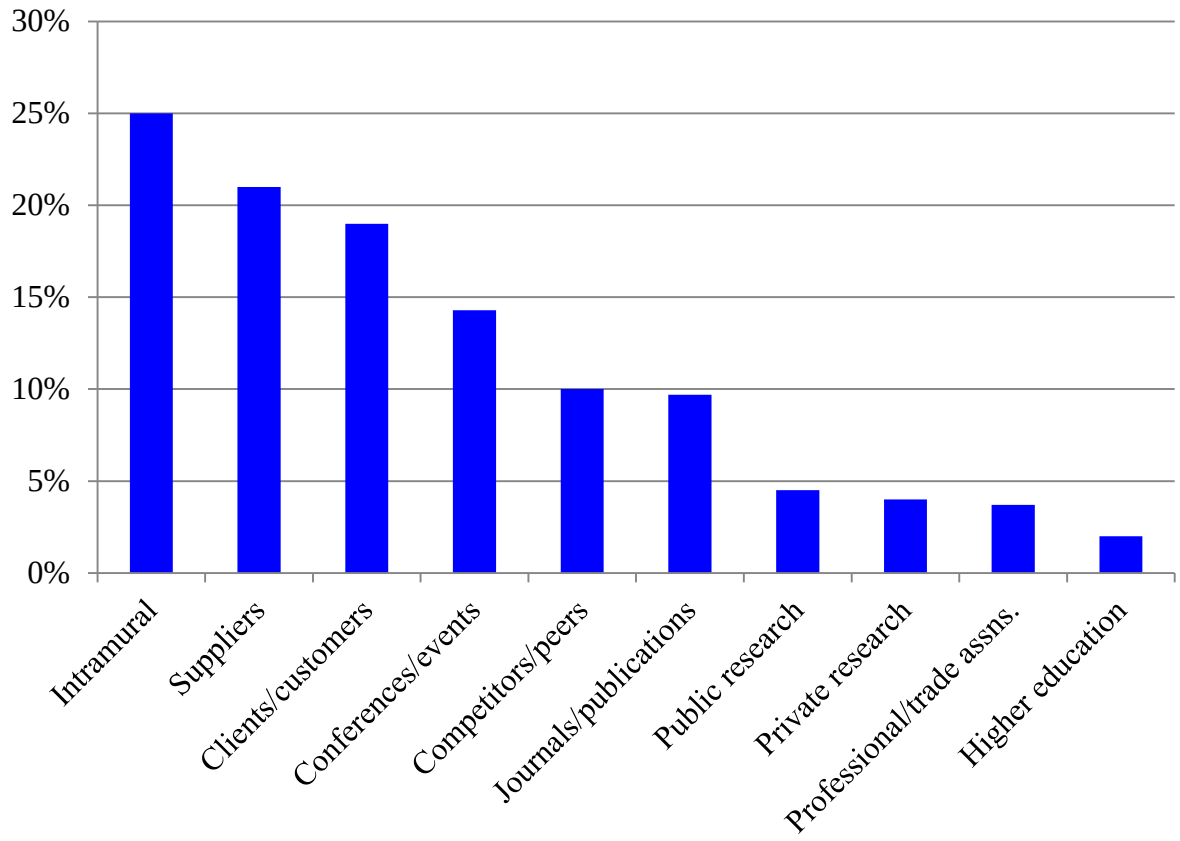

*Source:* Analytical Reference: Status of science and technology and results of scientific, technical, innovation and technology transfer in 2011, State Agency for Science, Innovation and Informatization of Ukraine / Ukrainian Institute of Scientific-Technical and Economic Information, Kiev, 2012. Original: Ukrainian.

Enterprises are not the only agents of innovation. During the Soviet era, their role was in fact limited to the implementation of innovations developed elsewhere – most often in industrial (branch) institutes. The post-Soviet era brought radical changes, as innovation became a market driven process. For innovation, the most important sources of information for innovative enterprises in Ukraine are similar to elsewhere: the enterprise itself, and its value

chains partners, i.e. purchasers and suppliers, as well as competitors (Figure 8). Innovation survey data for 2008-2010 show that these four information sources are used by 75% of enterprises. The second most important group of information sources for innovation are trade fairs and exhibitions, technical publications and industry associations. Between them, these three sources are used by 28% of innovative enterprises. The third and least important group of direct information sources for innovation includes private consultants or institutes, universities and public research institutes, which are used by only 10% of innovators.[50]

These data clearly demonstrate that innovation is developed and implemented within its market and institutional context, i.e. within the value chain and broader industry environment (as represented by fairs and exhibitions). The data also show that innovation is not based only on R&D and does not just originate from or in close cooperation with R&D organizations. Other extramural organizations are important for enterprises, both as a direct source of information for innovation, and as new sources of skilled professionals and R&D solutions as and when these are required by enterprises.

**Figure 8. Innovative enterprises[i] by most important sources of information for innovation and economic activities, 2008-2010**




*Source:* Science and Innovation Activity in Ukraine, State Statistics Service of Ukraine, Kiev 2012.
[i] Expressed as a percentage of enterprises with technological innovation. Note that multiple information sources are possible, and so figures may calculate to greater than one hundred. Higher education sector includes universities.

[50] Percentages add up to more than 100% because respondents to the survey were allowed to choose several information sources.

Consistent with the notion that innovation in Ukraine is not strongly based on R&D, enterprises (the major sources of innovation in general) play a limited role in R&D. Innovation survey data show that only 5% of enterprises invest in intramural (own) R&D, while 10% fund extramural (external) R&D (Table 10).

**Table 10. Share of innovative enterprises performing intramural and extramural R&D, by size, per cent[i]**

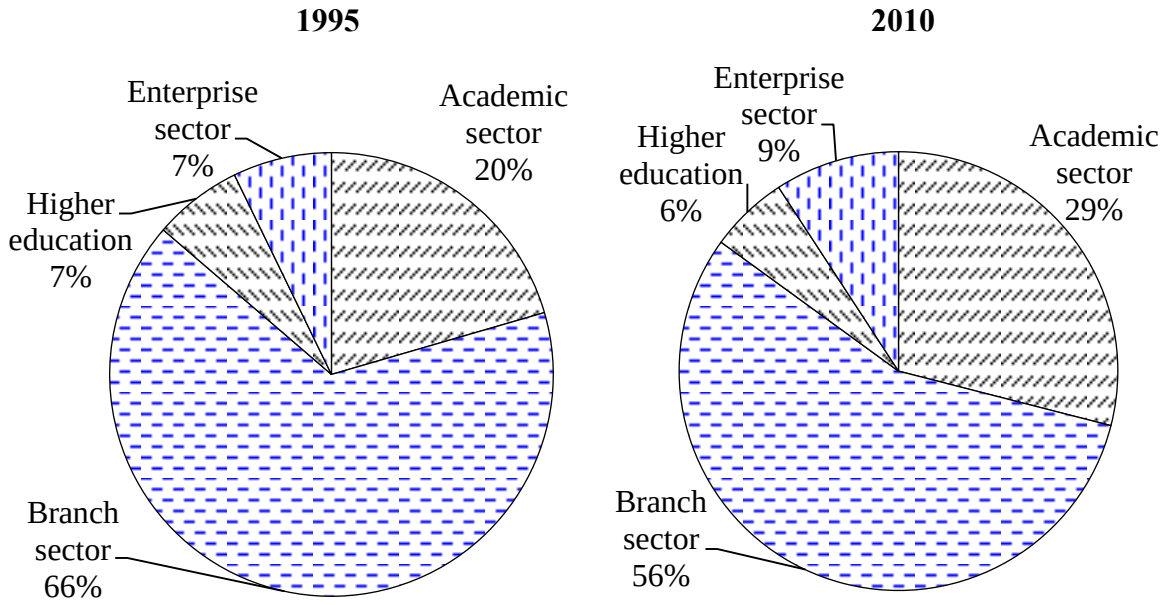
| Number of employees | Intramural R&D | Extramural R&D |
|---|---|---|
| 250 > | 18.4 | 22.5 |
| 50-249 | 3.9 | 11.2 |
| 10-49 | 2.7 | 7.2 |
| All innovative enterprises | 5.0 | 10.1 |

*Source:* O. I. Bilokon and N. O. Bilenka, A survey of innovation in the Ukrainian economy 2008-2010 (following international methodologies). Original: Ukrainian.

[i] Expressed as a percentage of enterprises with technological innovation.

Moreover, R&D within enterprises still comprises only 9.2% of total R&D performed by value, with the major actors in R&D remaining sectoral branch institutes, performing 56% of total R&D by value in 2010 (Figure 9). In this respect, the Ukrainian innovation system still reflects the influence of the Soviet era as well as the country's position as a modest innovator. Nonetheless, there is evidence of progress from 1995 to 2010, with a gradual diversification in the performers of R&D. The shares of R&D accounted for by enterprises and the academic sector have gradually increased, with the share of R&D performed by branch institutes showing a corresponding decline. However, the role of universities in R&D remains marginal, and the Ukrainian R&D system has yet to be fully restructured as a market based system in which enterprises are the major financiers and performers of R&D. It is perhaps therefore unsurprising that much of the Ukrainian post-Soviet R&D system remains of secondary importance in the economy's ongoing innovation activities.

**Figure 9. Share of R&D performed by institutional sectors, per cent**

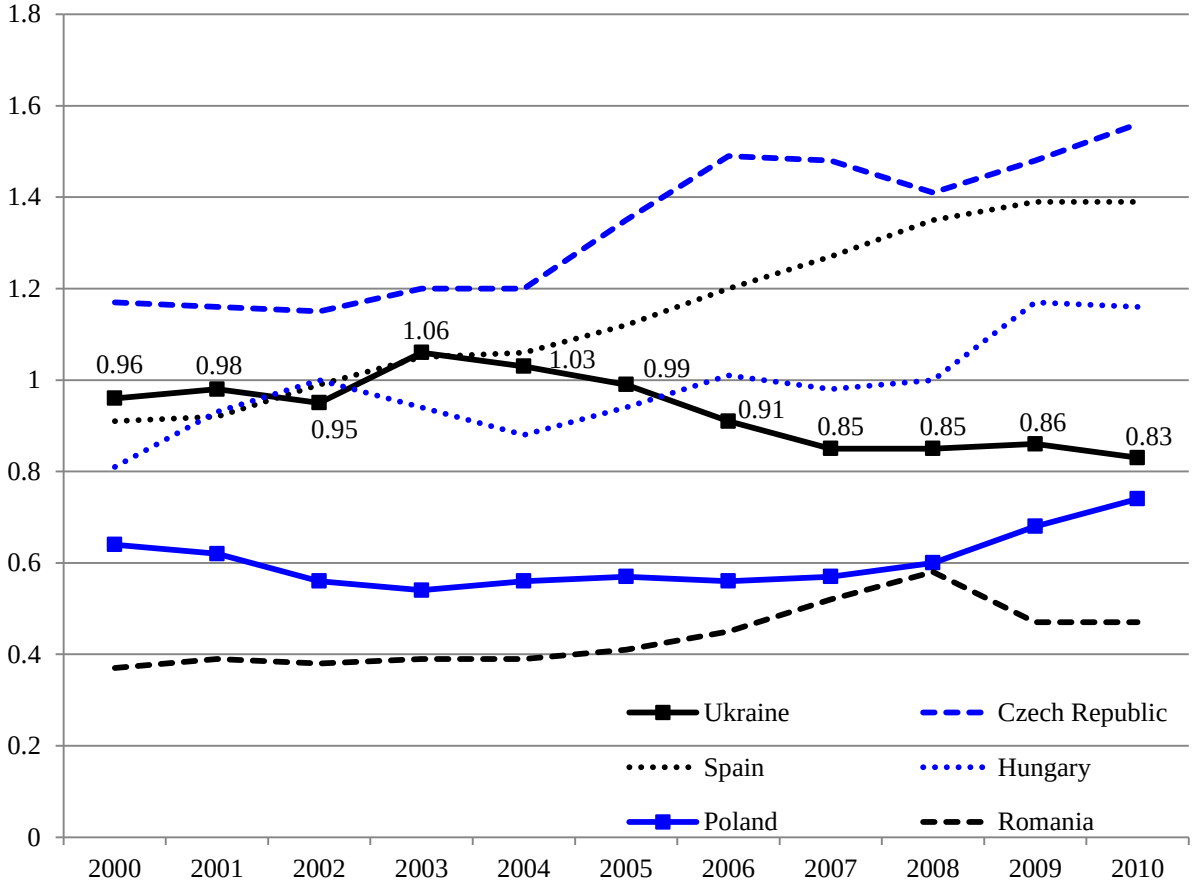



*Source:* Science and Innovation Activity in Ukraine, State Statistics Service of Ukraine, Kiev, 2012.

When considering the statistics shown in Figure 9, some would argue the sum of research conducted in the branch and enterprise sectors to be more comparable with figures for R&D performed by the business sector in other countries. However, not all research carried out in the branch sector may be considered to be commercial, and truly comparable figures remain elusive for an R&D system that is still in transition.

The decline in R&D expenditure as a share of GDP during a period of strong economic growth further suggests that the R&D system is not the key driver of the innovation process in Ukraine (Figure 10). According to official statistics,[51] employment in R&D fell from 170,000 people in 2005 to 134,700 in 2011. These statistics are not expressed as full time equivalent (FTE), and include all workers involved in R&D in their "primary place of work", including part time (over 60,000 workers), and so are not comparable with OECD or UNESCO data for other countries based on FTE. This decline in employment raises questions regarding R&D system capacity, and the contribution of R&D to business sector innovation. In fact, given the limited role of organized R&D in Ukrainian firms' innovation processes, R&D expenditures of around 1% of GDP largely reflect an inherited, public sector oriented R&D system rather than one supporting ongoing innovation activities and commercialization.

**Figure 10. Gross GDP expenditures as a share of GDP, 2000-2010, per cent**




*Source:* Science and Innovation Activity in Ukraine, State Statistics Service of Ukraine, Kiev, 2012.

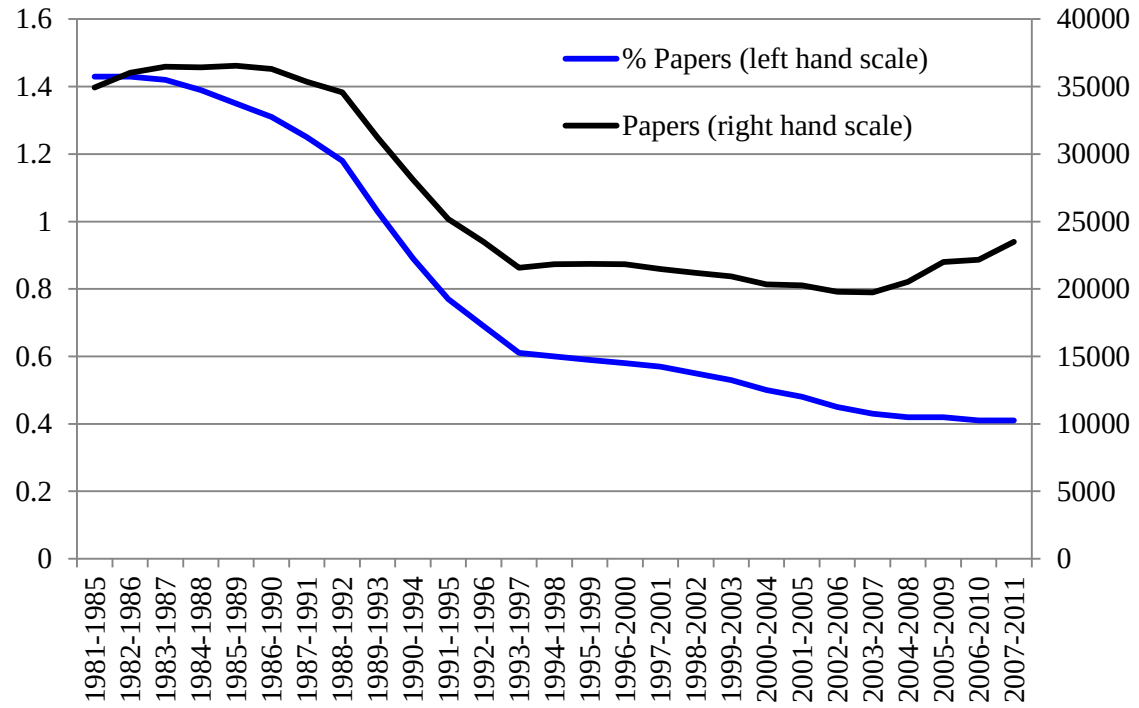
[51] Table 3.1, Science and Innovation Activity in Ukraine, State Statistics Service of Ukraine, Kiev, 2012. Original: Ukrainian.

Thus, the assumption underlying much of the current policy thinking on science and innovation in Ukraine, according to which R&D is the key source of technology and innovation, is mistaken. R&D does play a role, but its effect on local and national economic development is modest in the short to medium term. Instead, greater attention should be paid to helping innovative enterprises to improve productivity and thus generate greater demand for R&D, which would also accelerate the structural changes that have been slowly taking place in the R&D sector.

## 4.2 The science and technology system

Ukraine, like many transition economies in the region, has lost the advantages of scale of the science and technology system inherited from the Soviet era.[52] The current science and technology system (public R&D, education and vocational training) is inefficient. The annual number of scientific papers published fell from more than 35,000 during the Soviet period to around 20,000, and is only now recovering towards the 25,000 level (Figure 11). As world science has progressed, Ukraine's share in world scientific publications has declined from 1.4% to 0.45%, and while this share shows signs of stabilizing, recent increases in absolute numbers have ensured that the Ukrainian science system maintains rather than expands its international share.

**Figure 11. Number of scientific papers and world share, 1981-2011**

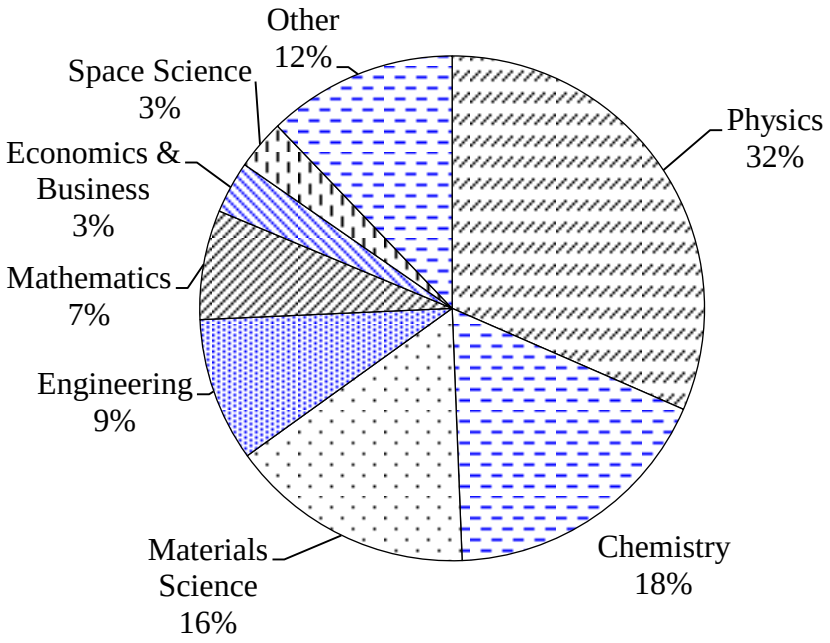



*Source:* Science Indicators Database, Thomson Reuters.

[52] V. Kravtsova and S. Radosevic (2011), Are systems of innovation in Eastern Europe efficient?, Economic Systems, vol. 36(1), pp. 109-126.

In terms of disciplinary structure, the Ukrainian science system remained largely unchanged during the early transition period,[53] although the last decade has seen some significant change, including a shift within disciplines towards basic research. Physics, chemistry, materials science and engineering continue to dominate scientific output, while the shares of life sciences and environment are negligible (Figure 12).

**Figure 12. Distribution of scientific papers of Ukraine, by discipline, 2007-2011**




*Source:* Science Indicators Database, Thomson Reuters.

The recent rise in the absolute number of Ukrainian publications has been driven by growth in basic research, the share of which increased from 9% of academic R&D in 1991 to 22% in 2010 (Figure 13).[54] This increase, however, also reflects an increased "polarization of the R&D spectrum",[55] or differentiation in the academic sector between basic science and close to market activities like development and science and technology services, which have "squeezed" applied research. Applied research requires technological ambition that goes beyond the short term developments, testing and consultancy services that are typical of close to market activities in the academic sector.

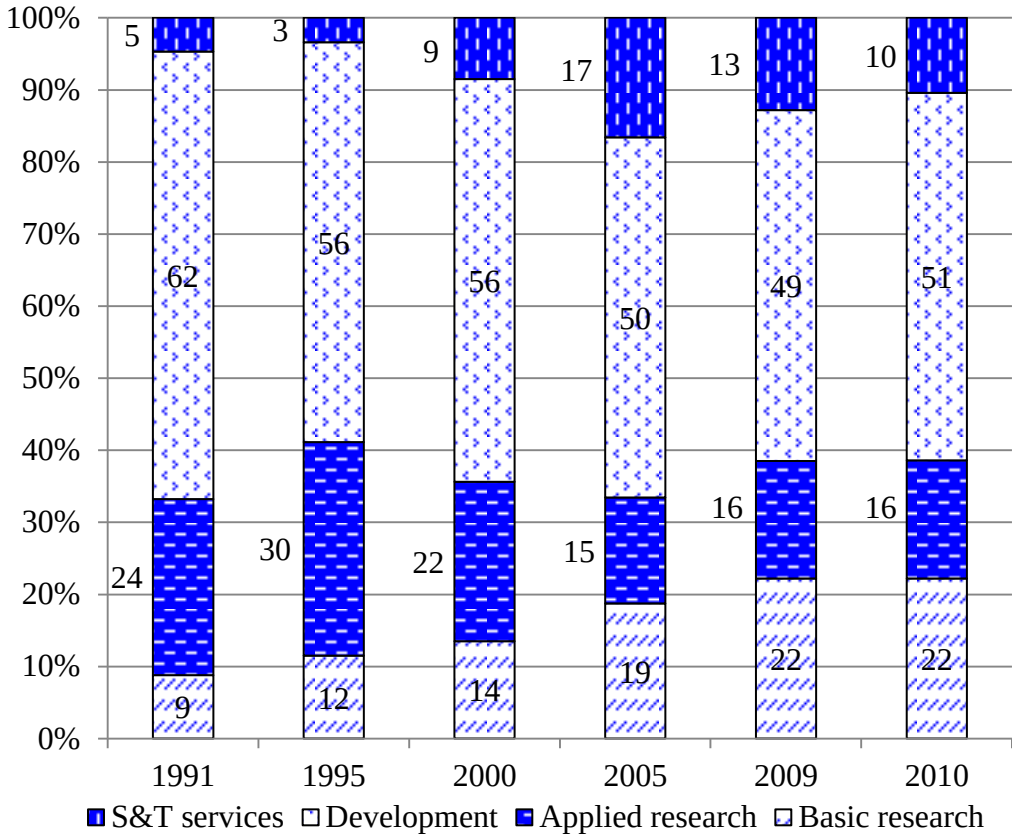
[53] J. Kozlowski, and S. Radosevic, and D. Ircha (1999), "History matters: The inherited disciplinary structure of the Post-communist science in countries of Central and Eastern Europe and its restructuring", Scientometrics, Vol. 45, No. 1, pp.137-166.

[54] Although it should be noted that these figures relate to the formal distribution of state funds (and hence are strongly influenced by the R&D focus of the academies of sciences), as opposed to the real distribution of R&D projects according to the various stages of the research process.

[55] S. Radosevic, "Science and Technology Capabilities in Economies in Transition: Effects and Prospects", The Economics of Transition, Vol 3(4), December 1995, pp.459-78.

The polarization of R&D performed in the academic sector suggests it is filling a gap, with certain parts of the sector functioning as a *de facto* knowledge-intensive services sector providing testing, measurement, design, engineering services and the like for the business sector. It provides an important source of complementary expertise in the form of added-value through technology that is conceived to enhance clients' productivity. The other part of the Ukrainian academic sector has shifted towards basic research, and should therefore operate under criteria of world excellence.

**Figure 13. Distribution of academic R&D performed by type of activities, per cent**




*Source:* Science and Innovation Activity in Ukraine, State Statistics Service of Ukraine, Kiev, 2012.

As criteria of world excellence are not widespread in the Ukrainian academic sector, certain activities are contributing neither to the local economy nor to world science. Such activities are located in the fourth policy quadrant (Table 11), which is neither internationally excellent nor locally relevant. A long-term policy goal should be to prioritize locally relevant and internationally excellent basic research, i.e. to shift from the fourth quadrant to the first.

**Table 11. Strategic policy dilemmas in science and technology**

| | **Locally relevant** | **Locally irrelevant** |
|---|---|---|
| **Excellence** | (1) First best / Virtuous cycle | (2) Second best / Islands of excellence but not relevant locally |
| **Non-excellence** | (3) Third best / Locally relevant but mediocre R&D | **(4) Bad strategic option / Locally irrelevant and mediocre in terms of quality / Vicious cycle** |

*Source:* S. Radosevic and B. Lepori (2009), Public research funding systems in Central and Eastern Europe: between excellence and relevance: introduction to special section, Science and Public Policy, 36(9), pp.659-666.

In the Ukrainian academic sector, the predominant organizations remain the former branch institutes. Of 1,255 R&D organizations, 52% are branch institutes, with 29% falling under one of the State Academies of Sciences and 14% in the higher education sector. Branch institutes have declined significantly in number, from 837 in 2005 to 570 in 2011. This reflects bottom-up, micro-driven restructuring processes whereby ex-R&D, design and engineering organizations are adjusting to the business environment, and often shifting from R&D to services.

The state of flux in which the S&T system finds itself is leading to polarization between R&D carried out at universities and institutions falling under the Academies of Sciences, which are largely funded from the state budget, and ex-branch institutes. The Academy of Science system is 85% funded from the state budget, while university R&D is 70.7% state funded and has more domestic customers (20.4% versus 6.4% for the Academy of Science system). Ex-branch institutes receive 39.6% of their funding from abroad, 37.4% from domestic customers and only 15.8% from the state budget. R&D in the enterprise sector is 46.2% funded from own resources and 38.9% from abroad, with Russian sources being the most frequent.[56]

Many industrial or ex-branch institutes have been commercialized and are subordinated to their respective ministries, many to the Ministry of Economy's Department of Industrial Policy or the Ministry of Infrastructure, with 55 falling under the Ministry of Defence. Although nominally organizations under private law, industrial institutes benefit from certain formal or informal benefits, meaning they generally do not wish to cut all ties with the State. For instance, they pay minimal land tax (there are several rates for this tax in Ukraine) and are exempt from VAT on goods and services when undertaking projects financed from the state budget. Their employees may receive state "scientific" pensions, which are often higher than in other sectors of the economy, while formal affiliation with a ministry facilitates necessary state orders and participation in state programmes. Directors of these institutes are nominated by the State, an indication that they are considered organizations of public interest.

Overall, policy in relation to the academic sector could be described as one of passive adjustment, i.e. allowing adaptation to changing demand without a clear vision of the desired final model of academic R&D. This "muddling through" approach was a rational response to high levels of uncertainty and declining GDP during the 1990s, but its continuation is more difficult to justify. The result is a very low contribution of the academic sector to business innovation, with the unreformed academic sector unable to offer new types of services. The business sector also fails to generate strong demand for academic R&D and innovation

[56] Science and Innovation Activity in Ukraine, State Statistics Service of Ukraine, Kiev, 2012.

services. These failures on both the supply and demand sides of R&D services have led to a failure to preserve R&D capacity, and to an overall decline in R&D intensity in the economy.

## 4.3 Assessment of policy options

***Current situation***

At present, the productivity of Ukrainian enterprises depends on investment in modern equipment, their capacity to adapt this to requirements and to offer additional services or added-value. Recent growth reflects these investment- and efficiency-driven productivity gains, with foreign customers and investors representing important knowledge sources for catch-up. However, Ukraine is poorly integrated in global value chains, with research showing it to be outside both "buyer-driven" networks (e.g., clothing), as well as "producer-driven" global networks, including trade in parts and final manufacturing products.[57]

Ukraine has been successful in attracting significant FDI (Chapter 7), although predominantly in low technology sectors, e.g. real estate. There is a complex picture of strong FDI with weak integration in global value chains, and little consensus on the desirable scale and scope of international integration. Lack of competitive pressure in domestic markets, together with limited FDI and integration in global value chains in key sectors have meant a slow pace of industrial upgrading. Low levels of productivity despite significant wage competitiveness indicate challenges reaching world standards in production based on standard technologies.

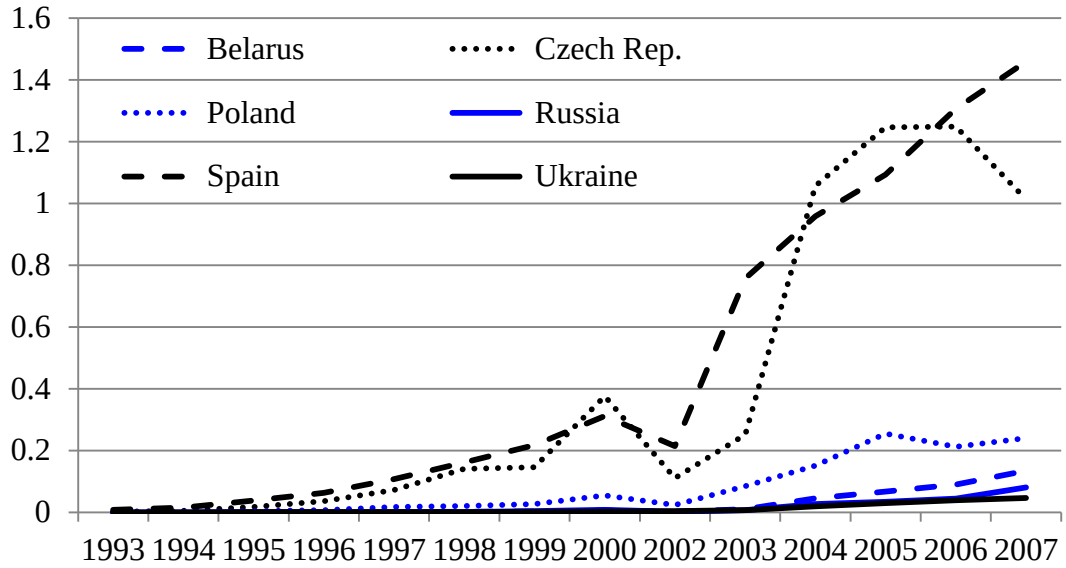
ISO 9001 certification data can provide an imperfect but useful proxy for the adoption of managerial best practices, irrespective of the level of technological advancement of specific companies. With the diffusion of new business models based on contract manufacturing and fragmented value chains, quality standards have become "entry tickets" to global production networks. Research on productivity determinants shows that production capability (using ISO 9001 data as a proxy) in combination with R&D capabilities can provide a satisfactory explanation for productivity differences among OECD and East European countries,[58] and so are important for growth and catch-up. R&D capabilities matter not just for knowledge generation at the world technology frontier, but also for acquiring absorptive capabilities.

Ukraine lags far behind in terms of its number of ISO 9001 certificates per capita, together with Russia and Belarus (Figure 14). This is a sign of isolation from global value chains, as well as an indicator of the huge scope for improved management of production capabilities.

[57] World Bank, 2005, From Disintegration to Reintegration: Eastern Europe and the Former Soviet Union in International Trade, Edited by Harry G. Broadman, Chapter 7. http://siteresources.worldbank.org/INTECA/Resources/tradereport-complete.pdf.

[58] V. Kravtsova and S. Radosevic (2011), Are systems of innovation in Eastern Europe efficient? Economic Systems (2011), vol. 36(1), pp.109-126.

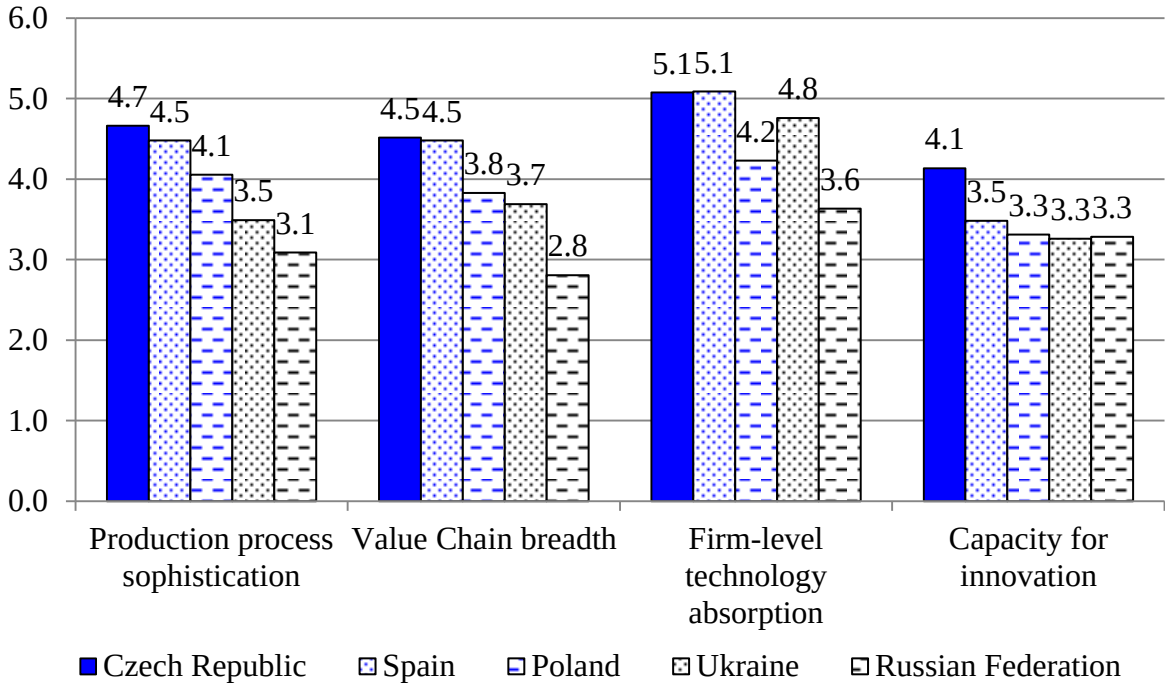
**Figure 14. Number of ISO 9001 certificates per 1000 population, 1993-2008**




*Source:* The ISO Surveys 1993-2007

Production and technological capabilities, as assessed by local business communities, are also illustrative (Figure 15). Ukraine lags behind in terms of the level of sophistication of production processes, with exporters concentrated in resource extraction or production rather than in the non-production stages of value chains. Although the assessment is more favourable than for the Russian Federation, the gap with other EU countries is significant. There is, however, evidence that the capacity of Ukrainian firms to absorb new technology is an area of relative strength. Its firms are not out of line with comparable countries, where enterprises often obtain technology from abroad and conduct limited own R&D.

**Figure 15. Subjective assessment of production & technology capabilities, 2012-2013**




*Source:* WEF GCR Database. *Note:* Higher values denote more positive assessments. Measurement scale: 1-7.

***Policy options***

There is a high-level policy assumption in Ukraine that further regulatory reforms are the most important priority, being essential for a good business environment without which there may not be growth, and there is indeed tremendous scope for improvement in this regard. However, to increase their impact, regulatory reforms should be inextricably linked to potential drivers of growth, as discussed in the assessment of the current situation above. In this respect, there is no trade-off between the needs for technological upgrading and regulatory reform. Regulatory reforms should be prioritized in precisely those areas with potential for medium and long-term growth.

Similar to "generic" or "horizontal" regulatory reforms, sectoral reforms are not sufficient without sector- or technology-specific innovation policy measures. The degree of sector or technology specificity can vary and there is no common "blueprint". Reforms should address not only the general obstacles to doing business, but equally the sector specific obstacles that can be so significant, targeting specific areas with potential for growth.[59] These could include the ICT, agricultural or aircraft industries, among others. The aim would be to remove sector specific, institutional obstacles to growth without creating new distortions. This would require addressing failures in inadequate training and investment in human capital in these areas, as well as designing technology-, sector- or area-specific investment promotion packages with due care not to give unfair advantages to specific types of investor.

A challenge for Ukrainian policymakers is to balance horizontal and vertical regulatory reforms, as well as balancing horizontal with technology-specific innovation policy programmes. However, the key message is that regulatory reforms and innovation policy measures should be implemented in ways that complement one another.

To date, the policy focus in Ukraine has been on market enhancing governance reforms (quadrant 1), and sector or technology specific innovation policy measures (quadrant 2) (Table 12). Ukraine lags behind in terms of regulatory reform when compared to countries with economies in transition in Central and South-Eastern Europe.[60] In terms of generic innovation policy, Ukraine has a developed S&T infrastructure. It has 16 technoparks, 24 incubators, 15 innovation centres, 14 IPR commercialization centres, 21 enterprises for "implementation of research findings" and 12 centres for S&T informatization. In total, Ukraine has 114 organizations of innovation infrastructure. However, effectiveness has not been fully scrutinized, and it seems there are issues in terms of lack of demand and relevance.

[59] For a similar argument elaborated at greater length in the context of developing countries see Khan, Mushtaq (2009) "Is "Good Governance" an Appropriate Model for Governance Reforms? The Relevance of East Asia for Developing Muslim Countries.' In: Springborg, Robert, (ed.), Development Models in Muslim Contexts: Chinese, "Islamic" and Neo-Liberal Alternatives. Edinburgh: Edinburgh University Press, pp.195-230.
[60] EBRD (2012), Transition Report 2012: Integration across borders, Chapter 1: Progress in Structural Reforms.

**Table 12. Policy choices for industrial upgrading**

| | Structural reforms | Innovation policy measures |
|---|---|---|
| **Horizontal (generic)** | *Market enhancing governance reforms (1)*<br><br>Property rights; rule of law and contract enforcement; minimizing rent seeking and corruption, and transparent and accountable provision of public goods. | *Horizontal (generic) innovation policy measures (2)*<br><br>Generic innovation infrastructure, innovation vouchers; cooperative R&D programmes; and tax incentives. |
| **Vertical (sector/ technology specific)** | *Sector specific regulatory regimes (sectoral governance) (3)*<br><br>Sector-specific privatization rules; sector-specific price subsidies; sector-specific licensing regimes; sector-specific local content requirements; and sector-specific FDI promotion. | *Sector or technology specific innovation policy measures (4)*<br><br>Sector or technology specific infrastructure; thematic R&D programmes; technology platforms; and technology or sector-specific vocational training programmes. |

*Source:* S. Radosevic, (2012), Analysing three strategies for growth in South Eastern Europe, *mimeo* (work in progress).

Equally or even more important bottlenecks are in sector-specific regulations as well as in sector (technology) specific innovation policy measures. These are either hindering technological modernization (sector-specific regulations) or are absent (innovation policy). In agriculture, for example, there is a need for reform in the land market, and for policy measures to help farmers meet international quality standards. Similarly, the dairy industry needs increased private investment, lower input taxation, and improvements in veterinary medicine, feeding efficiency, animal husbandry and management. The civilian aircraft sector would benefit from a new governance system with separate branches for military and civilian sectors. [61] The system of technical regulations hinders modernization through its complexity, lack of self-regulation, obsolescence and huge scope for administrative discretion.

### *The potential of selected industries*

According to an OECD study,[62] the level of productivity in Ukrainian agriculture remains much lower than in comparable countries, with failures in meeting international standards impeding exports. Problems include a lack of human capital, insufficient food quality and safety, low efficiency and low productivity. Specifically in the dairy sector, there is a shortage of the key technical skills required to improve productivity.

[61] OECD (2012), Competitiveness and Private Sector Development: Ukraine 2011: Sector Competitiveness Strategy, OECD Publishing. http://dx.doi.org/10.1787/9789264128798-en
[62] *Ibid*.

It is important to recognize that Ukraine has inherited a well-developed design capacity in the aircraft industry. This could potentially be an important source of demand for new technology based firms if the relevant clusters develop. However, the major domestic company Antonov still faces a variety of issues related to international standards and access to markets, which is a similar challenge to that facing the agricultural sector. Although there are opportunities to engage in the non-production stages of the value chain, including services and maintenance, it seems that systems integration is not an option due to high barriers to entry in that segment.[63]

A sector with great potential is ICT – the only sector in Ukraine that is truly integrated in global value chains through ICT outsourcing services. In 2009, Ukraine had the greatest number of IT specialists (18,100) involved in the IT outsourcing and custom software development in the CEE region.[64,65] With 16,000 IT specialists graduating from Ukrainian universities each year, the country holds the fourth position in the world in terms of number of certified IT specialists, after the USA, India and Russia. In 2011, the number of IT specialists working in industry reached 25,000 (Table 13).

**Table 13. Indicators of Ukrainian ICT outsourcing services, 2007-2011**

| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Volume of IT outsourcing services ($m) | 544 | 533 | 697 | 874 | 1,100 |
| Number of IT specialists | 14,000 | 14,400 | 18,100 | 20,800 | 25,000 |
| Number of IT outsourcing companies | 800 | 850 | 940 | 990 | 1,050 |

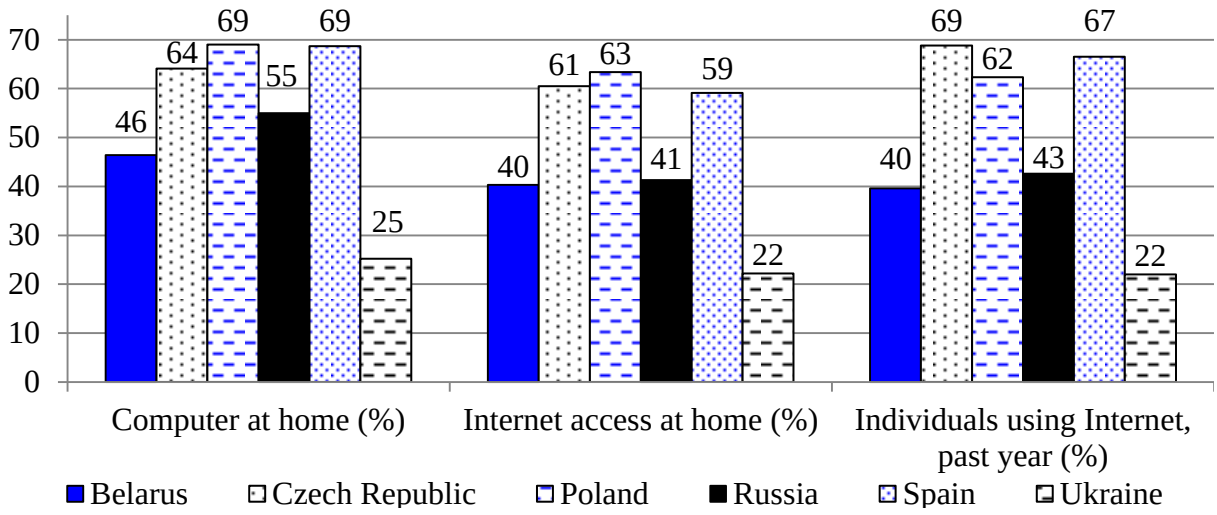
*Source:* Exploring Ukraine IT Outsourcing Industry 20112, Ukrainian Hi-Tech Initiative, p.49

It is encouraging that 37% of IT specialists work in large outsourcing companies with more than 1,000 employees, generating 39% of IT outsourcing services by value.[66] This is important, as simple availability of human capital is not sufficient for effective global integration without the organizational capabilities of local IT companies. However, this sector also faces challenges in terms of production capabilities. Few companies are ISO certified, and only four leading companies held software industry specific CMMI certification in 2011.[67] Finally, a poor business environment encourages many IT firms to operate informally.

Estimated annual exports of $1 billion in IT outsourcing services (Table 13) give Ukraine potential to become a global player in IT, particularly if the sector continues to develop its international linkages. Large domestic enterprises should also become major sources of demand for knowledge intensive services, with potential to dramatically increase productivity and modernize the wider economy through investment in IT based solutions. Limited diffusion of ICT among the general population continues to limit growth spillovers (Figure 16), with low income levels constraining the diffusion of ICT, and Internet services in particular.

[63] *Ibid*.
[64] Exploring Ukraine IT Outsourcing Industry 2012, Ukrainian Hi-Tech Initiative
[65] ICT Country profile: Ukraine. USAID 2011, Regional Competitiveness Initiative
[66] Exploring Ukraine's IT Outsourcing Industry 2012, Ukrainian Hi-Tech Initiative, p. 54
[67] https://sas.sei.cmu.edu/pars/pars.aspx

**Figure 16. Diffusion of ICT among population in selected countries, 2010[i]**




[i] Belarus 2011
*Source:* ITU World Telecommunication / ICT Indicators Database.

## 4.4 Recommendations

Public support for R&D is both low and insufficiently focused, resulting in efforts and resources being spread inefficiently. The relative importance of state programmes is limited, with their priorities not always reflected in thematic Research, Development and Innovation (RDI) programmes. The mobilization of private sector resources through coordinated public policy initiatives could provide an effective instrument for industrial restructuring in specific sectors, in line with state priorities defined in strategic policy documents.

*Recommendation 4.1*

*Focused R&D efforts to address specific priorities and the problems of particular sectors would increase the effectiveness of policy initiatives and the ability to attract resources from the private sector, including through concerted actions that rely on consultations between major stakeholders. Priority areas could include the food industry, energy efficiency, renewable energies and the ICT industry. The authorities should consider:*

- *Allocating future increases in public R&D funding to thematic Research, Development and Innovation (RDI) programmes based on criteria of technical excellence and local relevance; and*
- *Developing technology platforms linked to sectoral working parties for restructuring. Such technology platforms should be led by industry and define research priorities and action plans in a number of technological areas. State support could be confined to a coordination role, as well as thematic RDI programmes co-funded by the budget.*

FDI is a major driver of innovation through the import and adaptation of foreign technologies and business models. Ukraine has received significant FDI, but these inflows have not driven structural change or technological upgrading, given their sectoral composition. For Ukraine,

the ability to absorb and diffuse foreign technologies is a key driver of innovation, but the potential of FDI to encourage innovation remains largely untapped.

*Recommendation 4.2*

*Ukraine's FDI promotion policy is generic and not focused on promoting innovation. The possibilities created by the establishment of the State Agency for Investment and National Projects could be used to ensure that sector-specific FDI promotion is integrated into sector- or technology-specific R&D and innovation support programmes. In particular, the authorities could consider:*

- *Linking FDI that reduces energy intensity to sector-specific diffusion programmes for new energy technologies, reflecting energy efficiency's policy priority status;*
- *Encouraging foreign companies to set up R&D facilities in Ukraine, through closer alignment of FDI and innovation policies; and*
- *Facilitating linkages between foreign companies and SMEs, including through actions aiming to enhance capacity in the domestic business sector.*

Knowledge-generating institutions, such as research institutes and universities, often lack commercial orientation. For SMEs, the costs of developing relations with such organizations are rather high, and rigid frameworks for interaction do not fit their changing needs.

*Recommendation 4.3*

*The gap between ex-branch institutes and universities on the one hand, and enterprises on the other, could be bridged by the introduction of innovation vouchers. These would be given to enterprises and allow them to purchase different types of innovation services; including innovation audit, training, new business and service development, knowledge transfer projects and many others (see recommendation 5.4).*

The design of appropriate policy measures seeking to reform the academic sector requires a thorough analysis of existing capacities and programmes. While there are some areas of strength, there is also a duplication and dispersion of efforts that should be addressed.

*Recommendation 4.4*

*In order to strengthen the effectiveness and coherence of R&D policies, the authorities should assess the current situation and devise a robust evaluation system, with options including:*

- *An international benchmarking of Ukrainian R&D, as a whole and at the level of the major institutions (institutes of the Academy of Sciences, major universities and selected ex-branch institutes), to facilitate comparison with other countries in the region and EU member States; and*
- *Establishing different systems of project evaluation and selection for various types of projects and programmes (basic, applied, cooperative, innovation based programmes, etc.). Appraisal methodologies should be clear and well understood by prospective applicants.*

Supply-oriented interventions seeking to increase R&D, whether in the academic or business sector, have clear limitations as long as demand for innovation remains low which, as in other countries with economies in transition, is a key constraint for Ukraine.

*Recommendation 4.5*

*In order to address the barriers created by weak demand for RDI, public procurement could be used to drive technological development. This would stimulate technological innovation while providing public agencies with cost-effective, technical and scientific solutions to their needs. Procurement programmes designed to stimulate the demand for innovation should:*

- *Specify goals and objectives without pre-judging the technical solutions;*
- *Be open to both established and new companies;*
- *Include a grant element and other forms of support for innovative companies to help them overcome potential problems with raising financing to develop technologies;*
- *Allow single company contracts without requirement for collaboration; and*
- *Be run through open competition under rules that take into account the risky nature of innovation projects.*

# *Chapter 5*

# *INDUSTRY-SCIENCE LINKAGES AND COLLABORATION IN THE INNOVATION PROCESS*

This chapter aims to identify and analyze existing mechanisms for interaction between academic institutions and enterprises. First, it introduces key actors and forms of innovation demand and supply interconnectivity, including selected framework conditions and intermediary structures. The chapter also assesses industry-science linkages (ISLs) on the basis of a systemic view of the national innovation system. Finally, a number of recommendations are made to improve the functioning of industry-science linkages.

## 5.1 Innovation demand and supply interconnectivity

Incentives for collaboration and the framework conditions facilitating knowledge flows between innovation supply and demand (and possible barriers), in particular for technology transfer and commercialization activities, determine the intensity of ISLs. The innovation actors themselves must be motivated to collaborate, i.e. it must bring benefits to them, which may be both tangible and intangible. Only then are the necessary linkages created and developed naturally, and only then do they enhance the performance of the innovation system.

Knowledge supply and demand (mis)match together with the availability of (physical and human) intermediary infrastructure (both internal and external) influencing the incentive structure for collaboration. If the products of domestic companies are not sufficiently knowledge intensive and/or are specialized in different sectors compared to knowledge supply, there is no space or motivation for ISLs. This mismatch may be actual or perceived, i.e. based on a lack of information on existing or potential technological supply and demand. The problem in the Ukrainian NIS is that the scope for exploitation of potentially available opportunities by key players has been extremely limited due to financial and legal/administrative constraints, particularly on the side of the academic sector. In addition, supporting measures, in particular in the form of the traditional technology transfer infrastructure, have had very limited impact.

Collaboration activities and their related aspects, including legal and financial issues, must be formally clarified for all involved parties, e.g. arrangements for intellectual property rights between entities producing and applying knowledge. This is particularly important considering the diversity of institutional sectors involved (in terms of ownership structures, legal status, financing, etc.), and the considerable risks and uncertainties involved. Such uncertainties are typical of innovation activities in general, but are harder to overcome where institutions are under-developed, and where limited previous experience of collaboration leads to a low trust environment.

There are certain additional aspects to considered when assessing ISLs. In the traditional (linear) view of the innovation process, academic organizations supply knowledge which is then exploited by knowledge demanding companies. In Ukraine, the dominant suppliers are the academies of sciences and the branch institutes, together with a very small number of universities who undertake, or at least formally report, R&D activities in addition to their

primary teaching activities. Their capacity to produce knowledge has been traditionally perceived as significant, but exploitation of results by companies is very limited, at least in terms of measurable economic outcomes.

Given this structural feature, a key aspect of ISLs in Ukraine concerns the creation or development of technology transfer and commercialization capacity in the academic sector. This capacity must be simultaneously supported by intermediaries, such as technology brokers, connecting knowledge supply and (potential) knowledge demand capacities, and creating the necessary intersectoral linkages.

Innovation demand in Ukraine is generally weak, and strengthening it is a key policy imperative, without which strong linkages between science and industry will not develop. The general weakness of innovation demand stems in part from the fact that the medium and large businesses in traditional sectors have, on average, low knowledge intensity. They also often have the scale and resources to procure existing technologies from abroad – something which may be an effective way of contributing to innovation in Ukraine, but which does not necessarily generate demand for the outputs of Ukrainian research organizations, with the exception of branch institutes, whose outputs are more oriented to adjustment of existing technologies. Increasing the innovation intensity of large firms in traditional sectors and making them a significant source of demand for technology, knowledge and associated services from the academic sector will take time. In the short term, the most promising sources of innovation demand may be new (small) innovative companies, including spin-offs founded by the academic sector itself, and foreign knowledge-intensive companies.

Science-industry collaboration and the linkages between the main actors generating, diffusing and applying knowledge increase the performance of the national innovation system (NIS).[68] However, the institutional sectors of the NIS (i.e. higher education institutions, public or private research institutes and businesses) have different and largely suboptimal incentives to collaborate with one other. Coordination and information barriers prevent knowledge and technology diffusion, transfer and application. There is therefore a need for supportive measures that target the creation or development of linkages, either directly or indirectly. Common barriers to intersectoral collaboration include the lack of specific skills and competencies (for example, IPR management), insufficient career incentive structures, search costs for partnerships and the closed nature of organizations. Supporting measures aim to trigger behavioural change, i.e. to increase the propensity of innovation agents to collaborate.

## 5.2 Knowledge supply and its funding

The capacity of the NIS to generate knowledge in Ukraine can be roughly approximated by human capital. There are 134,700 employees in R&D organizations (of which there were 1,255 in 2011), more than half of which are researchers.[69] The share of innovative products in total industry sales revenues has declined over time, standing at only 3.8% in 2011. There is

[68] For an introductory methodology and recommendations for evaluation of industry-science collaboration (linkages) and related measures see e.g. European Commission (2012): Evaluation of innovation activities (Guidance on methods and practices), http://goo.gl/37Eea.

[69] Analytical Reference: Status of science and technology and results of scientific, technical, innovation and technology transfer in 2011, State Agency for Science, Innovation and Informatization of Ukraine / Ukrainian Institute of Scientific-Technical and Economic Information, Kiev, 2012, p.7 and figure 1.4. Original: Ukrainian.

no systematic information available on actual technology transfer or on the commercialization potential of the academic sector in Ukraine, and we must instead rely on illustrative examples in the academic sector. No specific supporting measures for technology transfer and commercialization are available in Ukraine. This deficit can be illustrated in detail, e.g. by the lists of requirements presented both by various stakeholder groups and in analytical papers.[70]

The sectoral structure (as well as funding distribution) in 2011 showed the dominant role of branch institutes (52% of all R&D organizations), with the remainder being accounted for by academic institutes (29%), higher education institutes / universities (14%) and businesses (5%).[71] In terms of overall funding of the scientific domain, there was a sharp decline in extrabudgetary funding throughout the 1990s and early 2000s, leading to an increased reliance on the state budget.[72] Over recent years, the share of scientific domain financed by the state budget has fluctuated between a third and a half of total funding (Table 14), and stood at 40.5% in 2011. The structure of extrabudgetary funding has shifted over time in favour of foreign customers (from 36.5% in 2005 to 43.4% in 2011), while the share of domestic customers has declined (from 48.7% to 40.1%, respectively). The share of own funds increased slightly, but remains low (14.8% in 2011).

**Table 14. Budgetary and extrabudgetary funding of the Ukrainian scientific domain, UAH m.**

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|
| **Total funding of the scientific domain** | **5,163.5** | **5,167.5** | **6,150.9** | **8,021.4** | **7,815.5** | **8,653.1** | **9,586.4** |
| Extrabudgetary funds | 3,449.2 | 3,147.0 | 3,333.8 | 4,115.0 | 4,423.6 | 5,070.7 | 5,703.9 |
| per cent of total | 66.8% | 60.9% | 54.2% | 51.3% | 56.6% | 58.6% | 59.5% |
| *Of which* | | | | | | | |
| Own funds | 338.5 | 462.7 | 521.1 | 592.5 | 629.4 | 872.0 | 841.8 |
| Funds from domestic customers | 1,680.1 | 1,563.3 | 1,725.8 | 2,072.2 | 1,870.8 | 1,961.1 | 2,285.9 |
| Funds from foreign customers | 1,258.0 | 1,000.9 | 978.7 | 1,254.9 | 1,743.4 | 2,315.9 | 2,478.0 |
| Other funds | 172.6 | 120.1 | 108.2 | 195.4 | 180.0 | 121.6 | 98.2 |

*Source:* Table 1.4, Analytical Reference: Status of science and technology in 2011, Kiev (2012), adapted.
*Note:* Figures in table are expressed in current as opposed to constant prices, meaning shares of total funding are more informative than absolute levels.

On aggregate, the increasing shares of domestic and (especially) foreign customers in the financing of the Ukrainian scientific domain may indicate growing demand for knowledge production. Domestic customers consist largely of businesses. However, the financing structure differs markedly in individual institutional sectors (Table 15). Academy and

[70] Recommendation V, International Forum on Technology Transfer and Innovation: Business, Government, Regions, 15-16 December 2011. Original: Ukrainian. Extensive recommendations are addressed to the Parliament and Government, ranging from active innovation policy and innovation system development and improved physical and human capacities, to specific support for technology infrastructure and R&D activities, including tax and customs incentives and starting capital (particularly for SMEs).
[71] Page 7, Statistical Yearbook: Research and Innovation in Ukraine 2011, Kiev (2012).
[72] Figure 1.10, Statistical Yearbook: Research and Innovation in Ukraine 2011, Kiev (2012).

university science depends largely on state budgetary funds (84.9% and 70.7%, respectively), while branch research is financed mainly by domestic and foreign customers (jointly accounting for 77% of financing), and business research from own resources (46.2%) and foreign customers (38.9%). University science also receives a significant share of its financing from domestic customers (20.4%), while the academies receive only a small share of scientific funding from external domestic and foreign demand (6.4% and 3.4%, respectively).

**Table 15. Structure of funding of the Ukrainian scientific domain, per cent, 2011**

| | Total | Academic | Branch | University | Business |
|---|---|---|---|---|---|
| State budget | 40.5 | 84.9 | 15.8 | 70.7 | 7.9 |
| Own funds | 8.8 | 4.7 | 5.9 | 2.0 | 46.2 |
| Funds from domestic customers | 23.8 | 6.4 | 37.4 | 20.4 | 6.4 |
| Funds from foreign customers | 25.8 | 3.4 | 39.6 | 4.2 | 38.9 |
| Other funds | 1.1 | 0.6 | 1.3 | 2.7 | 0.6 |
| **Total** | **100** | **100** | **100** | **100** | **100** |

*Source:* Figure 1.12, Analytical Reference: Status of science and technology in 2011, Kiev (2012).

The distribution of R&D funding between branch institutes (roughly half), academic institutes (around one third), higher education institutes (around 7%) and businesses (around 9%) broadly reflects the sectoral structure at the aggregate level, although with significant differences between fundamental research, applied research and development work (Table 16). The strongest player in domestic fundamental research is traditionally academic science (85.1% of funding in 2011), while in the case of applied research the shares of academic science and branch institutes are roughly comparable (45.4% and 41.1%, respectively). The branch institutes prevail in development of applications (75.9%). The structure of knowledge supply *within* the individual institutional sectors shows that applicability differs more markedly: 64% of the funding of the academies is for fundamental research, 28% for applied research and only 8% for development work. In the branch institutes, 98% of funding is for development, with almost none for fundamental or applied research. The higher education sector has a more evenly distributed funding structure: 39% fundamental research, 44% applied research, and 18% development works.

**Table 16. Financing of R&D by activity and institutional sector (UAH m., %, 2011)**

| | | Academic | Branch institutes | University | Business | Total |
|---|---|---|---|---|---|---|
| Fundamental | UAH m | 1,871.8 | 113.5 | 215.4 | 0 | 2,200.8 |
| | % | 85.1 | 5.1 | 9.8 | 0 | 100 |
| Applied | UAH m | 822.8 | 745.0 | 245.5 | 0 | 1,813.9 |
| | % | 45.4 | 41.1 | 13.5 | 0 | 100 |
| Development | UAH m | 223.6 | 3,414.1 | 98.4 | 762.5 | 4,498.7 |
| | % | 5.0 | 75.9 | 2.2 | 16.9 | 100 |
| **Total** | **UAH m** | **2,918.2** | **4,272.6** | **559.3** | **762.5** | **8,513.4** |
| | **%** | **34.3** | **50.2** | **6.6** | **9.0** | **100** |

*Source:* Table 1.5, Analytical Reference: Status of science and technology in 2011, Kiev (2012), adapted.

In relation to the structure of funding of individual types of research, the share of state budget resources is one potential indicator of the degree of influence of state R&D policy, standing at 41.4% overall. However, examining at a more disaggregated level reveals significant differences: 93.4% of fundamental research funding is by the State, 55.1% of applied research, and only 10.3% of development works (Table 17). As a result of these differing intensities of public support for R&D, the majority of budget financing goes to fundamental research, with smaller shares to applied research and development works (58.5%, 28.3% and 13.2%, respectively, in 2011).

**Table 17. State funding of R&D by activity (UAH m., %, 2011)**

| | | Fundamental | Applied | Development | Total |
|---|---|---|---|---|---|
| State funding | UAH m | 2,063.8 | 999.6 | 465.2 | 3,528.6 |
| | % | 58.5 | 28.3 | 13.2 | 100 |
| Total funding | UAH m | 2,208.8 | 1,813.9 | 4,498.7 | 8,513.4 |
| *of which state* | % | 93.4 | 55.1 | 10.3 | 41.4 |

*Source:* Analytical Reference: Status of science and technology in 2011, Kiev (2012), p. 21, adapted.
*Note:* The total imputed in tables 16 and 17 (UAH 8,513.4 m.) is lower than total R&D figures quoted by the State Statistics Service of Ukraine for 2011, as the disaggregated figures here do not include scientific and technical services, which have grown strongly in recent years to reach UAH 1,291.5 m. in 2011.

Outcomes from Ukrainian R&D funding may be assessed according to various indicators, although these provide only limited information on economic impact. Of total R&D works (outputs) produced in 2011, 12.4% were classified as new products, 10.2% as new technologies and around 15% as new methods and theories. The largest share of output was classified as so-called other works (59%), largely comprising technology and legal documentation. An important indicator of the efficiency of state budgetary support to R&D activities is the degree to which scientific works are exploited. Since 2008, data on exploitation of scientific outputs during the first three years after their production have been gathered. The evidence shows the majority of outputs are exploited in the first year (on average 70%). Thereafter, the likelihood of exploitation declined significantly, to 30% in the second year (of those not exploited in the first year), and almost zero in the third year. In 2011, 60% of knowledge output financed by general budget funds was exploited (most of it in the categories of other works, and new methods and theories), and 77 % of outputs financed by special funds.[73]

## 5.3 Knowledge demand

Innovation activities in Ukraine are largely financed from internal resources (70% of innovative companies in 2011),[74] although their share of total innovation expenditure has declined since 2005 (from 87.7% in 2005 to 52.9% in 2010, Table 18). The share of state budgetary funds remains negligible, at around 1%. The structure of innovation expenditure is dominated by the purchase of machinery, equipment and software (73%), which contributes to technological catch-up. Internal R&D expenditure represents 5.8%, external R&D and other knowledge inputs 2.3% and 1.7%, respectively (UAH 246.6 million and

[73] Statistical Yearbook: Research and Innovation in Ukraine 2011, Kiev (2012), pp.28-34.
[74] *Ibid*, p.69.

UAH 324.7 million).[75] The structure of R&D expenditure was industry specific (medium to medium-low technology and resource intensive sectors), with internal R&D activities concentrated in the machinery and chemical industries, and demand for external R&D and other knowledge inputs in metallurgy and machine tools.

**Table 18. Expenditure on innovation activities in Ukraine (UAH m.)**

| | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|
| Total funding of innovation | 1,757.1 | 5,751.6 | 10,821.0 | 11,994.2 | 7,949.9 | 8,045.5 | 14,333.9 |
| *of which own resources (per cent)* | 79.6 | 87.7 | 73.7 | 60.6 | 65.0 | 59.3 | 52.9 |

*Source:* Analytical Reference: Status of science and technology in 2011, Kiev (2012), p. 69, adapted.
*Note:* Expenditures are expressed in current as opposed to constant prices.

The share of innovative products in total sales has been low in Ukraine and declining (from 9.4% in 2000 to 3.8% of total industrial production in 2011). The industry structure of innovation production is again concentrated in the traditional (machinery) and resource-intensive sectors (fuels and metallurgy), which together represent more than 75%. Of total innovation production in 2011, 59% was new to the company and 41% new to the market. The effectiveness of innovation expenditure is measured by the ratio of innovation production (in 2011 the coefficient was 3.0 compared to 5.0 in 2006, however, the values vary markedly from industry to industry).[76] Almost 30% of innovation production in 2011 was exported, although this ratio had peaked at 52% in 2006, and has since declined. [77]

## 5.4 Intellectual property rights

The current state of the intellectual property rights system (IPRs) in Ukraine, in terms of its legislative framework and performance, is presented in the Annual Report of the State Intellectual Property Service (SIPS 2012). The national IPR legislation has been adapted to European standards, including through legal amendments submitted to the Parliament (Verkhovna Rada) in 2011. The Law "On state regulation of activities in the field of technology transfer", passed in October 2012 and discussed in greater detail in section 5.6, also seeks to improve framework conditions for the commercialization of research results by permitting knowledge-producing organizations to pursue ownership of an invention and other intellectual property resulting from research funded fully or partly from state budgetary resources. The effects of these recent changes remain difficult to evaluate at present.[78] One of the priorities of the SIPS includes the use of electronic tools in its activities, including electronic publications and online databases of IPRs granted.[79] Training and development of

[75] *Ibid*, page 72.
[76] *Ibid*, page 75.
[77] *Ibid*, pages73-76.
[78] P. V. Soloshenko and A. Z. Shaikhatdinov (2011), The system of state management of intellectual property in Ukraine. Theoretical and practical aspects of the economy and intellectual property, UDC 347.778:346.
[79] The Conception of the Development of the State System of IPRs Protection for 2009-2014 and Programme of the Development of the State System of IPRs Protection for 2010-2014 define the long-term information tasks of SIPS and the Ukrainian Industrial Property Institute (UIPI), especially Patent Information Base for Examination

experts and knowledge dissemination on intellectual property issues are another priority. The SIPS certifies patent attorneys (intellectual property representatives), [80] provides training to experts and carries out activities to disseminate knowledge on intellectual property issues.

Applications and grants in all IPR categories except utility models have declined relative to 2007, although they have since begun to recover (Table 19). In the case of patent applications, almost half were filed by foreign applicants in 2011 (mostly from the USA, followed by Germany and France), and more than half of patents granted were to foreign applicants (their share increased from 35% in 2007 to 53% in 2011).

**Table 19. IPR applications filed and patents granted**

| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Patent applications | 6,163 | 5,697 | 4,816 | 5,311 | 5,256 |
| Patents granted | 4,058 | 3,832 | 4,002 | 3,874 | 4,061 |
| *- to domestic applicants* | *2,618* | *2,399* | *2,395* | *2,034* | *1,902* |
| Utility models (applications filed) | 8,870 | 9,600 | 9,208 | 10,678 | 10,427 |
| Industrial designs | 2,147 | 2,285 | 1,669 | 1,686 | 1,761 |
| Trade marks and service marks | 33,266 | 33,083 | 26,479 | 28,577 | 29,756 |

*Source:* SIPS (2012), pp.8-9.

In terms of field of specialization, the leading fields for foreign applications are organic chemistry, followed by medical or veterinary science, and agriculture. The domestic field specialization differs somewhat and presents a less concentrated structure, although with significant numbers of patent applications in medical or veterinary sciences, measuring and testing and agriculture.[81]

Utility models are much more frequently used for domestic intellectual property protection, with the share of foreign applicants being negligible. The field specialization structure resembles that of invention applications, with the largest share for medical or veterinary sciences, followed by measuring and testing, and agriculture. The largest group of IPRs is represented by trademarks, mostly related to business service activities.

The patent applications and grants themselves do not indicate their economic value, although contracts on disposition of economic industrial property rights in the state registers may provide some indication. At the beginning of 2012, there were almost 17,300 such contracts registered, of which 19% concerned patents (compared to only 8% in 2011) and 70% trademarks (81% in 2011). The remainder were divided between utility models and industrial designs. In terms of contract types, the numbers of exclusive and non-exclusive licenses for

Purposes (of patent applications). SIPS regularly publishes official bulletins on Industrial Property ("Promyslova Vlasnist") and Inventions in Ukraine ("Vynakhody v Ukraini").

[80] As at end 2011, there were 375 registered patent attorneys in Ukraine. A course on intellectual property (on average 54 hours) is taught in higher education institutions in master and specialist programmes, and 15 HEIs were licensed to conduct education in the specialization of intellectual property. Two institutions are licensed for skill upgrading of specialists in the field (around 500 students per year in total).

[81] SIPS (2012), page 10.

the exploitation of IPRs have been negligible (9 in 2011), while the assignment of IPRs (123 in 2011) and so-called "licenses of right" (36 in 2011) are more significant. However, the reported scale of IPR dispositions is very small, compared to patenting activity itself (Table 20).

**Table 20. Distribution of registered contracts on disposition of economic industrial property rights, by category, 2010-2011**

| | Inventions | Utility models | Designs | Trademarks | Total |
|---|---|---|---|---|---|
| Non-exclusive licenses | 13 | 24 | 7 | 248 | 292 |
| Exclusive licenses | 5 | 18 | 3 | 110 | 136 |
| Assignment of right | 198 | 127 | 156 | 2,741 | 3,222 |
| Licences of right | 175 | 164 | 0 | 0 | 339 |
| **Total** | **391** | **333** | **166** | **3,104** | **3,994** |

*Source:* SIPS (2012), page 19, adapted.

## 5.5 The evaluation of industry-science linkages

Detailed statistics are available only for knowledge activities and outputs financed by state budgetary funds, providing an incomplete picture of the situation. It seems that a large segment of innovation actors and their external knowledge linkages is not or is only partially included in these information resources (especially business sector and branch institutes), as well as the informal activities and linkages of budgetary innovation actors.

The same information limitation applies to the innovation outputs, as the patent office (SIPS), understandably, deals only with the knowledge outputs protected formally by IPRs. As experience in developed economies shows, only a small share of innovations is protected through patent offices. At the same time, the number of patents does not in itself reflect their economic benefit, which is especially true in relation to the activities of the academic sector. In this regard, the number of foreign patents is more informative, as applications take place only when the probability of commercial benefits is sufficiently high. The number of foreign patents in Ukraine remains low, as in other less knowledge-intensive countries, considered as those economies with low R&D expenditure as a share of GDP.

Based on the information available, the Ukrainian R&D sector consists of two key players – academic science and branch institutes. Their orientation is completely different. The first segment traditionally concentrates on fundamental and applied research. While the reasons for the limited application of its results are partly country specific, similar examples may be found in all innovation systems. Branch institutes, which in practice receive little budgetary support in comparison to academic science, directly target the application of knowledge, while their role in knowledge production is low.

These two contrasting missions largely reflect the historical positions of these two players, when they were linked in what was conceived as a traditional (linear) innovation process. The academic institutes produced knowledge outputs, of which those with application potential were developed by the branch institutes for exploitation in companies. The problem in the system was its technology push nature, i.e. the academic sector remained distant from

companies, and branch institutes had a tendency to minimize or avoid the risks of developing more innovative knowledge outputs. Consequently, the knowledge intensity of the ISLs was low.

In any case, the branch institutes remain an important part of the NIS in Ukraine. As they crucially depend on external, non-budgetary financing, their external linkages are of vital importance, and must also bring adequate benefits to their customers. The knowledge intensity of their activities is likely to be rather low in terms of R&D content, but this can be viewed as a reflection of the general level of knowledge intensity in the Ukrainian economy. In terms of ISLs, branch institutes could play a potential role as technology brokers, thanks to their closeness to technological knowledge and its application.

A key question is the degree to which the customers of branch institutes are fixed, i.e. consist of relatively small groups of entities (businesses) which outsource some of their activities to these branch institutes, and to what extent the activities are of a routine nature. In such a case, the innovation capacity of branch institutes, i.e. knowledge production and its implementation, would in fact be limited to largely routine, technical tasks for a limited network of business customers. This would imply negligible or nonexistent capacities for technology brokering, which would also be difficult to develop.

With the exception of the largest universities, the role of higher education institutions (HEIs) in knowledge production and application in Ukraine remains limited, although other HEIs may have developed informal knowledge linkages with domestic customers. [82] The educational activities of HEIs represent both an advantage and a disadvantage in terms of the development of ISLs. One such advantage includes availability of R&D resources not financed from the public budget, i.e. from enterprises (both private and state-owned), which gives HEIs more space to develop ISLs, where such capacities exist. Development of such linkages requires infrastructure in the HEI itself to support staff that are fully or partially released from teaching activities. Such staff can use their capacity largely for research, while making use of the available student potential. At the same time, such knowledge producers at HEIs are considered responsible for the exploitation of their R&D output results, and therefore for increasing the resources available for further capacity development. The leading figures at HEIs, such as heads of department or institute, typically fulfil the role of technology broker, largely without specialized training. The external knowledge linkages are very much based on individual initiative and active networking in related fields, such as public presentations of projects.

The type of customer for knowledge outputs is a key factor. Domestic customers can be numerous but usually have limited and unstable resources, while foreign customers tend to be bigger, more knowledge intensive and with a longer-term perspective. However, HEIs are still considered to be predominantly educational institutions, i.e. the R&D activities do not receive sufficient strategic support, and tend to be viewed rather as by-products. This is not entirely negative, with low expectations of HEIs as knowledge producers meaning greater flexibility,

[82] See, for instance: T. B. Karabash, T. M. Matyashova and K. V. Makhmudova (2011), On the issue of improving the efficiency of university research. Theoretical and practical aspects of the economy and intellectual property rights, UDC 347.77:378. Original: Ukrainian; and Z. V. Frolov (2011), Higher educational problems of commercialization of intellectual property. Theoretical and practical aspects of the economy and intellectual property rights, UDC 330.341.1. Original: Russian.

and that any additional outcomes are viewed as a success. Moreover, the HEI segment is very heterogeneous in terms of the knowledge intensity of their outputs and their distance from market exploitation, and consequently, in the nature of their external linkages.

Several distinct types of HEIs can be identified. The first resembles the traditional academic approach to scientific work (technology push). It produces knowledge output which is generally removed from market exploitation, close to fundamental research and largely motivated by academic objectives, e.g. publication in academic journals. A second group produces research of an applied nature, or at least with potential for application, for which it seeks market opportunities. Within this group, it is possible to differentiate further those who actively seek customers to increase the revenues accruing to their institution. Their knowledge production is therefore partly influenced by knowledge demand. However, such activities typically lack systemic support for related aspects of knowledge exploitation, such as transfer offices and administrative support for intellectual property protection. Uncertain external knowledge demand requires active efforts to secure customers, while income per individual project is on average low. This group would require a more stable source of demand for at least part of its R&D activities, coming from large, knowledge-intensive companies or innovative public demand in cases where private demand does not exist.

The third group deals largely with developmental work, i.e. elaborates specific solutions for external customer assignments on a commercial basis. The knowledge content is usually low and there is a tendency to perform tasks on a non-institutional basis, i.e. through individual contracts between researchers and customers, either with or without explicit approval by the related authorities. In this case, technology transfer and commercialization activities are not necessary, but may deliver greater benefit to the knowledge producer, e.g. by securing IPR enforceability where they have adequate expertise in this field.

As for academic scientific institutes, their position is the most complex and challenging in terms of improving ISLs. Their funding depends on the state budget and their outputs are mostly fundamental research works for which there is low domestic demand due to the limited technology intensity of domestic production. Their capacity to penetrate foreign markets is limited, as well as their ability to adjust to, or even explore, domestic demand possibilities. State funding is largely absorbed by personnel and overhead costs, while there are very limited resources for scientific equipment and instruments.[83] However, there are important differences among individual institutes in terms of their technology transfer and commercialization activities and, consequently, their capacity to raise external, extrabudgetary funding.[84]

Two groups of institutes can be differentiated – those with and those without commercialization and technology transfer activities.[85] The commercialization capacity of

[83] In 2011, 70% of expenditure related to personnel costs, 26% to overheads, and 4% to scientific equipment and instruments – see National Academy of Sciences of Ukraine: Summary Annual Report for 2011, Kiev, 2012.
[84] For a detailed overview based on a field research see for instance V. Yu. Griga (2010), Theoretical and practical aspects of the scientific results of the NAS in the Ukrainian economy (second revised edition), Centre for Scientific and Technological Potential and History of Science, named after H. M. Dobrova, NAS Ukraine, Kiev. Original: Ukrainian.
[85] Comparative analysis by P.M. Tsybuljov, 2008-2010: Commercialization of scientific research outputs at the institutes of the National Academy of Sciences of Ukraine. Assessment against the following criteria: academic staff number; financing structure; start-ups; patenting and licensing; interaction with industrial enterprises;

some academic institutes is supported by technology transfer teams. The members of these teams have received some training on issues such as commercialization of knowledge outputs and IPR management, establishment of spin-off or joint venture companies and other related topics.

In principle, academic institutes do consider external linkages to be important, although the economic exploitation of knowledge is not generally a strong priority. Statistical indicators show the number of so-called business contracts increasing annually up to 5,200 in 2008,[86] although this was a pre-crisis year, and numbers are typically somewhat lower. In spite of the relatively high numbers of such contracts, actual economic benefits remain low, as they mostly do not generate revenues from licenses, manufacturing or sales of products based on internally developed knowledge outputs. Experts working in these organizations consider that the only way to diversify academic funding sources is the sale of intellectual property or its exploitation through joint production of goods or services, via spin-offs, start-ups or joint ventures. Exploring these options would require support by the relevant institutions and accompanying legal and capacity-building measures.

### Box 2. Methodology for the evaluation of industry-science linkages

There has been extensive work at the EU level on the methodology and recommendations for evaluation of science-industry collaboration (linkages) and related measures.[i] Evaluation follows the stages of the impact value chain. Evaluation questions and indicators focus on four key aspects:

- Concrete RDI production (outputs) of organizations (institutes and businesses);
- Changes to collaborative practices and behaviour;
- Improvements in RDI management through learning within collaborative projects; and
- Economic effects of collaboration.

More specifically, **inputs** are to include grants and financial instruments, loans for infrastructure investments, advisory services, cluster management, intermediaries, types of collaborating innovation agents and their cooperation patterns, framework and specific conditions for collaboration, technology transfer and commercialization (incentive schemes, IPR arrangements), demand for collaboration and its intensity and extent, and policy incentives for collaboration. **Outputs** include increased RDI investment from collaboration (additional RDI expenditure funded by company involved), newly established or extended networks and centres, joint projects of scientists and engineers, joint innovative, marketing and export activities. **Results** can be evaluated as increased number and/or quality of patents/co-publications, prototypes developed, new products or services, increased number and/or quality of patents/co-publications, prototypes developed, new products or services, enhanced capacity for the project management of collaboration (RDI management practices

organizational structure in the context of technology transfers; information resources; internal regulations governing activities associated with commercialization of scientific research outputs; and availability of a team dealing with technology transfer and commercialization.

[86] Section 2, Annual Report of the National Academy of Sciences of Ukraine for 2008, Kiev, 2009. Original: Ukrainian.

**Box 2. Methodology for the evaluation of industry-science linkages *(continued)***

or change of orientation towards applied research), enhanced capacity to jointly develop products and services, enhanced innovation management capacities of companies (newly adopted practices, business models, recruitment patterns), revenue from contract research, technological services, knowledge transfer. **Impacts** include sales of innovative products or services, share of knowledge intensive activities sustained increase in RDI investment in companies involved in collaboration, increased share of private RDI funding, sustained change in type and frequency of collaboration, and increased (intersectoral) personnel mobility.

[1] See, for example, European Commission (2012): Evaluation of innovation activities: Guidance on methods and practices.

## 5.6 Technology transfer and commercialization capacity

With regard to framework conditions, technology transfer legislation in Ukraine was amended in 2012 through changes to the Law "On state regulation of activities in the field of technology transfer", [87] reflecting demands from research institutes, universities and companies. The changes are generally aimed at intensifying activities in technology transfer and creating better legal conditions for the commercialization of research results. Specifically, the new law (in line with Bayh-Dole type legislation) [88] permits knowledge-producing organizations to pursue ownership of an invention and other intellectual property resulting from research funded fully or partly from state budgetary resources. Research organizations are therefore encouraged to collaborate with the business sector thanks to commercial incentives and to utilize inventions arising from budgetary funding, as well as being expected to file patents for inventions over which they claim ownership and to give preference for licensing to businesses. The knowledge producing organizations can receive revenues for the commercialization of their research results and use them for innovation activities. While restrictions may apply in certain situations, namely technology and/or its components that were created by the state budget and referred to as state secret and in other cases specified by law, [89] after informing the responsible public authority, knowledge producers should be informed within two months if property rights will be restricted, after which knowledge producers may assume that no restrictions apply. The law also changes the rules for evaluation expertise in relation to technologies purchased on behalf of the state, so that new technologies to be purchased by the State should be subject to an expert evaluation. There is a broad similarity with the spirit of the special Law on KPI Science Park (2006), which has

[87] Draft Law on Amendments to the Law of Ukraine "On state regulation of activities in the field of technology transfer", No. 5407-VI, approved by the Parliament 2 October 2012.

[88] Patent ownership is seen as a way to encourage the additional and often substantial investment necessary for new goods and services, particularly in the case of small businesses. A university's possession of title to inventions is expected to provide motivation to license the technology to the private sector for commercialization in anticipation of royalty payments.

[89] Article 11 specifies conditions upon which the responsible state authority (not always the funding agency) can withhold property rights for the newly developed technology or the part which used state funding in cases of: links to state security and defence; exploitation of results in the public interest; and implementation of the technology in final production exclusively with state budget funding. When property rights are completely restricted, disposal of the property right is a decision resting with the responsible authority.

seen the creation of a successful science park at the National Technical University "Kyiv Polytechnic Institute" (Chapter 3).

The recent legal amendments regarding the ownership of R&D results can be considered a key systemic transformation. The law is to reduce the distance between scientific and technological developments and implementation of the results into production, and to motivate businesses to invest in developing new technologies.[90] Two aspects are decisive for successful implementation of new legislation. Firstly, all necessary changes in related legal acts must be fully actioned. Moreover, clear rules for relations between individual researchers (as knowledge producers) and their organizations must be applied, possibly with sufficient space for manoeuvre to reflect the specificities of individual parties. Secondly, the capacities of knowledge-producing organizations for technology transfer and commercialization activities must be systematically developed and strengthened to maximize the potential benefits of acquired intellectual property rights (Box 3). Research organizations generally lack the means of production required to take the research results and generate marketable products. Such activities are carried out by industry. Thus, the emphasis on the promotion of cooperative efforts between academia and the business community remains crucial.

### Box 3. Capacity-building for technology transfer

**Internal capacities** include specialized staff and services for assessing disclosed inventions, patenting, licensing, and developing and funding spin-offs (firms established on the basis of formal knowledge transfer from a knowledge-based organization) and other start-ups (new firms established involving the organization's staff or students), but also for proactively approaching firms for contract-based arrangements (projects and transfer deals). **Funding** of technology transfer and commercialization activities must be provided by public or other external resources given extremely limited research and innovation budgets, particularly in the case of academic institutes. Prospectively, transfer activities can also draw upon a mix of funds resulting from the commercialization of knowledge, namely a share of the capital gains on spin out equity participation, a portion of the net royalty on licensed technology, or an overhead on collaborative research agreements. **Internal functions** of a transfer office (TO) must be developed in close relation with its parental knowledge organization. Transfer and commercialization activities are considered as the key operations, proactively searching for opportunities and supporting relationships with third parties with potential revenue benefits. The TO also assists researchers in the management of their research contracts, and is their primary source of service and assistance in relation to IP-related issues. **External functions** of transfer offices develop in relation with different industry, business and community actors (large companies, including multinationals, SMEs, entrepreneurs, NGOs, non-profits, potential individual investors and other stakeholders) to identify opportunities for co-production activities (research agreements, consulting) and circulation of produced knowledge assets (patents, licenses). In developing technology transfer through entrepreneurship, the TO may play a passive role that is limited to providing referrals to assist in the start-up process, or an active one by becoming involved in the development of the business plan, setting up the company, arranging initial seed financing, recruiting a management team, and securing first round venture funding.

[90] "The new Law on Technology Transfer will contribute to technological modernization of the economy", Press Service of the State Agency for Science, Innovation and Informatization, 6 November 2012. Original: Ukrainian.

## 5.7 Recommendations

A systemic evaluation of the current system of practices regarding industry-science linkages (ISLs) is the starting point to identify barriers and opportunities, understand the impact of actions and measure changes over time. This comprehensive evaluation, which should be considered a learning rather than a judging process, is still lacking.

*Recommendation 5.1*

*In order to gain the necessary knowledge to design effective policy interventions and facilitate the activities of innovation stakeholders, the authorities should promote a comprehensive evaluation of ISLs. The following principles should be observed:*

- *The evaluation should be internal (at the level of key organizations) and external, carried out on a periodic basis and the results widely disseminated, so innovation stakeholders can assess their relative position within the system and the effectiveness of supporting policy measures; and*
- *The results of the evaluation should provide the rationale for future policy changes, so these are understood by innovation stakeholders and a shared vision of future direction can emerge.*

The commercialization of academic research faces up-front costs and requires development of a complex range of skills, which are expensive to acquire. Given the uncertainty of the expected returns and the financial constraints faced by these academic organizations, public support is required to overcome these difficulties.

*Recommendation 5.2*

*The creation of dedicated institutional structures to support research commercialization is necessary to address the challenges faced by research organizations trying to commercialize their outputs. Given the limited innovation budgets of these organizations, public funding of technology transfer and commercialization activities is needed, as significant time is required before these activities can generate a profit. The authorities could consider:*

- *Granting subsidies for research commercialization activities. These could take the form of knowledge transfer grants or be provided as a small share of total research budgets;*
- *Subsidizing the costs of obtaining patent and other forms of intellectual property rights protection, or allow grant recipients to use research funds to pay for IP-related costs;*
- *Providing training to technology transfer offices, in particular on a variety of IP-related issues, including patent application, copyright and industrial design registration, and the negotiation of licensing contracts with companies; and*
- *Facilitating access to legal and patent services providers when these functions are outsourced.*

The collaboration between science and business is hampered by the lack of information on opportunities and the high costs faced by organizations in the search for partnerships. The involvement of the public sector can facilitate the coordination of private initiatives and encourage closer links between industry and research.

*Recommendation 5.3*

*The authorities should actively promote collaboration measures between different innovation actors, seeking permanent changes in their behaviour. The scope of public intervention could, involve varying resource commitments and target different areas, including:*

- *Strategic collaboration between different organizations, where a condition for funding is that both science and industry stakeholders are involved. This type of intervention may target a key technology or promote centres of excellence that support the development of joint research structures between firms and industry;*
- *Cluster-based interventions, which aim to strengthen linkages between start-ups, companies, and research organizations in a particular sector or region. Support measures may include funding for joint projects or the improvement of framework conditions, including physical infrastructure, human capital and internationalization platforms;*
- *Development of matchmaking and other intermediary services; and*
- *Platforms for interaction between research organizations and providers of finance and business, through information services, exhibitions and supporting the formation of networks (see recommendation 6.3).*

Small-scale projects that aim to encourage relations between industry and science with limited resource requirements but potentially large demonstration effects are particularly appropriate in Ukraine, given financial constraints and governance challenges. Innovation vouchers are a useful instrument, given the limited administrative burden involved in their administration and their ability to target SMEs.

*Recommendation 5.4*

*The authorities could address weak collaboration between the science sector and small companies with the introduction of a voucher scheme, which should target small and medium sized enterprises that have difficulties in accessing external expertise, or which do not consider such expertise as sufficiently beneficial in the short term. Vouchers for the purchase of innovative solutions to SME problems should be allocated on the basis of the following principles:*

- *Simple and clear eligibility criteria for companies to participate;*
- *Selection rules to deal with the possibility that the number of applications is higher than available vouchers should be very specific. To simplify administration, a lottery system could be considered;*

- *Reporting requirements to both the company demanding the services and the research organization providing them should be minimal;*
- *Support to cooperation through the pooling of vouchers between different companies on larger innovation projects; and*
- *Non-technological forms of innovation (e.g. organizational, marketing, management, etc.) could also be considered as services that can be purchased by a voucher.*

# *Chapter 6*

# *FINANCING INNOVATIVE ENTREPRENEURS*

This chapter discusses the framework conditions for entrepreneurship in Ukraine, the challenges in raising finance and the main support measures. The first section outlines basic concepts used to classify entrepreneurial activities, and covers experiences from transition countries and Ukraine, respectively. The following sections consider the level of development of the financial system in Ukraine, which is analyzed firstly by discussing innovation financing, secondly by an overview of the banking system and its role in financing innovation and thirdly by an in-depth examination of the role public and private institutions, and the programmes they operate to foster innovation and entrepreneurship in Ukraine.

## 6.1 Innovative entrepreneurship in Ukraine

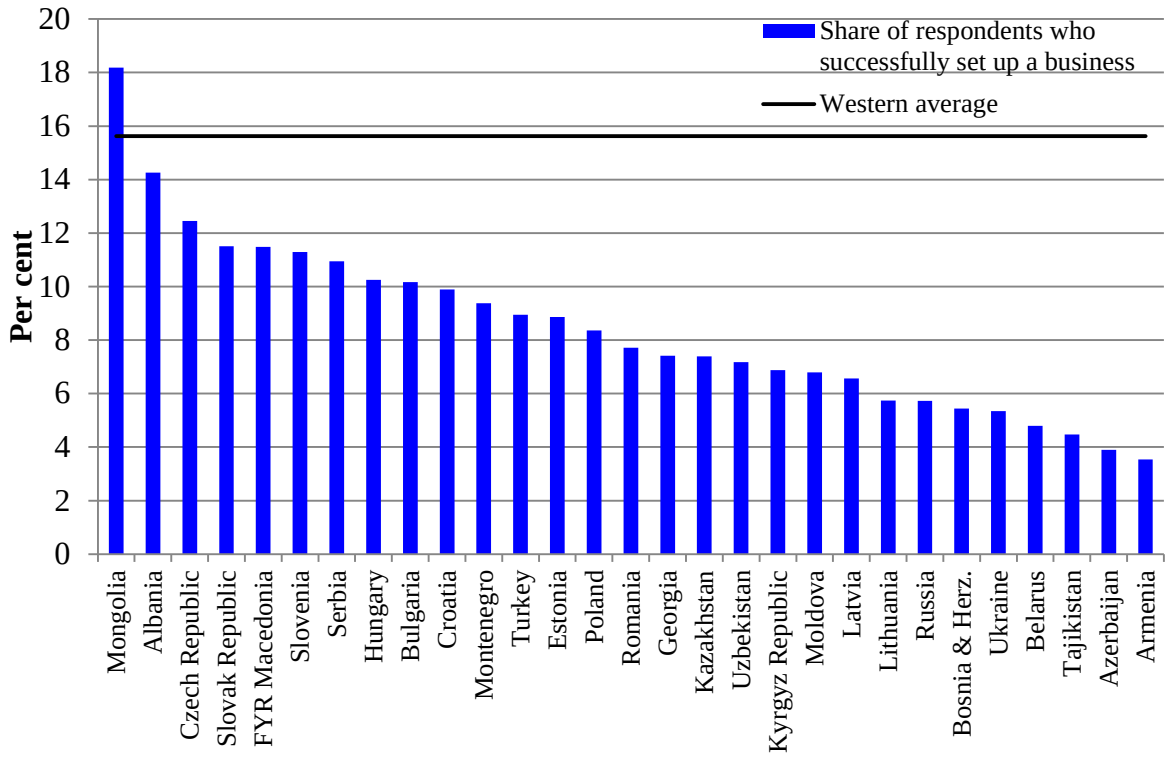
Entrepreneurs are particularly important during transition, being expected to drive development of the domestic private sector and complement privatized and state-owned companies and subsidiaries of multinationals. During the early years of transition, entrepreneurs were faced with uncertainty, rapidly changing business environments and institutional deficiencies. In some countries, framework conditions have improved somewhat, but the environment remains difficult for start-ups. Elsewhere, the environment is so challenging that the survival rate of entrepreneurs is at best modest.

The incidence of successful business start-ups is driven by two factors: the proportion of the population attempting a start-up, and their likelihood of success. While the percentage of individuals starting an enterprise in the region's transition countries does not differ significantly from advanced economies, the likelihood of success is markedly lower. The result is a generally lower incidence of successful start-ups in transition countries when compared to a Western European average of almost 16%. In Ukraine, only around 5% of all respondents reported having successfully set up a business, ranking 25$^{th}$ among 29 countries (Figure 17). This is largely driven by low probability of success, as Ukraine compares more favourably in terms of "percentage of persons that ever tried" to set up a business.[91]

This low probability of success for start-ups is a reason for the low share of SMEs in Ukraine, where only around 86% of companies are classified as SMEs.[92] This translates as 7.3 SMEs per 1,000 people, which is higher than in Belarus (2.5) or Kazakhstan (3.4), but far lower than in Poland (43.3) or Germany (38.3). There is thus huge potential for SME development, increasing the number of companies and employment. However, when considering all official figures for SMEs in Ukraine, it must be considered that the Ukrainian legal framework leads to a greater tendency for entrepreneurs to register as individuals as opposed to companies, and so actual levels of successful "start-up" may be higher than statistics would suggest.

[91] E. Nikolova, R. Frantisek and D. Simroth (2012), Entrepreneurship in the transition region: an analysis based on the Life in Transition Survey, EBRD Working Paper No. 141, London.
[92] Micro, Small and Medium Enterprises Country Indicators, International Finance Corporation and McKinsey & Company, 2010.

**Figure 17. Successful business start-ups, share of respondents, per cent**




*Source:* Analysis by Nikolova, Ricka, and Simroth (2012) based on EBRD Life in Transition Survey (2011).
*Note:* Western comparator countries taken as France, Germany, Italy, Sweden and UK.

Deficiencies in the general business climate may be expected to impact to an even greater degree on SMEs and start-ups. Ukraine has made sustained efforts in this regard to climb 15 positions in the World Bank's "Doing Business 2013" rankings (benchmarked to June 2012), reaching 137$^{th}$ position out of 185 economies (Table 21). This was driven largely by improved procedures for starting a business, which is particularly relevant to start-ups. Factors that continue to constrain progress include dealing with construction permits (183$^{rd}$ position), getting electricity (166$^{th}$ position), paying taxes (165$^{th}$ position), resolving insolvency (157$^{th}$ position) and trading across borders (145$^{th}$ position). Of these factors, complexities in the tax code are likely to strongly impact upon start-ups and SMEs, who lack the necessary in-house expertise, with barriers to trading across borders also likely to impact more heavily on small businesses for similar reasons, and posing particular challenges for SMEs wishing to explore export possibilities.

Resolving insolvency is also an area of weakness, and given the high risk of failure, may act as a deterrent to potential entrepreneurs. On average, it takes 2.9 years to resolve insolvency (versus 2.4 years in Eastern Europe and Central Asia (EECA), and 1.7 years in OECD countries), with an average cost of 42% of the estate (versus 13% in EECA countries, and 9% in OECD countries). A low average recovery rate following insolvency of 8.7 cents in the dollar (36.9 cents EECA and 70.6 cents OECD) will also act as a deterrent to financiers, implying considerable risk for investors in the event of insolvency.

### Table 21. Ukraine's position in the World Bank "Doing Business" survey

| Topic | 2013 Ranking | 2012 Ranking | Change |
|---|---|---|---|
| Starting a Business | 50 | 116 | +66 |
| Dealing with Construction Permits | 183 | 182 | -1 |
| Getting Electricity | 166 | 170 | +4 |
| Registering Property | 149 | 168 | +19 |
| Getting Credit | 23 | 23 | 0 |
| Protecting Investors | 117 | 114 | -3 |
| Paying Taxes | 165 | 183 | +18 |
| Trading Across Borders | 145 | 144 | -1 |
| Enforcing Contracts | 42 | 44 | +2 |
| Resolving Insolvency | 157 | 158 | +1 |
| **Aggregate ranking** | **137** | **152** | **+15** |
| ***Total countries ranked*** | ***185*** | ***183*** | |

*Source:* World Bank, Doing Business 2013

Official statistics do not include activities in the informal sector, underestimating entrepreneurial activities. A comparative study of the Russian Federation, Ukraine and England found that 100%, 90% and 77%, respectively, of entrepreneurs surveyed conduct some or all of their transactions in the informal sector,[93] providing evidence of considerable participation in the informal economy in developed as well as transition economies. This does not necessarily mean that entrepreneurs operating in the informal sector are "necessity-driven"[94] – another potential explanation is that they are seeking greater autonomy, flexibility and freedom.[95] Improving general framework conditions for business would serve to reveal the true extent of entrepreneurship, while reducing the informal economy.

### Box 4. What is an entrepreneur?

There is no generally agreed typology of an entrepreneur. For some, entrepreneurs are born rather than made, possessing the necessary intuition, vigour, energy, persistence and self-esteem. However, few people fulfill such a characterization in practice, with entrepreneurs coming from diverse backgrounds. A working definition focused on the act of establishing an enterprise rather than personal characteristics sees them as "...persons that have started a business within a certain period of time – somewhere between 36 and 42 months ago.[i,ii]

The decision to start an enterprise is driven by a combination of the personal characteristics of the entrepreneur and interaction with his or her environment. The decision may be motivated by economic needs or by a desire for self-realization.

[93] C. C. Williams, Beyond necessity-driven versus opportunity-driven entrepreneurship: A study of informal entrepreneurs in England, Russia and Ukraine, The International Journal of Entrepreneurship and Innovation, Volume 9, Number 3, August 2008 , pp. 157-165(9).
[94] C. C. Williams, J. Round and P. Rodgers, Explaining the off-the-books enterprise culture of Ukraine: reluctant or willing entrepreneurs, International Journal of Entrepreneurship and Small Business, Vol. 10., No. 2, 2010.
[95] K. Gerxhani, The Informal Sector in Developed and Less Developed Countries: A Literature Survey, Public Choice, Springer, vol. 120(3_4), 2004.

**Box 4. What is an entrepreneur?**
***(continued)***

In many recent studies, this dichotomy is conceptualized as necessity versus opportunity driven entrepreneurship. Necessity driven entrepreneurs lack opportunities to earn income, while opportunity driven entrepreneurs exploit technological or market opportunities. Necessity driven entrepreneurs occur more frequently in less affluent regions and in the lower income brackets, with the opposite being the case for opportunity driven entrepreneurs. Empirical research finds evidence that the ratio of willing-to-reluctant entrepreneurs is greater in higher income countries, and that nations dominated by willing entrepreneurs have a lower rate of early-stage business failure, which has led to a tendency to favour the willing entrepreneur – the opportunity seeker – as the prime target of policy initiatives.[iii]

Framework conditions are also a decisive factor determining entrepreneurial activities in a country, including ease of doing business, access to finance, institutional set-up, rule of law and corruption. Unfavourable conditions raise costs, decrease the number of (successful) start-ups, and drive entrepreneurs wholly or partially into the informal sector. In countries with significant informal sectors, this is a key policy consideration.

[i] K. Gerxhani, The Informal Sector in Developed and Less Developed Countries: A Literature Survey, Public Choice, Springer, vol. 120(3_4), 2004.
[ii,iii] D. Smallbone and F. Welter, Conceptualising Entrepreneurship in a transition context, International Journal of Entrepreneurship and Small Business, Vol. 3, No. 2, 2006.

Entrepreneurship policy tends to focus on willing entrepreneurs at the expense of necessity driven start-ups, even more so where the latter operate in the informal economy. This approach has clear limitations. Despite the fact that entrepreneurship in transition countries is more often necessity driven than in advanced economies, evidence from Ukraine, Belarus and Moldova in the early 2000s showed the most common reasons for starting a business being "to increase income" (73%), "independence" (71%), and "personal fulfilment" (61%).[96] Only a minority referred to "unemployment" as a motivation for start-up. Other survey based studies of entrepreneurs have drawn similar conclusions.[97] A survey based on personal interviews of "off-the-books" entrepreneurs in Ukraine finds evidence that corroborates these findings. Interviewees initially gave largely necessity driven reasons for starting a business, but presented a more complex set of motivations once they moved beyond initial questioning. Under further investigation, few entrepreneurs identified as solely necessity (13%) or opportunity driven (7%), with 80% identifying as combination of the two (56% largely necessity driven, and 24% largely opportunity driven). While the motives for becoming an entrepreneur in the informal economy did not change for 43% of respondents, 47% switched over time from being necessity oriented to opportunity oriented entrepreneurs, with only 10% switching in the opposite direction to become necessity oriented.[98]

[96] D. Smallbone and F. Welter, Entrepreneurship in transition economies: necessity or opportunity driven?, June 2003.
[97] For example: R. Aidis, F. Welter, D. Smallbone and N. Isakova, Female entrepreneurship in transition economies: the case of Lithuania and Ukraine, Feminist Economics, Vol. 13, No. 2, 2006.
[98] C. C. Williams, J. Round and P. Rodgers (2010), Explaining the off-the-books enterprise culture of Ukraine: reluctant or willing entrepreneurs, International Journal of Entrepreneurship and Small Business, Vol. 10., No. 2.

The distinction between necessity and opportunity driven entrepreneurship is particularly relevant to innovation and technology diffusion. Opportunity driven entrepreneurs tend to have chosen self-employment as opposed to having no alternative, and seek to exploit market or technological opportunities by offering products and services that are new to the enterprise or market. This is the entry level for own innovative activities and/or contributing to technology diffusion. Following this line of reasoning and the empirical evidence, only 13% of "off-the-books" entrepreneurs are purely necessity driven in Ukraine, and so likely to be of limited relevance to innovation policy, with the large majority (87%) being solely, largely or partly opportunity driven. It may be expected that the share of opportunity driven entrepreneurs should be equally high or higher among registered entrepreneurs, suggesting a strong potential role in innovation driven growth, given appropriate supporting measures.

Taking account of the high level of entrepreneurship in the informal economy, the level of entrepreneurship is close to that of more advanced economies. Also, the strong presence of opportunity driven entrepreneurs suggests a sector that could benefit from improved framework conditions and support for investment and innovative activities. This would be advisable, given current low rates of success for entrepreneurs in Ukraine.

## 6.2 Financing innovative entrepreneurs

### *The role of the financial system*

There is a strong positive link between the functioning of financial systems and long-term growth. Financial systems and production structures co-evolve and thereby interact in many ways. Banks benefit directly from growth in the manufacturing and service sectors, while economies with better functioning financial systems tend to grow faster as external financing constraints impeding firm expansion are eased.[99] This is particularly important in the innovation context, given evidence that sectors that are more dependent on external finance grow faster in countries with well-developed financial systems.[100] There is a causal link between a high level of financial development and the degree of innovative development.[101]

Financial frictions are particularly detrimental for start-ups, SMEs and firms in the service sector, which face difficulties collateralizing investments and innovation activities.[102] These observations are of particular relevance for policymakers as the companies concerned would bring about structural change and operate in priority market segments.

In the context of catching-up countries and innovative performance, it has been frequently observed that foreign owned companies are more productive, i.e. closer to the technology

[99] See R. Levine, Finance and Growth: Theory and Evidence, Working Paper 10766, National Bureau of Economic Research, Cambridge MA, September 2004.
[100] See R. Rajan and L. Zingales (1998), "Financial dependence and growth", American Economic Review, 88: pp.559-586.
[101] See F. Jaumotte and N. Pain, From Ideas to Development: The Determinants of R&D and Patenting, OECD Economics Department Working Papers 457, OECD, Paris, 2005.
[102] D. Czarnitzki and H.L. Binz (2008), R&D Investment and Financing Constraints of Small and Medium-Sized Firm, ZEW Discussion Papers 08-047, ZEW – Zentrum für Europäische Wirtschaftsforschung / Center for European Economic Research, Mannheim.

frontier, than domestic companies.[103] Domestic companies invest less in modern production equipment and innovation, and so fail to emulate best practices and techniques. A firm's innovative activities are strongly influenced by financial frictions, and these particularly affect domestically owned firms that depend on the domestic financial system. Insufficient access to external finance caused by an underdeveloped financial system will not only hamper innovation, but also the second major channel for catch-up: export activities.

Access to external finance depends on the structure of the financial system, which is generally either bank- or equity-based. In developed countries, there has been a trend towards strengthening equity-based elements, particularly risk capital. There is complimentarity between bank- and equity-based finance, with the systems meeting different needs. Bank based systems favour industries that rely on incremental innovations, with banks not usually prepared to accept the risk involved in (radical) innovation projects, while SMEs – especially start-ups and service sector SMEs – often lack collateral. Equity-based systems (e.g. stock market floatation, angel investment and venture capital) are better equipped to support research based activities that lack collateral to secure bank financing, e.g. biotechnology. They help overcome information asymmetries between the investor and innovator through closer investor involvement in company decision making processes.

Independent of their level of financial development, generally proxied by the level of bank credit and stock market capitalization/liquidity,[104] all advanced countries have established innovation support systems seeking to address the shortcomings of both bank- and equity-based financial systems. There is clear evidence that SMEs, and start-ups in particular, have insufficient access to external financial resources due to the risk aversion of banks and limited presence of business angels and venture capitalists.

While venture capital is important, its limited scope means that only a small fraction of companies will benefit. Venture capital may therefore be important for the most innovative and promising projects, but no substitute for general mechanisms of support for innovative companies. The obvious gap between the financial resources provided by banks and risk capitalists vis-à-vis the resources needed to bring an innovation to market must be filled by the entrepreneur or company themselves, or by public support.

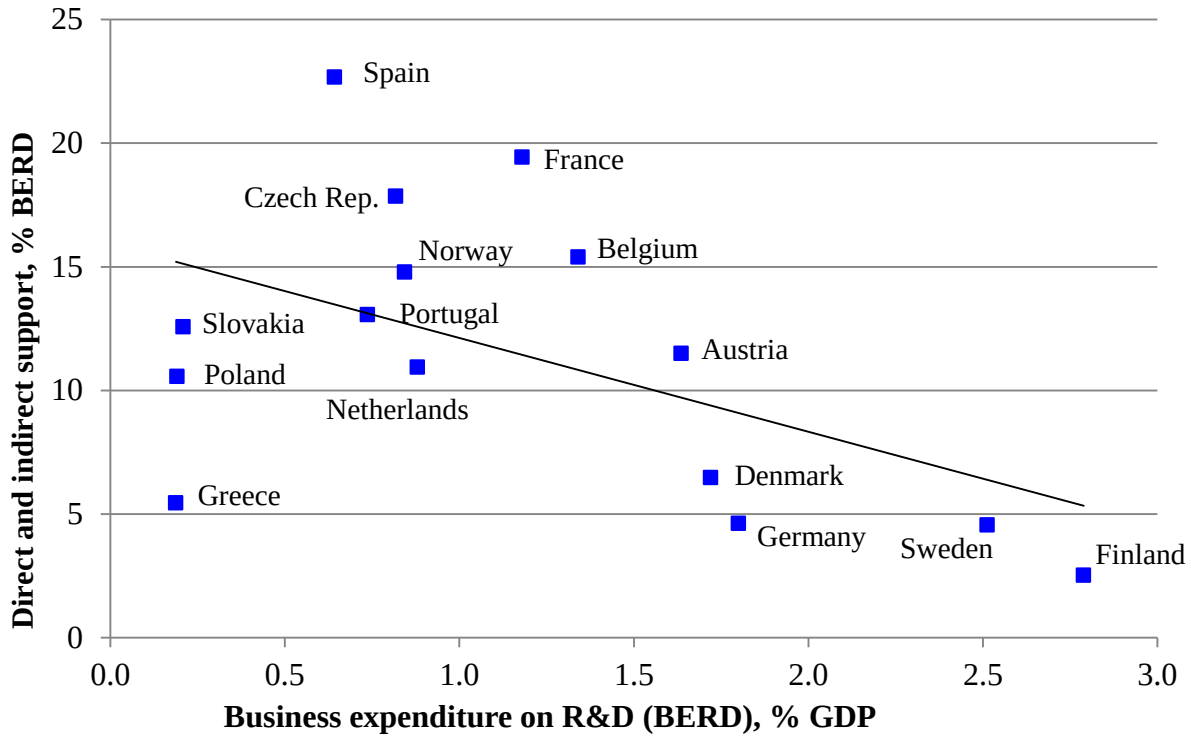
Financing start-ups is a highly specialized activity and a key factor in entrepreneurial success. In terms of other factors, education raises the likelihood of starting a business, but does not increase the rate of success, while females are less likely to start a business, but equally likely to succeed once they have made this step. There is also some evidence that regional clustering may have a positive impact on entrepreneurship. In Ukraine, around 40% of founders report difficulties in accessing finance. While substantial, this is around half the level in Azerbaijan, Mongolia, Turkey, Georgia, Kazakhstan and Kyrgyzstan. Bureaucracy is a more significant problem than in most transition countries, reported by around 20% of respondents, while bribery and the threat of competitors are lesser concerns for start-ups in Ukraine.[105]

[103] For example: S. Estrin, J. Hanousek, E. Kocenda and J. Svejnar (2009), The Effects of Privatization and Ownership in Transition Economies, Journal of Economic Literature, 47:3.
[104] See R. Levine and S. Zervos (1998), Stock Markets, Banks, and Economic Growth, American Economic Review, 88: pp.537-558.
[105] See E. Nikolova, F. Ricka, D. Simroth (2012), Entrepreneurship in the transition region: an analysis based on the Life in Transition Survey, EBRD Working Paper No. 141, London.

The funding gap is even more pronounced for R&D performing companies in transition economies. In Ukraine, around 80% of companies surveyed said that inadequate own finances limited their innovation activities, while 54% identified inadequate state financial support.[106]

In Europe, R&D performing enterprises in transition countries receive around 15% of R&D revenues through direct and indirect support measures. In the countries where firms invest most in R&D, the public share in company R&D funding declines to around 5% (Figure 18). Overall, catch-up requires support for R&D and innovation activities to become self-sustaining, as in advanced countries. However, even in these countries, there are substantial support measures for companies making risky investments in new products and services.

**Figure 18. Direct and indirect support to R&D in the enterprise sector, share of business R&D spending, per cent**




*Source:* Leo, 2012

### *Sources of financing*

In Ukraine, around 1,000 companies invest in innovative activities. They account for approximately 10% of enterprises in manufacturing and spend – besides R&D expenditures – about 1% of turnover on innovation.

[106] I. Yegorov, Innovation Policy and Problems of Creation and Development of the National Innovation System in Ukraine, Centre for S&T Potential and Science History Studies, National Academy of Sciences of Ukraine, paper presented to second session of the UNECE Team of Specialists on Innovation and Competitiveness Policies, Geneva, 14-15 February 2008.

Fluctuations in innovation expenditures over the past decade have been substantial, with growth in the period to 2008 followed by decline. The majority of funds for innovation activities come from the enterprises' own resources (Table 22). In 2011, enterprises contributed 53% of innovation expenditures, although this was much lower than the 72% average over the period 1998-2011, and sharply down from a peak of 88% of innovation expenditures in 2005.

**Table 22. Structure of expenditures on innovation by source, per cent**

| Year | Source of finance | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Company resources** | **State and local budgets** | **Non-budget funds** | **Bank loans** | **National investors** | **Foreign investors** | **Other sources** |
| 1998 | 75.5 | 1.7 | 4.7 | 3.3 | 0.5 | 12.3 | 2.0 |
| 1999 | 69.6 | 10.1 | 3.2 | 6.1 | 0.6 | 7.6 | 3.1 |
| 2000 | 79.6 | 0.5 | 1.9 | 6.3 | 2.8 | 7.6 | 1.3 |
| 2001 | 83.9 | 3.0 | 1.2 | 6.0 | 1.8 | 3.0 | 1.2 |
| 2002 | 71.1 | 1.6 | 0.2 | 12.6 | 2.0 | 8.8 | 3.8 |
| 2003 | 70.2 | 3.1 | 0.0 | 18.0 | 3.7 | 4.3 | 0.7 |
| 2004 | 77.3 | 1.4 | 0.0 | 17.8 | 0.2 | 2.5 | 0.8 |
| 2005 | 87.7 | 0.8 | 0.0 | 7.1 | 1.4 | 2.8 | 0.3 |
| 2006 | 84.6 | 2.1 | 0.0 | 8.5 | 0.4 | 2.9 | 1.5 |
| 2007 | 73.7 | 1.4 | 0.0 | 18.5 | 0.2 | 3.0 | 2.2 |
| 2008 | 60.6 | 2.9 | 0.0 | 33.7 | 1.4 | 1.0 | 0.4 |
| 2009 | 65.0 | 1.7 | 0.0 | 11.8 | 0.4 | 19.0 | 2.0 |
| 2010 | 59.4 | 1.2 | 0.0 | 7.8 | 0.4 | 29.1 | 1.3 |
| 2011 | 52.9 | 1.1 | 0.0 | 38.3 | 0.3 | 0.4 | 6.9 |
| **Average** | **72.2** | **2.3** | **0.81** | **14.0** | **1.1** | **7.4** | **2.0** |

*Source:* I. Yegerov (2012), Background paper on innovation policy in Ukraine, *mimeo*.

The decline in the share of own resources was accompanied by increases in financing from foreign sources and banks. The average contribution of banks to innovation financing over 1998-2011 stood at 14% but has been highly variable – as high as 38% in 2011, but only 7.8% in 2010, for example. Given the general reluctance of banks to finance risky projects, it is likely the risk content of bank financed innovation projects is lower than average.

Foreign investors financed a substantial share of innovation expenditures in 2009 and 2010, corresponding to large investment inflows in the chemical sector. The low share of state and local budgets (around 1-2%) is remarkable by international standards, and shows very limited public support for innovation.

***The banking sector***

The banking sector experienced rapid expansion during the past decade, with total assets peaking at 91.2% of GDP in 2008, accompanied by a rapid inflow of FDI with foreign banks accounting for almost 48% of assets in 2009. Due to the financial and economic crisis,

concerned households withdrew substantial deposits in 2008 and 2009, and access to foreign resources was limited. There was a dramatic increase in non-performing loans (NPLs), and the government was forced to nationalize five banks and provide more general support to the sector. Bank loans to the private sector recovered somewhat in 2011, after further sharp declines in 2009 and 2010. However, banks have cut costs and reinforced risk management practices to address NPLs and, given low demand, a weak legal environment and low asset quality, loans and banking assets as a share of GDP have continued to decline.[107]

Foreign banks helped stabilize the financial system during the early stages of the crisis, with most receiving support from their parent companies. However, consolidation measures in their home countries mean many foreign banks are now reconsidering their activities in Ukraine, with a decline in the market share of foreign owned (excluding Russian) banks (Figure 19). State-owned banks increased their market share in 2009 with efforts to ease the crisis, along with Russian and private Ukrainian banks.

Rapid expansion before the crisis was based on an inflow of financial resources from abroad. While private households did not accumulate as much debt as in other transition economies during this period, 72% of their loans were denominated in foreign currency (59% of private sector loans) at the end of 2008. At this time, the National Bank of Ukraine imposed a ban on foreign currency loans, and the share in total household debt fell to 57% by 2011.[108]

NPLs increased dramatically to reach over 40% of gross loans in 2009 and 2010, resulting in considerable losses to lenders, and a negative return on equity. Banks dramatically scaled back their lending activities. Following initial withdrawals, deposits held relatively steady as a share of GDP while credit contracted (Table 23), and deposits now constitute the backbone of lending in Ukraine, with a lower ratio of loans to deposits.

The changed landscape going forward will include both a tighter supply of credit, as well as reduced demand for loans. However, lower levels of leverage and increased reliance on domestic sources of finance may have the benefit of resulting in a more stable financial system, and act as a spur to the long-term development of the domestic financial sector.

**Table 23. Selected banking sector indicators**

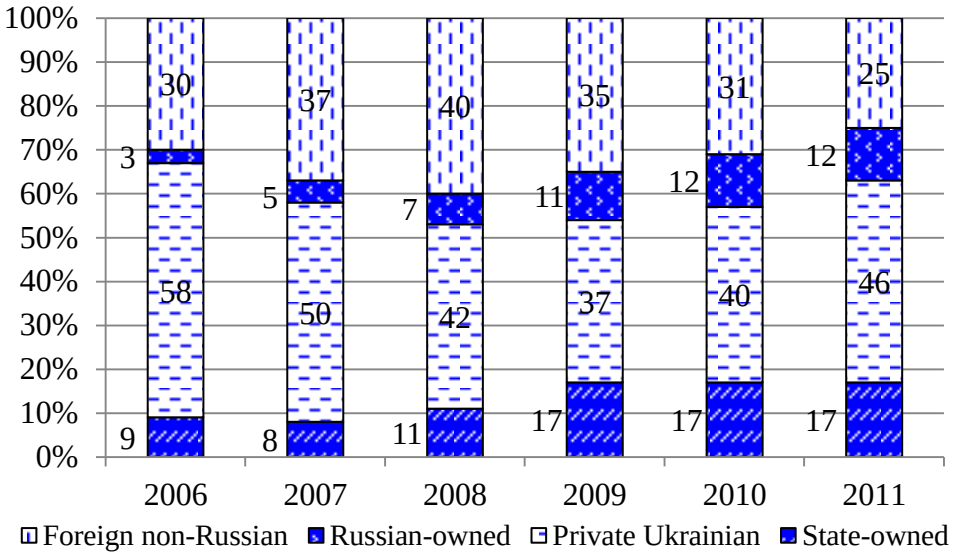
| | 2008 | 2009 | 2010 | 2011 | 2012e | 2013f |
|---|---|---|---|---|---|---|
| Assets/GDP | 97.7 | 96.2 | 87.0 | 80.6 | 75.6 | 72.1 |
| Deposits/GDP | 37.7 | 35.8 | 38.3 | 37.0 | 36.8 | 37.2 |
| Loans/GDP | 77.4 | 78.4 | 66.9 | 60.4 | 55.1 | 51.9 |
| Loans/Deposits | 205.1 | 218.9 | 174.9 | 162.9 | 149.6 | 139.5 |
| NPLs/Gross Loans | 17.4 | 40.5 | 42.5 | 37.7 | - | - |
| Return on equity | 8.5 | -32.5 | -10.2 | -5.3 | - | - |
| Capital adequacy ratio | 14.0 | 18.1 | 20.8 | 18.9 | - | - |

*Source:* Sologoub, 2012.

[107] D. Sologoub, Ukrainian banking sector: The roller-coaster ride, Raiffeisen Bank Aval, presentation to the Kyiv School of Economics Alumni Congress, 25 May 2012. Based on data from the National Bank of Ukraine, IMF and Raiffeisen Research.

[108] Source: National Bank of Ukraine and Raiffeisen Research.

**Figure 19. Market Structure of Ukrainian banking sector, by ownership**




*Source:* Sologoub, 2012.

### *Access to finance*

Despite the crisis, there is evidence that finance is less of a constraint for enterprises compared to other features of the Ukrainian business environment (e.g. corruption, access to land, tax administration), with Ukraine ranked in 23rd position for "Getting Credit" in the World Bank's Doing Business survey in both 2012 and 2013. However, this is at the aggregate level, and may mask significantly different conditions for entrepreneurs and SMEs. This favourable ranking is also driven by a strong legal rights framework[109] for finance – i.e. legal prerequisites are in place, but may not yet be reflected by the financial system.

The 2008-2009 World Bank/EBRD Business Environment and Enterprise Performance Survey (BEEPS) of business owners and managers ranked Ukraine 21st out of 29 countries in Eastern Europe and Central Asia (EECA) in terms of level of private foreign ownership, with 4.5% of firms in private foreign ownership, compared to a 6.2% EECA average and 7.4% in the EU10.[110] It was noted that the burden of regulation and corruption tend to fall more heavily on firms in foreign as opposed to domestic ownership,[111] which could help explain this relatively limited foreign ownership. However, as one of the region's larger economies, a higher degree of insulation of the domestic economy is perhaps to be expected.

BEEPS revealed a marginally higher than average percentage collateral requirement for loans in Ukraine than is typical in relevant comparator countries (Table 25). However, it also highlighted positive reforms aimed at strengthening creditor rights, including a centralized registry for charges on moveable assets and out-of-court remedies for secured creditors.[112]

[109] International Bank for Reconstruction and Development / World Bank, Doing Business 2013, Washington.
[110] Tables 1 and 2, Enterprise Surveys Country Note 5: Ukraine, Rev. 7/2011, World Bank Group, Washington.
[111] Page 5, *Ibid*.
[112] Tables 1 and 3 and pages 5-6, *Ibid*.

The World Bank's "Doing Business 2013" showed relative strength in terms of the legal framework in relation to finance, with adequate creditor safeguards a prerequisite for continued financial development. However, effective financing for start-ups is a challenging policy objective, even in mature financial systems, and development of business angels, incubators and venture capital remains relatively limited.

More recently, the World Bank identified a number of mid-term challenges for reform. In addition to pension and social transfer reforms, energy reform and public services, the following would help set the framework conditions needed for innovative entrepreneurship:[113]

- A level playing field for SMEs and FDI by streamlining entry/exit regulations, avoiding distortive interventions and reducing the burden of permits and inspections;
- Creating a broader, more stable tax base and improving tax management to address obstacles to doing business (particularly for SMEs), reducing the informal sector;
- Better management of public finances through transparent procurement, strengthened governance in state-owned enterprises, and modernized capital budgeting; and
- Securing a sound banking sector, rationalizing the State's role and direct ownership role, including disposal of state-owned stakes in commercial banks.

BEEPS 2008-2009 found 52% of Ukrainian small enterprises, defined here as those with fewer than 20 employees, to be operating as sole proprietorships, with 41.1% as closed shareholding companies, and 4.5% as open shareholding companies. Small enterprises in Ukraine tend to be domestically focused, with low levels of internationally recognized quality certifications (Chapter 7). Only 7.0% are exporters, compared to 15.8% of medium sized and 29.8% of large enterprises.[114] A potential factor limiting credit worthiness is that only 27.3% of enterprises had their annual financial statements reviewed by an external auditor, compared with 37.7% on average in the EECA region, and 49.3% across all lower middle income countries.[115] This figure was yet lower for small enterprises in Ukraine, and could be related to their higher dependency on equity and sale of stock for financing (Table 24):

**Table 24. Sources of finance for investment in Ukraine, by company size, per cent**

| | Ukraine (aggregate) | Small (1-19) | Medium (20-99) | Large (100+) | Eastern Europe & Central Asia | Lower middle income |
|---|---|---|---|---|---|---|
| Internal finance | 62.1 | 60.5 | 61.3 | 69.7 | 62.0 | 66.3 |
| Bank finance | 18.5 | 16.2 | 20.7 | 18.5 | 23.8 | 16.8 |
| Trade credit financing | 6.7 | 5.1 | 9.4 | 3.5 | 5.0 | 4.3 |
| Equity, sale of stock | 12.7 | 18.3 | 8.6 | 8.3 | 8.8 | 4.4 |
| Other financing | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 8.2 |
| *Total* | *100* | *100* | *100* | *100* | *100* | *100* |

*Source:* Summary of Enterprise Survey Indicators, Ukraine Country Profile 2008, Enterprise Surveys, World Bank and International Finance Corporation, Washington, updated January 2010.
Numbers in parentheses indicate number of employees per firm for small, medium and large firm categories.

[113] Country Partnership Strategy for Ukraine for the period 2012-2016, World Bank, 20 January 2012, para. 56, page 14.
[114] Summary of Enterprise Survey Indicators, Ukraine Country Profile 2008, Enterprise Surveys, World Bank and International Finance Corporation, Washington, updated January 2010.
[115] *Ibid*.

While access to checking (current) or savings accounts for SMEs is not significantly below average and there is no evidence of higher collateral requirements for small enterprises, BEEPS data did suggest that fewer SMEs make use of bank loans and lines of credit (Table 25). Only 26.3% of small enterprises in Ukraine had a bank loan or line of credit at the time of BEEPS fieldwork in 2008, compared to 50.4% of large enterprises. Additionally, since this time, there has been considerable disruption in the banking sector as a result of the global financial crisis.

**Table 25. Access to banking services in Ukraine**

| | Ukraine (aggregate) | Small (1-19) | Medium (20-99) | Large (100+) | Eastern Europe & Central Asia | Lower middle income |
|---|---|---|---|---|---|---|
| Firms with bank loans/ line of credit (%) | 31.7 | 26.3 | 34.8 | 50.4 | 43.6 | 33.4 |
| Firms with a checking or savings account (%) | 90.1 | 86.5 | 93.7 | 98.1 | 88.7 | 86.6 |
| Collateral needed for a loan (% of loan) | 137.5 | 124.4 | 143.4 | 154.2 | 133.4 | 133.5 |

*Source:* Summary of Enterprise Survey Indicators, Ukraine Country Profile 2008, Enterprise Surveys, World Bank and International Finance Corporation, Washington, updated January 2010.

### *Support for SMEs*

There have been a number of important developments recently, with the Law of Ukraine on State Support of Small and Medium Entrepreneurship being adopted in March 2012. However, policy towards SMEs in Ukraine requires longer-term strategic priorities, and greater resources.[116] Nonetheless, while the bulk of SME financing in Ukraine comes from banks, credit unions and pawnshops, there are government supported credit guarantee schemes in place targeting energy efficiency and competitiveness, which are open to SMEs. Specifically for SMEs, there are national programmes of support implemented by the State Export-Import Bank of Ukraine (Ukreximbank), including preferential financial support provided by the Ukrainian Fund for Entrepreneurship Support (UFES). The Law on Mandatory State Social Unemployment Insurance provides a lump sum allowance for unemployed members of the workforce starting their own business.[117]

SMEs access to finance has been and continues to be an area of focus for major international financial institutions, including the International Finance Corporation (IFC), the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD). Typically, resources are provided to local banks for on-lending to SMEs under different programmes in areas of importance for Ukraine's economic catch-up.

[116] EU, ETF, EBRD, OECD (2012), SME Policy Index Eastern Partner Countries 2012: Progress in the Implementation of the Small Business Act.
[117] *Ibid*, page 280.

## 6.3 Financial support from the public sector

At present, there is no public institution with a specific mandate to support innovative enterprises or start-ups, although there are some initiatives that target SMEs in general. The UFES provides funding and helps develop the financial support infrastructure for SMEs. UFES, which operates under the State Committee for Entrepreneurship and Deregulation, provides financial support for the implementation of national and regional policies promoting entrepreneurship, including through participation in local and regional funds and provision of credit guarantees. UFES is also involved in educational activities. However, the resources available to the UFES are limited: in 2011 only UAH 1 million was spent on developing public funds for the support of entrepreneurship, with an additional UAH 500 thousand allocated to various educational projects. Many of these projects are carried out in cooperation with foreign donors. Support is provided in the form of loans and interest subsidies on commercial bank loans.

The absence of dedicated support to innovative SMEs can be explained by the ongoing fiscal consolidation drive, together with general reluctance to commit resources to this area given problems with past schemes. However, at the time of this Review, the State Agency for Science, Innovation and Informatization was leading work to secure the authorized capital for a Fund to support small innovative businesses. This fund was expected to receive UAH 35 million (about €3.5 million). The nature of the resources – either equity capital for the fund or treasury funding – was yet to be decided. Treasury funding would reduce autonomy and subject resource availability to the annual budget process. By contrast, equity capital would strengthen the independence of the fund and provide a more stable source of financing. The final details of the fund's overall set-up are still to be finalized, with selection criteria to be defined after the fund's inception.

The Fund to support small innovative businesses would support companies in financing their innovations through interest rate subsidies, insurances and guarantees or loans with interest rates linked to inflation. Subsidized interest rates would be double the National Bank of Ukraine's base rate, which was 7.5% at the time of this Review. Companies submitting projects within innovation priority areas and registered as innovators would receive a loan of up to 100% of the project size. Registered companies outside the priority areas would receive a loan of up to 50% of project size. The Fund targets small and medium sized companies, i.e. applicants should have no more than 50 employees and a turnover of less than €500,000 per annum.

There is also a State Fund for Fundamental Research (SFFR), which seeks to finance basic (fundamental) research from alternative sources on a competitive basis, i.e. not from block grants for the research institutes or universities concerned. It also seeks to encourage international cooperation with foreign specialists and scientific centres in fundamental research; and disseminate scientific information among Ukrainian specialists.[118] While the SFFR is not commercially oriented in itself, it is likely that a number of the projects it funds may produce outputs of potential interest to investors.

[118] Source: http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ua/supportmeasure/support_mig_0001?tab=template&country=ua

## 6.4 Venture capital

A number of venture capital funds were created in Ukraine under a special law in the mid-2000s. However, their resources were exclusively used in the construction sector, responding to a boom in the property market. The now liquidated State Agency of Ukraine on Investment and Innovation (SAUII) prepared a draft law on venture funds in 2008 to direct financial resources into the innovation sphere, which aimed to prevent the use of resources for other purposes.[119] However, this Law did not pass through the Parliament, and the country has no current legal act to support venture financing.

Despite this, at least on paper, Ukraine has a thriving venture capital scene. Based on various sources (data from official sources as well as from the Ukrainian Association of Investment Business (UAIB), specific survey and case studies), there are estimated to be around 700 venture funds in Ukraine.[120] Total assets in these funds were slightly less than €2 billion in 2009. Analyzing the structure of target companies – mostly brokers, consultancies, construction, and trade – reveals that these venture capital funds (VCs) are overwhelmingly vehicles for acquiring or managing equity stakes in companies. However, closer analysis reveals some evidence of real venture capital flows,[121] although venture funds supporting innovation tend to be of foreign origin, with domestic funds predominantly focused on real estate and related areas.

The venture capital scene in Ukraine remains in its infancy. Figures on investments are scarce, with detailed documentation and analysis scarcer still. One source[122] estimates that new Ukrainian venture capitalists have invested around €125 million in the IT field – certainly a preferred sector given the success of the IT outsourcing business.

Presently, there are a number of VCs on the Ukrainian market (Box 5). These include international companies, Russian investors with operations in Ukraine, and Ukrainian investors that invest on both the local and international markets.

Development of the Ukrainian VC infrastructure is held back by an incomplete legal framework, for example in relation to taking (minority) stakes in businesses or the introduction of option schemes. Consequently, a number of funds and even enterprises that received VC investments are registered abroad. Besides these VC specific issues, more general difficulties of doing business in Ukraine increase the risk of failure for start-ups.

A low deal flow is another concern. In the area of software and web services – a traditional stronghold for VCs – the success of the IT outsourcing industry has created a large number of well-paid jobs, and companies keen to employ university graduates. Consequently, the number of people willing to assume additional uncertainties related to starting a business, along with a business idea that is attractive for VCs, is limited.

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[119] White Book: Intellectual Property in Innovation Economy of Ukraine – Kiev: Parliament of Ukraine. Committee on Science and Education, 2008, p. 71-72. Original: Ukrainian.
[120] O. Krasovska (2012), Does venture capital in Ukraine really support high technology investments?, International Journal of Economics and Law Vol. 2, No. 4, pages 55-59.
[121] *Ibid.*
[122] See http://www.blog.ciklum.com/2012/09/torben-majgaard-a-different-approach-towards-it-investments/.

### Box 5. Active venture capitalists in Ukraine

**DeKarta Capital** (dekartacapital.com) was founded in December 2008 and specializes in early stage and growth equity investments in medium-sized companies in Russia, Ukraine and Latvia. The fund manages assets of around $100 million, comprising investments in financial services, retail, media, Internet and technology. Typical investments are up to $1 million for early stage and $2 – 15 million at later stages.

**Eastlabs** (www.eastlabs.co) is a Kiev-based company that operates Ukraine's first private business incubator and provides seed capital. The incubator is managed by a team of international professionals and provides a large mentoring network and a broad array of support services that help businesses develop their ideas.

**e.ventures** (http://www.eventures.vc/) is a global venture company that manages five local funds across the globe. The Russia based fund is actively seeking investments in Ukraine. The current portfolio includes two investments in Ukraine.

**KM Core** (www.kmcore.com) "capitalizes on the rich legacy of science and engineering and intellectual capital" available throughout the CIS region and aims to trigger inward and outward investment. Investments include international companies located in the USA, Israel, and Canada.

**TA Ventures** (www.taventure.com) is a Ukrainian venture fund that is registered in Luxembourg and invests in innovative seed-stage and early-stage Internet companies in the USA and Europe, particularly in Ukraine, Russia and other CIS countries. The fund also invests in successful growth-stage companies seeking to expand their businesses in Ukraine, Russia and other CIS countries. The fund started with an initial capital of €50 million.

**Ciklum** (www.ciklum.com) is a rapidly growing IT outsourcing company looking to invest up to $10 million in four to five startups over the next few years.

**Vostok Ventures** (vostokventures.com) was established by a group of successful entrepreneurs to make seed and early stage venture investments in IT projects originating from Ukraine, Russia and other CIS countries. To date, Vostok Ventures has made nine investments in Ukraine.

*Source:* Interviews during fact-finding mission, September 2012.

## 6.5 Recommendations

Ukraine has entrepreneurial talent and a relatively strong risk-taking attitude. These are major ingredients for any policy intervention seeking to promote innovative entrepreneurship. However, the survival rate of start-ups is low in comparison to advanced countries. Effective policy actions that improve this rate would create employment, diversify the industrial structure and stimulate competition.

*Recommendation 6.1*

*Overall framework conditions have a strong influence on the development of start-ups and SMEs, shaping the impact of other policy interventions. The authorities should make focused and sustained efforts to improve the legal and regulatory environment for start-ups and SMEs. Within this overall effort, the authorities could consider the following actions:*

- *Tailor legislation to improve the ease of doing business, with an emphasis on timely interventions with significant practical impacts for businesses, including reducing administrative burdens and red tape, standardizing procedures and lowering the costs of doing business;*
- *Encourage female entrepreneurs, who are less likely to start a business but display high success rates, and could be specifically targeted by awareness raising or training initiatives;*
- *Reform business legislation to facilitate the entry/exit of firms, support start-ups and encourage the development of venture capital firms, in line with international best practice and with a view to reversing the observed trend of companies being established abroad; and*
- *Document these actions in an annual progress report, with monitoring and evaluation against milestones and key performance indicators (KPIs).*

Innovative companies and SMEs in general face particular difficulties when trying to raise finance, which remains a critical obstacle when starting a business. However, support programmes for SMEs are very limited and there are no public interventions targeting start-ups. Limited public resources and previous unsuccessful attempts to stimulate innovation by offering financial incentives help explain the current absence of financial mechanisms to encourage the development of innovative enterprises.

*Recommendation 6.2*

*Public support is necessary to address the financing problems of innovative companies. A new Fund to support small innovative businesses, although limited in size, would have positive effects by facilitating the development of start-ups and helping them to attract private financing. There is also a need to consider other funding possibilities. The authorities could consider the following principles and actions, with a view to selecting genuine innovation projects:*

- *The Fund to support small innovative businesses should be initially of a limited size. Once it has a proven track record of successfully supporting innovative SMEs, resources could be increased. A fund that is run well, with stringent but transparent*

*criteria to select companies, could attract a good quality deal flow and would also encourage private sector interest in the companies being financed;*

- *As innovation goes hand-in-hand with risk, it is crucial that there be a tolerance of failure. Funding should be stable, preferably in the form of a contribution to the capital of the Fund to support small innovative businesses, so risks can be managed on a portfolio basis, without requiring a positive outcome for every project financed; and*
- *Given the limited resources available and the need to enhance the credibility of interventions in this area, it would be useful to engage international know-how in the administration of the Fund to support small innovative businesses. One option would be to establish such a fund under a twinning agreement with a well-established development bank or European funding organization.*

Ukraine has an emerging venture capital scene, which indicates the presence of entrepreneurial opportunities in the country. While this form of financing caters for the financial needs of only a small fraction of innovative SMEs, it is an important ingredient of the innovation system. However, the development of the venture capital industry requires the presence of other financial intermediaries and business services, together with a continuous supply of opportunities needing financing.

*Recommendation 6.3*

*The authorities could provide further impetus to the development of the venture capital industry in Ukraine by considering the following actions:*

- *Continued efforts to improve framework conditions for SMEs in order to increase potential investment opportunities;*
- *Engagement of the private sector in public technology programmes through close consultation or public-private partnerships, so venture capitalists have better information on potential commercialization opportunities; and*
- *Encouraging the emergence of business angel financing as a way of exploring small scale opportunities that can be developed further by venture capital firms. This could be done by supporting the formation of business angel networks and the creation of platforms for communication with research organizations and universities.*

# *Chapter 7*

# *THE ROLE OF INNOVATION IN INTERNATIONAL ECONOMIC INTEGRATION*

This chapter assesses the international dimension of innovation and the role of international economic cooperation in fostering innovation. Firstly, it analyzes the major channels of international exchange in the field of knowledge and technology transfer. Secondly, it looks at the institutional frameworks which support internationalization of the national economy and cooperation in areas related to innovation. Finally, it analyzes various international opportunities, including regional and international cooperation and development themes, which play an important role in Ukraine's international economic integration. This analysis serves as the basis for a number of policy recommendations.

## 7.1 International knowledge flows

Evidence from recent studies of globalization and innovation suggests strong linkages between economic growth, increased international trade and Foreign Direct Investments (FDIs), and innovation. As has been argued in chapter 4, at its current stage of economic and technological development, Ukraine should make importing, adopting and adapting technologies, business models and other forms of knowledge a priority within its innovation strategy. One of the key elements in the triangle of economic growth, international trade and investment and innovation is the exchange of information and knowledge between countries. The important role of social factors, including personal contact, information flows and cultural proximity, is reflected in the KOF Index of Globalization, with an aggregate weighting of 37% for "social globalization" factors (personal contact, information flows and cultural proximity), compared to 36% for "economic globalization" and 26% for "political globalization". [123] Ukraine continues to develop the major components that stimulate international knowledge flows: internationalization of higher education and R&D, cross-border mobility, and raising awareness about the potential of national R&D and S&T through international conferences and exhibitions.

### *Internationalization of education and R&D*

Strong R&D and S&T influence the ability to attract international partners and investors. The government of Ukraine has been using various tools to promote the internationalization of its education and achieve greater integration into the international R&D and S&T space.

Ukraine has a long history and strong traditions in education and in research and development, which during the 20th century were integrated into the Soviet and Central and Eastern European education and R&D systems of regional cooperation. According to statistical data (also discussed in chapter 5), there were around 135,000 researchers in 2011,

[123] A. Dreher (2006), Does Globalization Affect Growth? Empirical Evidence from a new Index, Applied Economics, volume 38, issue 10, pages 1091-1110.

down from 293,000 in 1995 and 450,000 in 1991.[124] Teaching and research institutions in the country have often played a hub or "bridging" role between partners in Eastern and Central Europe on the one hand, and Commonwealth of Independent States (CIS) members on the other. Ukraine – the second largest country by population in the CIS after the Russian Federation – has a high quality of mathematical and scientific education, which was ranked in 34th position worldwide in the 2012-2013 Global Competitiveness Report (GCR).[125,126]

Traditionally, there was a division of labour between R&D and educational institutions. The six National Academies of Sciences (NAS) received a significant portion of funding for research purposes and mobilized their financial and human resources to conduct fundamental research, as well as for international collaboration. In many cases, applied research, implementation and commercialization of innovative products and technologies was the responsibility of specialized research institutes subordinated to large enterprises and/or ministries. Many universities and institutions of higher learning specialized exclusively in training a new generation of scholars, with R&D often of secondary importance. The legacy of this can perhaps still be seen, with the GCR placing Ukraine in 70th position (of 142 countries) in terms of collaboration between universities and industries in R&D. According to Ukrainian experts, up to 39% of top managers believe that the national education system "does not meet the needs of businesses."[127]

Policymakers in Ukraine have developed a number of strategies seeking to reform the national S&T system as well as supporting international cooperation in S&T and education. New measures introduced over the past twenty years intended to encourage international knowledge and information flows included:

- Joining the Bologna Process, to enhance academic mobility and raise standards;
- Promotion of international exchanges;
- Support for international publications and conferences;
- Support and in some cases funding for the establishment of new institutions of higher education, private universities, R&D centres and think tanks; and
- Improving access to scientific information and academic databases, and enhancing the infrastructure for international communication (notably, Internet based).

Certain institutions have played an active role in internationalization. For example, the NAS has concluded bilateral agreements or set up contacts with research centres in more than 50 countries, and with many foreign universities. Additionally, it has significantly advanced multilateral cooperation with academies of science in Black Sea Region countries, and is active in over 20 international research organizations, having for example signed a memorandum of understanding with CERN, the European Organization for Nuclear Research,

[124] Table 3.1, Science and Innovation Activity in Ukraine, State Statistics Service of Ukraine, Kiev, 2012. Original: Ukrainian.
[125] T. Podvysotska, Ukraine's education system in critical need of overhaul, Kiev Post, 31 August 2012, page 15.
[126] World Economic Forum, Global Competitiveness Report 2012-2013: Full Data Edition, Geneva, 2012.
[127] T. Podvysotska, Ukraine's education system in critical need of overhaul, Kiev Post, 31 August 2012, page 15.

in June 2006, and representing Ukraine in more than 30 professional science unions and associations.[128]

However, the internationalization of education, S&T and R&D in Ukraine requires further development, with collaboration between research and educational institutions on the one hand, and between universities and industries on the other, remaining weak. The concept of internationalization of R&D and S&T is also not always fully integrated into the work of research universities.

Integrated technoparks, such as the BIONIC Hill Innovative Technopark and others, may help develop synergies for internationalization of S&T by attracting international investors. The attractiveness of BIONIC Hill lies in creating a large R&D and S&T centre on a greenfield site within Kiev city limits that is integrated with leading universities, developing R&D and production lines and attracting large international IT and telecoms players to build R&D and outsourcing centres. It is supported by the State Agency for Investment and National Projects of Ukraine and the Kiev City Administration, with Phase I expected to be completed in 2014. Some experts have suggested the creation of a foundation to support the technopark, which could operate in a similar way to the Skolkovo Foundation and facilitate closer cooperation with Skolkovo.[129]

***Cross-border mobility***

Policymakers in Ukraine have also supported international academic exchange and mobility of students and faculty. These exchanges have been driven by several factors, including: access to international funding through various international and regional programmes (the British Council, IREX / Muskie Graduate Fellowship Program, TACIS programmes, etc.); support of a large Ukrainian diaspora in Western Europe, the Americas and Australia (especially in-kind contributions, informal services and networks); and economic and social benefits of partnerships in these programmes (e.g. stipends and fellowships).

Ukraine's accession to the Bologna Process (with full membership from 2005),[130] also represents a significant tool to facilitate academic exchange with major western universities. As with many other new member States of the Bologna Process from Central and Eastern Europe and Central Asia, Ukraine has sought to improve the quality of education and R&D by increasing the international mobility of students and faculty, and by importing educational, managerial and R&D know-how. It is hoped to reform the higher education system by attracting leading international scholars and institutions, introducing internationally comparable systems of grading and academic credits, improving educational programmes and curricula and attracting greater numbers of foreign students and faculty. Despite joining the Bologna Process, the cross-border mobility of teaching staff, both inward and outward bound, remains relatively low, particularly in relation to Western Europe and North America.

[128] Country Report 2011 Ukraine, Annex to the "White Paper on Opportunities and Challenges in View of Enhancing the EU Cooperation with Eastern Europe, Central Asia, and South Caucasus in Science, Research, and Innovation", IncoNet EECA, p.160.
[129] http://eng.spb-venchur.ru/news/16074.htm (accessed 22 September 2012).
[130] For additional information about higher education and Bologna Process see: http://www.ond.vlaanderen.be/hogeronderwijs/bologna/links/documents/HigherEducation_in_Ukraine_English.pdf (accessed 22 September 2012).

There is a need to continue the drive to internationalize the higher education system, for example by partnering with leading foreign universities, encouraging the involvement of Ukrainian professors abroad in education at home universities, and keeping the domestic market open to foreign institutions of higher learning.

***Conferences, expositions and internationalization of publications***

A number of international conferences, workshops and exhibitions involving international partners have been organized to facilitate participation in international networks. Some of these events are focused on specific fields, while others are more general and designed to match Ukraine's R&D and S&T communities with international partners, manufacturers and investors. For example, in 2012 the country hosted around 20 relatively large international events.

One of the most important aspects of the internationalization of education and R&D is access to up-to-date information, particularly in specialized fields and via international publications. Various agencies and institutions make use of ICT-based and traditional media platforms for publications to promote Ukraine's R&D. For example, several web based portals provide comprehensive information about Ukraine's R&D and S&T sectors and innovative investment opportunities, including web portals such as InvestUkraine and others (see annex for further information). In addition, the Ukrainian scholarly community produces a number of science journals and magazines, which include English language articles. The Academies of Science and many universities in the country enjoy access to the key international databases (Scopus, Thomson Reuters, Springer, etc.), as well as participating in the establishment of the free SFFR library.[131]

Despite progress, R&D and S&T in Ukraine face many challenges, such as the declining number of scholarly publications (a key indicator of R&D and S&T dynamics), at home and abroad. For example, the number of articles published by Ukrainian scholars in international journals with high impact factor between 1996 and 2011 stands at 88,707, ranking below 265,139 for neighboring Poland and 480,665 for Russia. Ukraine also needs to invest in improving the quality and competitiveness of its higher education, with none of its universities featuring in the QS Top 600 or Times Higher Education world rankings of universities (2012). Ukraine also has a relatively low number of R&D projects that have been commercialized internationally or received international patents.

## 7.2 Internationalization of the economy and innovation

Internationalization can improve the environment for innovation, facilitating access to the latest international know-how, innovation management and international capital. Access to larger foreign markets increases potential rewards from successful innovation, while openness increases competitive pressure on domestic companies, strengthening incentives to innovate. In the current environment of rapid globalization of R&D, trade and exchange, and increasing capital mobility, the key challenge for many countries in the region is to create a business environment supportive of local and international companies operating domestically and to establish attractive framework conditions for FDI.

[131] The State Fund for Fundamental Research (SFFR) is an entity that was established by the Cabinet of Ministers of Ukraine in March 1992.

### *Institutional framework for international cooperation in innovation*

Policymakers in Ukraine have targeted a business-friendly legal environment and simplified regulatory framework by introducing new measures in consultation with international partners, and amended existing regulations that were barriers to international cooperation.

A number of legal changes have improved the framework for international business partners, including the Law on Investments, which introduced equal rights for foreign and domestic investors, the Law on Protecting Intellectual Property Rights, the Law on Industrial Parks (2012), the Law on Innovation Activities, the Law on Priority Directions of Innovation Activities, and regulations on taxation and duty free zones. Major initiatives with an impact on the business and legal environment for international cooperation, technology transfer and innovation, include:

- Concept of the State Program of Development of Investment Activity;
- Ukraine National Space Programs, which promote technology transfer, international cooperation and integration into the worldwide network of space-related industries;
- Joint projects with the Commercial Law Development Program (USA), including on customs, intellectual property and WTO trade remedies;[132]
- National Programs of Maritime Transport Development, promoting maritime trade and business exchanges;
- Decree adopted in 2012 "On approval of the State Program of Cooperation with Ukrainians abroad for a period up to 2015" aiming to facilitate information exchange and international cooperation via the Ukrainian diaspora; and
- State Special-Purpose Program on hosting the European Football Championship 2012 in Ukraine invested heavily in hospitality and transport infrastructures.

The tax code and system of regulations (approvals, certifications, licensing, etc.) continue to act as barriers to international cooperation. Despite an improved ranking in the World Bank's "Doing Business 2013" survey. Ukraine ranked 145$^{th}$ in terms of trading across borders, particularly relevant for international cooperation, indicating this as an area with significant scope for improvement (Chapter 6).

### *Institutions supporting international cooperation on innovation*

An important institution in this regard is the State Agency for Investments and National Projects (SAINP) of Ukraine, which seeks to attract FDI for national priority projects and implement investment reforms. In addition, SAINP develops various ICT and traditional platforms for promoting investment opportunities in the country.

The National Information Centre for Ukraine-EU S&T Cooperation was established in 2003 to support integration into the European Research Area through the National Information

[132] http://cldp.doc.gov/countries-regions/europe-eurasia

Points Network, and established a network of regional contact points.[133] It is based at the Kyiv State Centre for Scientific, Technical and Economic Information.[134]

At the province (oblast) level, provincial administrations promote a better business environment and strengthen institutional support for international cooperation by supporting the establishment of one-stop-shops for businesses and investors. These centres aim to provide investment, taxation and technical support in their respective provinces and cities.

***Trade***

Ukraine is close to three major markets – Western Europe; Eastern Europe and Central Asia; as well as Turkey and the Middle East. A relatively well-developed regional transport infrastructure and access to major maritime routes from the Black Sea to the Mediterranean mean that Ukraine has strong potential for international trade.

However, the current trade structure (Chapter 1) suggests a need to further diversify trade linkages while increasing the proportion of higher value-added goods and services. Russia, the EU, China, Belarus, the USA and Turkey are the main sources of Ukraine's imports (2010 estimates), which are dominated by energy and manufactured goods. The Russian Federation, the EU, Turkey, Belarus, India, Egypt, China and Kazakhstan are the major destinations for Ukraine's exports (2010 estimates), with metals and agricultural products being most significant.

With a relatively large domestic market, a degree of domestic orientation is to be expected. However, the World Bank notes regulatory barriers to business entry and exit, and costs of operation remain high, which particularly affect SMEs and foreign entrants. The share of Ukrainian SMEs exporting indirectly or directly (at least 1% of sales) declined from 33.9% in 2005 to 22.8% in 2008.[135]

Ukraine participates in a number of regional and supra-regional organizations, including the World Trade Organization (WTO), to which it acceded in 2008. WTO membership improved access to major international markets while creating challenges for some traditional sectors, including heavy industries, machinery, textiles and agriculture.

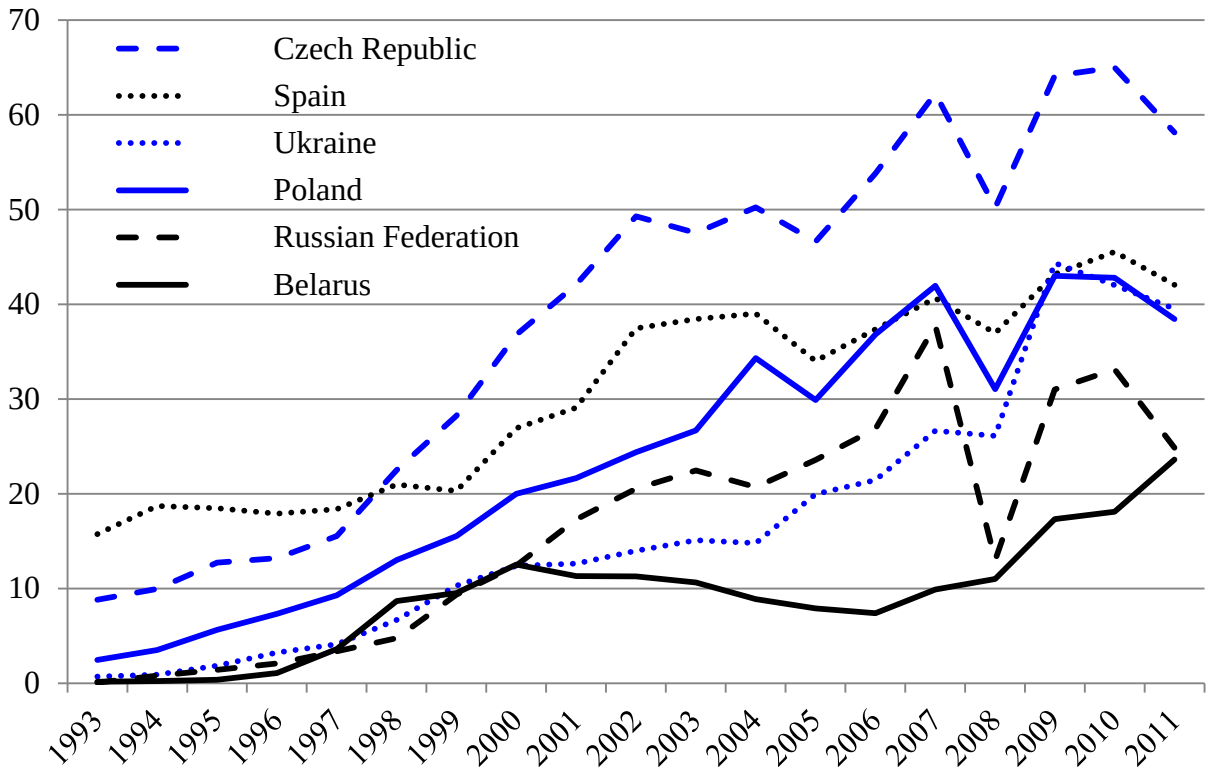
Access to foreign markets has also been supported by a longstanding tradition of regional division of labour and trade exchanges. For many decades, industrial and agricultural goods from Ukraine enjoyed stable access and a sizable presence in almost all major markets in Eastern Europe and Central Asia, in particular Georgia, Kazakhstan and Russia.

[133] Country Report 2011 Ukraine, Page 166, Annex to the "White Paper on Opportunities and Challenges in View of Enhancing the EU Cooperation with Eastern Europe, Central Asia, and South Caucasus in Science, Research, and Innovation", IncoNet EECA.
[134] See http://www.ideal-ist.eu/ncp/national-information-centre-ukraine-eu-st-cooperation-kyiv-state-centre-scientific-technical-and for contact details.
[135] Pages 51 and 60, Country Partnership Strategy for Ukraine for the period 2012-2016, World Bank, 20 January 2012, refers to BEEPS data.

### *Foreign Direct Investments*

FDI has been increasingly important for economic growth in Ukraine, which is among the top FDI recipients in the CIS, with $6.5 billion in 2011 (from $4.8 billion, 2010), behind Russia ($41.2 billion, 2011) and Kazakhstan ($10.0 billion, 2011).[136] As a share of GDP, the stock of inward FDI has increased over time, particularly during the 2000s, with accumulated stocks reaching levels comparable to Spain and Poland, at around 40% of GDP (Figure 20). Around one quarter of FDI in Ukraine originates from Cyprus, for example in 2011, which may indicate that this is partly Ukrainian capital reinvested as FDI. Additionally, 85% of FDI in Ukraine is from investors registered in activities of "real estate, lease, engineering and business services", of which a significant share relates to real estate. These specific features mean FDI flows may overestimate Ukrainian integration into global value chains, although integration has increased significantly over recent years, outpacing expectations. This progress probably reflects Ukraine's relatively large local market, as well as the importance of the steel industry as the most significant globalized sector in Ukraine.[137]

**Figure 20. Inward FDI stock as a percentage of GDP, 1993-2011**




*Source:* UNCTADStat

A strong focus on the domestic market and little pressure to internationalize has led to a very limited degree of globalization among Ukrainian business groups. As a result, outward FDI

[136] UNCTAD press release UNCTAD/PRESS/PR/2011/029, 26 July 2011, see: http://archive.unctad.org/Templates/webflyer.asp?docid=15211&intItemID=5803&lang=1 (accessed 22 September 2012).

[137] The second most globalized industry in Ukraine is the IT sector, although its globalization is not reflected in FDI as it is largely based on non-equity linkages.

stock as a share of GDP lags far behind Russia and Spain, being comparable to Poland and the Czech Republic (Figure 21).

Moreover, in 2011, 92% of outward FDIs were invested in Cyprus, suggesting these were not outward investments seeking access to foreign markets or foreign technology.[138] In this respect, the degree of internationalization of large Ukrainian firms does not seem to be higher than that of Belarusian firms. As FDIs are increasingly used as tools to access new technologies and foreign markets, this suggests that Ukrainian firms, with some exceptions, are generally national rather than regional players. Moreover, it seems that large Ukrainian firms are not very active in acquiring technology in disembodied form, i.e. via payments for licences. Total payments for royalties and licences during the period 2005-2009 were in the range $0.4-0.8 billion per annum, which is at the lower end of the range when compared to countries of a similar size.[139]

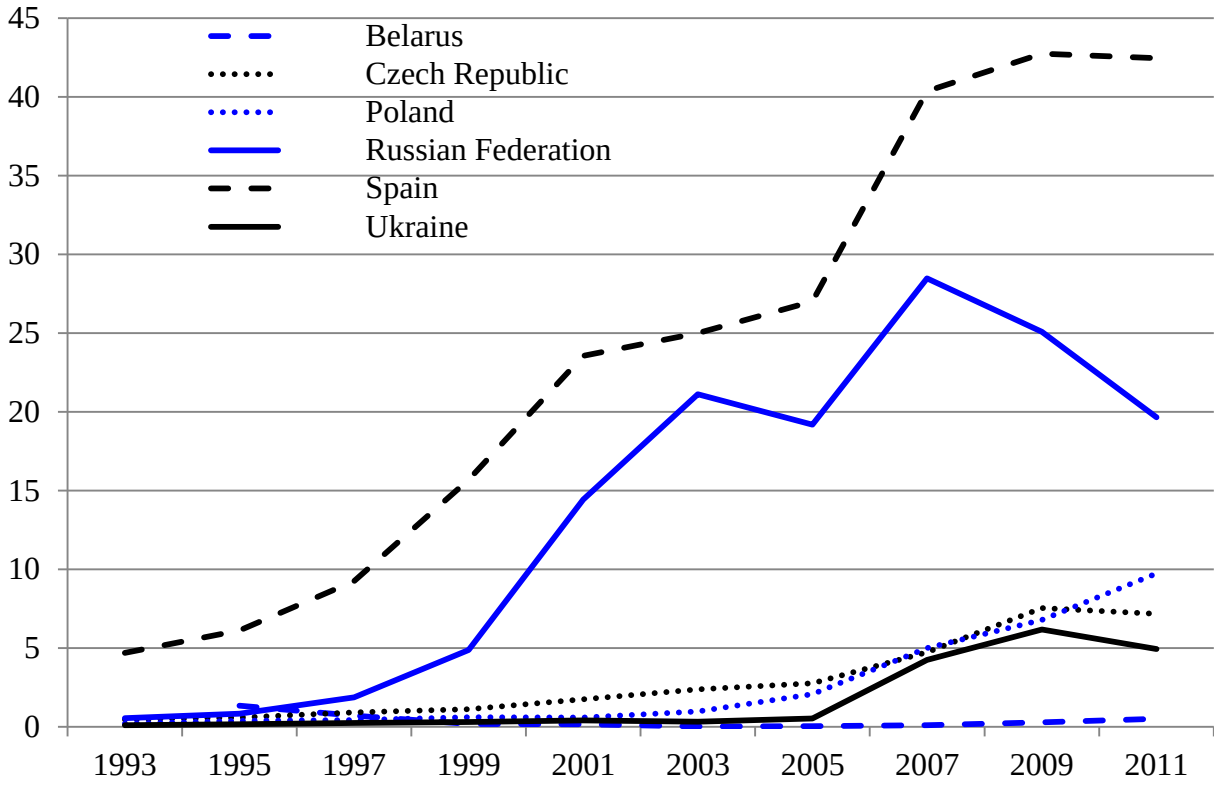
For several years, policymakers have sought to improve the business environment in Ukraine to make it more attractive for international investors and foreign companies. This included the introduction of several legislative acts and laws making it easier for foreign investors and business people to do business in Ukraine. It has also significantly improved the availability of legal, commercial and economic information to foreign investors.

In terms of areas of success, Ukraine's IT industry is one of the fastest growing sectors in the economy, with an estimated annual growth rate of between 15 and 30 per cent during the past five years and annual revenue of around $1.5 billion. This market has potential to become one of the largest in Eastern Europe, already attracting clients from wider Europe, the USA, Russia, South Korea and further afield, with a strong track record of multinational IT companies engaging in outsourcing activity in Ukraine. For example, Samsung Corporation has opened an R&D centre in Kiev and negotiated opening an R&D laboratory at Shevchenko State University. Between 2008 and 2012 the government of Ukraine also significantly increased investment in infrastructure, including ICT, transportation and hospitality infrastructure, in preparation for jointly hosting the 2012 UEFA European Football Championship with Poland.

Nonetheless, in spite of recent changes and improvements in the business environment, international investors still call for an easing of administrative constraints and red tape in Ukraine, as well as tax simplification and streamlined procedures in a number of areas where they deal with the public authorities.

[138] Source: State Statistics Service of Ukraine, Investment relating to external economic activity (inward and outward FDI), Kiev Statistical Yearbook 2012, page 53. Original: Ukrainian.
[139] UNCTAD, World Investment Report 2011, table IV.9, p. 139.

**Figure 21. Outward FDI stock as a percentage of GDP, 1993-2011**




*Source:* UNCTADStat

## 7.3 Innovation and international economic integration

Like many other countries, Ukraine has signed a number of bilateral and multilateral agreements and treaties seeking to facilitate international economic integration, in particular the integration of national R&D and S&T sectors into the relevant international systems.

***Bilateral cooperation agreements***

Ukraine has traditionally maintained intensive cooperation in R&D and S&T with many countries on a bilateral basis, signing around 50 agreements on S&T.[140] In this regard, major partners can be subdivided into four main groups:[141]

- Former Soviet republics (around 20% of bilateral agreements);
- East and Central Europe (former Comecom members);
- Western Europe (around 40% of bilateral agreements); and
- USA and Canada.

[140] I. Yegorov (2011), Erawatch Country Report 2011: Ukraine (forthcoming: European Commission), page 39.
[141] *Ibid.*

More recently, Ukraine has been developing bilateral relations with emerging economies such as China, South Korea, Turkey and others. The National Academy of Sciences has played an important role in establishing bilateral relations with institutions in third countries.

The country has traditionally maintained close relations with Belarus, Georgia, Kazakhstan and Russia. Until 1991, these relations were developed within the framework of division of labour between the Union Republics. Since then, these have evolved in the form of bilateral trade to maintain existing industrial and scientific cooperation, as well as supply and demand chains in large industrial complexes and transnational companies. A number of other Eastern and Central European countries are close to Ukraine geographically, culturally and historically, and present further opportunities to develop bilateral relations.

Western European countries emerged as important trade partners during the 1990s, with Ukraine developing particularly close relations with Germany and the UK. Both have become important sources of investment, technology transfer, education and training services, high-tech equipment and managerial know-how, helping Ukraine to modernize some of its largest enterprises. A survey by the G.M. Dobrov STEPS Centre of the National Academy of Sciences of partners of the Science and Technology Centre in Ukraine (STCU) found cooperation in Europe to be particularly close with Germany, the Russian Federation, France, the United Kingdom and Poland.[142]

The USA and Canada have also become significant partners for Ukraine, providing significant assistance and support on a bilateral basis. This has been directed through both government and private channels, with the large Ukrainian diaspora playing a supportive role. Cooperation has been especially significant in the fields of education, training and various S&T exchanges.

Among the most important developments in international cooperation for Ukraine in recent years has been growing cooperation with South Korean and Chinese companies as they increased their presence in Ukraine, planning to establish plants and factories.

***Cooperation with wider Europe***

Cooperation with the EU has become increasingly important in recent years, while an agreement on associated membership of the EU has remained a strategic priority for Ukraine.[143] Ukraine's integration, along with Moldova's, is well advanced compared to other countries in the EU's Eastern Partnership. Negotiations between Ukraine and the EU on an Association Agreement, including a Deep and Comprehensive Free Trade Area (DCFTA), were finalized on 30 March 2012, with other countries in the Eastern Partnership aiming to make similar progress ahead of a summit in autumn 2013. The EU has also signed protocols with the Republic of Moldova and Ukraine that provide the legal basis for their participation in EU programmes that are open to European Neighbourhood Policy (ENP) partners, and these two countries are also members of the Energy Community, which will drive integration in that sector. Moldova has made additional progress in that a Memorandum of Understanding

[142] Country Report 2011 Ukraine, Page 161, Annex to the "White Paper on Opportunities and Challenges in View of Enhancing the EU Cooperation with Eastern Europe, Central Asia, and South Caucasus in Science, Research, and Innovation", IncoNet EECA.
[143] Press release 3 October 2012, Press Office of President Viktor Yanukovych, http://www.president.gov.ua/ru/news/25629.html (accessed on 03 October, 2012).

associating Moldova to FP7 was applicable from 1 January 2012, allowing Moldovan researchers to submit proposals to all calls for tender open under the 2012 work programmes.

EU-Ukraine relations in the scientfic and technological domains must be considered within the wider context of political, economic, trade and humanitarian cooperation, as reflected by the European Neighbourhood Policy, the Partnership and Cooperation Agreement in force since 1998, the EU-Ukraine Association Agenda, and the National Indicative Programme 2011-2013.[144] Since 1991, the EU has provided support for several hundred projects in Ukraine, and devoted significant resources to technical assistance and policy reform. Total indicative allocations under the European Neighbourhood and Partnership Instrument (ENPI) for 2011-2013 stand at just over €470 million, of which 20-30% on promoting good governance and the rule of law; 25-35% on facilitating the entry into force of the EU-Ukraine Association Agreement, including the DCFTA; and 45-55% on sustainable development.[145]

The EU-Ukraine Association Agenda to facilitate implementation of the Association Agreement deals primarily with cooperation in relation to democratic reform of the judiciary, respect for the rule of law and human rights, transparency and democratic accountability, tackling corruption as well as increasing citizens' participation in public decision-making; and secondly in relation to establishing a deep and comprehensive Free Trade Area and implementation of relevant elements of the EU's *acquis communautaire* (community law). However, it does include specific provisions for cooperation in science and technology. [146]

Among these specific provisions facilitating EU-Ukraine cooperation in relation to science and technology, the Law of Ukraine "On Ratification of the Agreement by Exchange of Notes on Renewal of the Agreement on Scientific and Technological Cooperation between the European Community and Ukraine" was adopted in November 2011, renewing an agreement signed in Copenhagen in 2002, and provides commitments to:[147]

- Continue the EC-Ukraine S&T cooperation agreement, in order to enhance the participation of Ukrainian research entities in FP7 projects;
- Use available tools (S&T agreement, INCO-Nets) to prepare for a possible association of Ukraine to the Research Framework Programme, given that the successor programme to FP7, Horizon 2020, will be open to candidate and potential candidate countries, as well as selected third countries, fulfilling the relevant criteria; and
- Promote the activities of the ICT National Contact Points in Ukraine and involve the private sector in the research cooperation through participation in the ICT Theme of the 7th Framework Programme for Research.

By Resolution of the Cabinet of Ministers, the State Agency for Science, Innovation and Informatization of Ukraine is the administrator of budget funds and responsible for

[144] Information Exchange in Science and Technology between the European Research Area and Eastern European/ Central Asian Countries: Ukraine Country Report, IncoNet EECA, March 2012, pp.13-14.
[145] EU European Neighbourhood and Partnership Instrument Ukraine: National Indicative Programme 2011-2013, European Commission, Brussels.
[146] Association Agenda, adopted by EU-Ukraine Cooperation Council, 23 November 2009, p.3 and p.30.
[147] Information Exchange in Science and Technology between the European Research Area and Eastern European / Central Asian Countries: Ukraine Country Report, IncoNet EECA, March 2012, p.14.

implementation of the budget programme "Fulfilment of Ukraine's Commitments in the Field of International Science and Technology Cooperation".[148]

Although innovation is not noted separately as a policy priority, the ENPI Country Strategy Paper 2007-2013 for Ukraine contains a number of important provisions, the most directly relevant falling under the subpriority "Education, science and people-to-people contacts/exchanges". Key provisions include support for reform of Ukraine's education system to facilitate convergence with EU practices. Major tools include programmes such as Tempus and Youth in Action, opportunities for Ukrainian nationals to participate in exchange programmes such as Erasmus Mundus, and cooperation through EU cultural programmes. S&T cooperation is viewed as a tool to facilitate sustainable development, with provision for "fuller participation in research related activities such as the 7th Framework Programme, joint research projects, the Marie Curie international mobility scheme for scientists and practical training at the seven institutes of DG Joint Research Centre".[149]

The Tempus and Erasmus Mundus programmes have provided significant support for modernization of the education system at all levels, and for adoption of European educational and R&D standards. Nine new university cooperation projects were selected under the Tempus IV (2007-2013) programme during 2011, and Ukraine was involved in 38 projects as at the end of 2011. The European Commission has noted a steady increase in participation with each call of the programme. Ukraine also continues to participate actively in the Erasmus Mundus programme, with 354 scholarships and mobility grants awarded in 2011-2012. 2011 saw seven new Ukrainian projects selected under the Jean Monnet Programme, which fosters teaching and research in the field of EU integration studies. It should also be noted that, as at the end of 2011, Ukraine was ranked first among the Eastern Partnership Countries in terms of number of institutions (49) and individual researchers (62) participating in research collaboration under the Marie Curie research mobility grant schemes,[150] which is an EU programme with a strong focus on innovative research.[151] Collaboration in various applied research has also been especially productive under the funding from FP4, FP5 and FP7 programmes. For example, scholars from Ukraine received around €490 million in FP7 funding (as of 2011).[152] In relation to vocational and educational training (VET), the European Training Foundation has provided support to the ministries of Education and Economy to help balance supply and demand for qualified workers, leading to proposals for a National Qualifications Framework. Ukrainian participation in the eTwinning component of the Comenius programme, focused on interconnecting schools, is foreseen for 2012.[153]

[148] Country Report 2011 Ukraine, Annex to the "White Paper on Opportunities and Challenges in View of Enhancing the EU Cooperation with Eastern Europe, Central Asia, and South Caucasus in Science, Research and Innovation", IncoNet EECA, p.159.
[149] European Neighbourhood and Partnership Instrument: Ukraine Country Strategy Paper 2007-2013, European Commission, Brussels, p.15.
[150] Joint Staff Working Document: Implementation of the European Neighbourhood Policy in Ukraine: Progress in 2011 and recommendations for action, European Commission, Brussels, 15 May 2012, p.19.
[151] For examples, see European Commission (2012), Marie Curie Actions: Where innovative science becomes success, DG Research and Innovation.
[152] I. Yegorov (2011), Erawatch Country Report 2011: Ukraine (forthcoming: European Commission), p.34.
[153] Joint Staff Working Document: Implementation of the European Neighbourhood Policy in Ukraine: Progress in 2011 and recommendations for action, European Commission, Brussels, 15 May 2012, p.19.

There are provisions under other priorities of the ENPI Country Strategy for 2007-2013 that may be expected to provide a spur to innovative development, most notably under the areas of "trade, market and regulatory reform", and "transport, energy, information society and environment". Under the former, improvements to regulations, standards and framework conditions for business may all be expected to benefit innovation in Ukraine. Under the latter priority, specific technical cooperation includes energy efficiency, renewable energy, transport infrastructure (including integration into European aviation structures), and training support on potential applications of the GALILEO and EGNOS satellite navigation systems, for example shipment tracking.[154] These areas are also emphasized for Ukraine in the bilateral dimension of the Eastern Partnership Roadmap 2012-13, which highlights potential partnership roles in key innovative sectors for Euratom (nuclear safety), the European Investment Bank and European Bank for Reconstruction and Development (e.g. upgrading air navigation and natural gas transmission) and the Neighbourhood Investment Facility.[155]

***Multilateral cooperation within regional integration initiatives***

Ukraine is a member of several regional cooperation initiatives with economic dimensions, including those developed within the framework of cooperation with its traditional partners in the Commonwealth of Independent States. In addition, the GUAM Organization for Democracy and Economic Development and BSEC Organization of the Black Sea Economic Cooperation, for example, provide forums for dialogue in various sectors, including S&T, and include most Eastern European countries.[156]

Major challenges for regional cooperation in the fields of innovation, R&D and S&T include changes in the nature of market demand; difficulties in maintaining traditional linkages while developing new R&D and S&T programmes with longstanding partners in Central Asia and Eastern Europe (due to weak institutional arrangements and industrial sector linkages); and increasing international competition in R&D and S&T due to the liberalization of national markets and globalization.

Among the most recent trends in the development of R&D and S&T, some scholars identify the growth of a new, service-based economy in Ukraine. New media and social networking are an integral part of the new economy, and provide new opportunities for cooperation, as well as business and R&D networking.

Since the 1990s, Ukraine has maintained R&D and S&T linkages within the framework of regional cooperation, and these have been strengthened by longstanding institutional memory, similarities in technical standards and requirements, strong professional networks and reasonably developed information exchange and technology transfer. Scholars, researchers and business people regularly organize and attend various regional events, including

[154] European Neighbourhood and Partnership Instrument: Ukraine Country Strategy Paper 2007-2013, European Commission, Brussels, pp.14-15.
[155] Joint Communication of the European Commission and High Representative of the EU for Foreign Affairs and Security Policy, Eastern Partnership Roadmap 2012-13: the bilateral dimension, 15 May 2012, Brussels.
[156] K. Schuch, G. Bonas and J. Sonnenburg, Enhancing science and technology cooperation between the EU and Eastern Europe as well as Central Asia: a critical reflection on the White Paper from a S&T policy perspective, Journal of Innovation and Entrepreneurship 2012, 1:3.

conferences, workshops and exhibitions, to exchange ideas and discuss and work jointly on various projects.

For example, the Ukrainian Academy of Technological Sciences, the Integrated Center for Technology Implementation and the Ukrainian Institute of Scientific, Technical and Economic Information under the Ministry of Education are members of the Russian Technology Transfer Network (RTTN), which provides access to major innovation and technology-transfer networks in the CIS.

Also, within the European Neighbourhood and Partnership Instrument (ENPI), there are four cross-border programmes seeking to facilitate networking and cooperation:[157]

- Cross-Border Cooperation Programme Poland-Belarus-Ukraine 2007-2013;
- Joint Operational Programme Romania-Ukraine-Republic of Moldova 2007-2013;
- Joint Operational Programme Hungary-Slovakia-Romania-Ukraine 2007-2013; and
- Black Sea Cross-Border Cooperation Programme 2007-2013

***Eastern Europe and Central Asia***

As at 2012, Ukraine had concluded agreements on scientific and technological cooperation with 11 countries in Eastern Europe and Central Asia: Azerbaijan, Armenia, Belarus, Georgia, Moldova, Russia, Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan. These agreements seek to define specific areas for effective cooperation at the bilateral level.[158]

Since the early 1990s, Ukrainian cooperation in Eastern Europe and Central Asia has been most significant within the CIS framework in terms of volume and intensity, although this has varied over time. Cooperation with CIS members is based on a number of framework agreements.

Ukraine actively participates in the Interstate Council on Cooperation in Science, Technology and Innovation of the CIS member States (Armenia, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan and Ukraine), the major institution created within the framework of the CIS to promote cooperation in relation to R&D and S&T and innovation. Ukraine has joined the Inter-State Programme for Cooperation in Innovation of the CIS Member States for the Period until 2020, which aims at "forming interstate systems based on the commercialization and industrialization of innovation, and developing pilot projects to create innovation-oriented zones and industrial parks on a cooperative basis"[159] and strongly supported the establishment of the International Financial Corporation for Innovative Development during the Council's meeting in Kiev in April 2012. The goal of the Corporation is to provide funding for commercialization and industrial production of

[157] Country Report 2011 Ukraine, Annex to the "White Paper on Opportunities and Challenges in View of Enhancing the EU Cooperation with Eastern Europe, Central Asia, and South Caucasus in Science, Research and Innovation", IncoNet EECA, p.161.
[158] Information Exchange in Science and Technology between the European Research Area and Eastern European/ Central Asian Countries: Ukraine Country Report, IncoNet EECA, March 2012, p.12.
[159] http://business.highbeam.com/407712/article-1G1-287621215/interfax-ukraine-business-daily (accessed on 3 October 2012).

innovations, and for development of joint programmes in various industrial parks in member States, although funding sources and some other details have yet to be finalized. Ukraine, along with other Council members, identified and participated in five major programmes that focused on developing closer cooperation in S&T, human capacity building, commercialization and other areas.

Ukraine also participates in the CIS International Science and Technology Center (ISTC), established to promote cooperation in funding R&D and S&T, and collaboration on the most promising projects with other CIS member States.

In addition, Ukraine was a founding member of the International Innovation Center for Nanotechnologies (IICNT), intended to support R&D in nanotechnologies and their commercialization.

Another channel for promoting cooperation was the International Association for the promotion of cooperation with scientists from the independent states of the former Soviet Union (INTAS). This was a non-profit, charitable association largely funded by the EU that provided information and data support to a number of institutions in the country between 1994 and 2007.

***Eurasian Economic Community***

Ukraine has had observer status in the Eurasian Economic Community (EurAsEc) since 2002. The organization promotes economic cooperation and integration of all member States into a single economic space. The need to establish a competitive environment for R&D and S&T was a factor driving this group's creation. Member States have declared their strong support for the development of the Concept of a Eurasian Innovation System CEIS (2009) and the Eurasian Patent Information System (EAPATIS), among other initiatives.

***Black Sea Economic Cooperation Organization***

The Black Sea Economic Cooperation Organization was established in 1992 with the intention of promoting economic and political cooperation among member States. Ukraine as a founding member actively promoted cooperation in various fields, including trade, energy and education. On a number of occasions, member States have declared the need for closer cooperation in R&D and S&T, and boosted educational exchanges between member States, although some practical steps and mechanisms have yet to be developed.

***Prospects for deeper regional integration***

One way of promoting the internationalization of R&D and deeper regional integration has been the attraction of international experts and companies to the national network of industrial and science parks. Several laws[160] have been introduced seeking to create a favourable environment for international cooperation and investment. State and private delegations have visited Silicon Valley in the USA, Skolkovo in Russia and Nazarbayev University in

[160] Law on Industrial Parks (2012), Law on Innovation Activities, Law on Priority Directions of Innovation Activities and several others. For further information, see: http://erawatch.jrc.ec.europa.eu/erawatch/html2fo/reports/ua_pb_country.pdf (accessed on 22 September 2012)

Kazakhstan to learn about best practices and build expertise in attracting foreign partners and capital for national projects.

In line with other countries in the region, ageing of the R&D personnel remains a challenge, and an emphasis on creating attractive career prospects to both retain young scientific and technical personnel, as well as attracting members of the Ukrainian diaspora abroad to return, will be important. Part of this will be through domestic initiatives, but also through deeper participation in EU, CIS and other regional cooperation mechanisms in the field of S&T. This will facilitate the balanced exchange of personnel, as well as varied work and the opportunity to collaborate with international personnel, which are important factors in creating attractive employment opportunities.

There has been a policy dialogue between the EU and Eastern European and Central Asian (EECA) countries, and a White Paper on Opportunities and Challenges in View of Enhancing EU Cooperation with Eastern Europe, Central Asia and the South Caucasus in Science, Research and Innovation has been jointly prepared by EU and EECA experts.[161] This makes 39 recommendations seeking to tackle 18 policy challenges identified during the dialogue. It has been noted that the White Paper is less a formal policy paper than the culmination of work reflecting an ongoing policy dialogue, which suggests elaborating a medium-term joint roadmap for science, technology and innovation (STI) collaboration between the EU, its member States and EECA the countries.[162]

In relation to future policy developments, the EU's Multiannual Financial Framework for 2014-2020 will play an important role in setting the framework for cooperation in the Eastern Partnership, including Ukraine, with proposals of the European Commission being discussed by the Council and European Parliament during 2012-2013. Current Commission proposals at the time of this Review were to develop a new European Neighbourhood Instrument with a budget of around €18 billion over 2014-2020. There are also plans for significant new EU activities under the areas "Research, Innovation and Competitiveness" and "Education and Culture" for 2014-2020, which may create additional opportunities for Ukrainian cooperation.

## 7.4 Recommendations

Access to international knowledge will continue to play a critical role in modernization of the Ukrainian economy. External markets can provide the necessary demand for innovative Ukrainian companies. Facilitating participation in the global networks through which information flows and ensuring that researchers, students and companies have full access to international cooperation mechanisms help create the framework conditions for innovation to flourish.

[161] White Paper on Opportunities and Challenges in View of Enhancing EU Cooperation with Eastern Europe, Central Asia and South Caucasus in Science, Research and Innovation, IncoNet EECA, April 2012.
[162] K. Schuch, G. Bonas and J. Sonnenburg, Enhancing science and technology cooperation between the EU and Eastern Europe as well as Central Asia: a critical reflection on the White Paper from a S&T policy perspective, Journal of Innovation and Entrepreneurship 2012, 1:3, page 10.

*Recommendation 7.1*

*Ukraine has a well educated population, but continued improvements in human capital and the ability to retain local talent are ongoing challenges. The authorities could consider a number of actions to foster these aims, including:*

- *Continue to build on measures that facilitate the international mobility of graduate students, young researchers and educators. These could include taking advantage of existing EU programmes, developing new forms of cooperation through regional integration initiatives and establishing mechanisms of collaboration with the private sector through shared sponsorship and corporate-sponsored scholarships;*
- *Developing R&D programmes and encouraging spin-offs, including with the participation of foreign partners and private investors, to create long run employment opportunities for returning students and researchers;*
- *Improving the process of attracting foreign experts, scholars and qualified personnel through immigration policies and work permits, along with grants to attract internationally-renowned academics in priority fields; and*
- *Finalizing the standardization of the educational system in accordance with the Bologna Process (mutual recognition of diplomas, academic credits, etc.)*

Participation in global innovation networks and regional partnerships is important to access the knowledge required to advance the country's competitive position and ensure the relevance of domestic efforts. Ukrainian scientists are increasingly engaged in various research collaboration initiatives within bilateral, regional and international frameworks. However, the potential for collaboration has yet to be fully realized due to bottlenecks in existing capacity regarding skills and access to information.

*Recommendation 7.2*

*International cooperation in science can be encouraged by strengthening coordination mechanisms and the circulation of information. Engaging in these exchanges requires specific linguistic and managerial skills that can be developed through appropriate training. Building on current efforts, the Ukrainian authorities could consider measures to:*

- *Develop Internet-based platforms to enhance skills in international research collaboration, including managerial and administrative aspects related to grant applications, research collaboration and commercialization of research projects;*
- *Improve access to international science publications and provide foreign language translation and other support for articles to be published in international journals, as well as developing English language skills among the scientific community;*
- *Introduce a web portal to facilitate access by the R&D community to scientific, technical and educational information and communicate international opportunities for exchange and cooperation;*
- *Promote the emergence of a network of private business and non-profit NGOs to provide training services in preparation for grants and fellowship competitions and legal, managerial and administrative aspects of international collaboration; and*
- *Develop programmes of cooperation with foreign investors to train local staff and transfer international best practices.*

Ukraine has a favourable geographic location and well-developed cultural and economic relations with CIS countries, creating significant potential for cooperation opportunities, which could be exploited more fully. Despite a raft of ongoing initiatives, there remains scope for actions to provide a more solid institutional basis for common projects in various fields.

*Recommendation 7.3*

*The authorities should build on existing initiatives and common traditions to derive greater benefit from bilateral and regional economic cooperation in areas related to innovation, including through a number of possible actions such as:*

- *Strengthening R&D and S&T linkages with similar programmes in the CIS, and championing those programmes and projects where Ukrainian institutions and scientists have potential to become regional leaders and centres of excellence;*
- *Facilitating the integration of the emerging innovation infrastructure into various regional and international networks in the CIS, EU and BSEC; and*
- *Promoting the establishment of joint educational and training programmes in the field of higher education by establishing dual diploma/degree programmes or joint graduate programmes with major international universities.*

International visibility of innovation efforts is important to attract the interest of foreign partners and engage them in domestic initiatives. However, this requires coordinated efforts that present a coherent view of public programmes and allow synergies.

*Recommendation 7.4*

*The authorities should build on the growing network of cooperation with international partners to ensure increased recognition of the potential for cooperation by implementing new measures that could include:*

- *Identifying or developing a single national flagship project that would be promoted internationally, as a rallying point and catalyst for the interest of foreign partners;*
- *Improving coordination between different R&D and innovation programmes, identifying elements that would benefit from international cooperation, so these can be communicated in a consistent and unified way to foreign partners;*
- *Developing a communications strategy for the promotion of national goals among key partners, along with a national branding campaign to promote Ukraine as an attractive investment location; and*
- *Implement a monitoring and evaluation system to assess the impact of integration initiatives.*

# *Annex*

# *PROSPECTIVE INNOVATION-DRIVEN INVESTMENT PROJECTS AND INFORMATION SOURCES*

## 1 Introduction

Private sector participation is important to innovation performance. Within the European Union, for example, the latest Innovation Union Scoreboard (2011) notes that top performing member states tend to have national research and innovation systems including a key role for business activity and public-private collaboration.[163] It is therefore important that private actors are informed about priority areas for innovation policy, and also that policies are responsive to their needs. It is further noted that innovation leaders in the EU tend to perform well in terms of public-private co-publications per million population (i.e. strong linkages between the science base and enterprises), and in terms of commercialization of their technological knowledge.[164]

OECD (2012)[165] considered Ukraine to be an economy transitioning from being resource-led to efficiency-led. Taking into account the country's stage of economic development, market attractiveness and current assets, the OECD identified a number of sectors as priorities in terms of potential to attract foreign investors and improve the sectoral competitiveness of Ukraine: agribusiness (including grain and dairy value chains), energy-efficiency and renewable technologies (including the biomass value-chain), and machine manufacturing and transport equipment (including the civilian aircraft value chain. These are all sectors where innovation is important – whether in terms of adopting (and adapting) best practices from abroad (e.g. boosting agricultural yields), or closer to the knowledge frontier, as in the case of machine manufacturing and the civilian aircraft value chain.

Clarification of strategic sectors and territories where there are restrictions on foreign investment, as recommended by the OECD (2011) and others, may also result in considerable new investment opportunities for foreign investors. WTO accession has likewise led to the opening of a number of sectors for foreign investment, including transport, telecommunications and banking, with certain restrictions on foreign investment in the insurance and media sectors also due to be lifted by May 2013.[166]

The EBRD is currently the largest individual financial investor in Ukraine, with priorities for its investment activities including the agricultural and renewable energy sectors. In relation to agriculture, the grain sector has been a key EBRD focus for initiatives targeting market liberalisation and efficiency improvements. More recently, a policy dialogue has been launched between the EBRD, FAO and Ukrainian Ministry of Agrarian Policy and Food for

[163] Innovation Union Scoreboard 2011, DG Enterprise and Industry, European Commission, Brussels, p.8.
[164] *Ibid.*
[165] OECD (2012), Competitiveness and Private Sector Development: Ukraine 2011: Sector Competitiveness Strategy, OECD Publishing, p.18.
[166] OECD (2011), Investment Policy Reviews: Ukraine 2011, OECD Investment Policy Reviews, Paris, p.10.

the Ukrainian dairy sector, and will include key market regulators and participants. This aims to improve standards and boost output by promoting the sector's sustainable development, including through measures to increase its competitiveness and attractiveness to investors.[167]

## 2 Priority focus areas for innovation activity

The medium-term priorities for innovation[168] at the national level for 2012-2016 are, broadly, as follow (Table 26):

### Table 26. Priority focus areas for innovation activity for 2012-2016

| |
|---|
| Promotion of new methods of energy transmission, energy efficiency, resource-saving technologies and alternative energy sources.<br>*E.g. improved networks with EU interoperability; combined heat and power; alternative and renewable fuels (incl. storage); energy efficient construction; biomass; heat pumps.* |
| Promotion of new technologies of high-tech transport systems, rocket and space industry, aviation and shipbuilding, armaments and military equipment.<br>*E.g. high-speed rail; transport logistics; launching vehicles/ spacecraft; control systems for aircraft, ships, missiles, military electronics; new equipment, technologies and diagnostic tools in aviation, shipbuilding and space industries; and navigation systems.* |
| Promotion of new technologies for materials, their processing and connectivity, creating nanomaterials and nanotechnology industry.<br>*E.g. composite materials and tools; industrial, construction and transport sectors; functional biological and medical materials; and environmental protection.* |
| Technological upgrading and development of agriculture.<br>*E.g. soil protection technologies; production, storage and processing of high-quality crops; plant disease diagnostics; cattle and pig breeding; high performance biofuels; new biotechnologies in crop production; animal husbandry and veterinary medicine.* |
| Introduction of new technologies and equipment for high-quality medical care, treatment, pharmaceuticals<br>*E.g. diagnostics; treatment/prevention of human diseases; enzymatic technologies; recombinant growth hormones; cytokines and interferons; recombinant drugs for diabetes; diagnostics for hereditary, monogenic diseases; biosensor diagnostics; autologous cell therapies; drugs based on novel bioactive substances and biocompatible nanoparticles.* |
| Widespread use of cleaner production technologies and environmental protection<br>*E.g. land use; water supply and sanitation; closed cycle technologies; treatment technologies; recycling/disposal of industrial and household waste; radioactive waste recycling and disposal.* |
| Development of modern information and communication technologies, robotics<br>*E.g. decision-making technologies; grid technologies and cloud computing; national ICT networks; optical storage media; supercomputer technologies.* |

[167] EBRD press releases "EBRD boosts renewable energy sector portfolio in Ukraine" and "EBRD and FAO pledge support to Ukrainian dairy sector", April 2013.
[168] Resolution number 294 of the Cabinet of Ministers of Ukraine, 12 March 2012.

## 3 Public sources of information on investment and innovation projects

National Projects[169]

On 25 August 2010, the Committee on Economic Reforms identified a number of National Projects focusing upon socio-economic development, quality of life and national security. To support implementation of these National Projects, the State Agency for Investment and National Projects of Ukraine was established by Presidential Decree no. 583 of 12 May 2011. The list of projects has been subsequently updated, including by the Order of the President of Ukraine of 22 March 2012.[170]

The priority areas initially approved in 2010 were"national projects", which were in turn supplemented in 2012, to include for example an increased focus on the agricultural sector. At the time of this Review, there were 17 national projects (Table 27) approved by the Cabinet of Ministers of Ukraine:

**Table 27. National projects**

| National priority | National project | Regions |
|---|---|---|
| **New energy** | LNG Ukraine – development of a liquefied gas supply infrastructure | Odesa region, particularly regions of gas supplying countries |
| | Energy of nature – construction of wind, solar and small hydro power station, production of solid alternative fuel | Most regions |
| **New quality of life** | Affordable housing – network of projects for affordable housing construction | 10 pilot regions |
| | New life – improved quality of mother and child care | All regions |
| | Clean city – solid waste treatment | 10 pilot cities |
| | Quality water – quality drinking water | Most regions |
| | Open world – development of national ICT network for education based on 4G technologies | All regions |
| | Future City – drafting a strategic plan and projects for urban development | Kiev city, autonomous republic of Crimea |
| | Timely medical assistance – creation of unified regional dispatching service, GPS technology to reduce ambulance waiting times | All regions |

[169] Source: http://www.ukrproject.gov.ua/page/natsionalni-proekti-i-prioriteti
[170] Source: http://investukraine.com/5101-president-of-ukraine-has-extended-the-list-of-the-national-projects.

**Table 27. National projects *(continued)***

| National priority | National project | Regions |
|---|---|---|
| **New infrastructure** | Air express – railway connection between Kiev and Boryspil international airport, other infrastructure construction in Kiev region | Kiev region |
| | Danube corridor – development of transport interconnections and river navigation in the Danube region | Odesa region |
| | Industrial parks of Ukraine – development of industrial and production infrastructure | 10 pilot land plots |
| | Technopolis – development of innovative and high-tech infrastructure | - |
| **Olympic Hope 2022** | Development of sport and tourism infrastructure | Lviv, Zakarpattia, Ivana-Frankivsk regions |
| **Agri-prospective** | Grain of Ukraine – program for economically efficient grain production | - |
| | Cattle breeding – programme development and implementation | Volyn, Dnipropetrovsk, Kharkiv regions |
| | Green markets – development of regional wholesale food markets | Most regions |

These projects have been promoted to international investors through a series of road show presentations in late 2011 across Europe, North America, the Middle East and Asia.

Invest Ukraine

Invest Ukraine is an Investment Promotion Unit within the State Agency for Investment and National Projects, established by the President of Ukraine in 2011.[171] It provides a "one-stop-shop" service for investors, similar to that provided in many other countries for investment promotion purposes, seeking to provide a simplified system of interaction between investors and state and local authorities through a single executive body.

It aims to reduce "time to market" for a typical investor's business plan from what was typically over 24 months to 6-9 months by providing a single interface for investors with ministries, agencies, licensing bodies, local government and consulting services.

Services to be offered to investors will include:[172]

- Information and research services;
- Pre-investment support services;
- Support in getting started; and
- Aftercare.

[171] Source: www.investukraine.com/one-stop-shop/how-it-works.
[172] "Facing investors' needs", presentation by Mr. Sergiy Yevtushenko, Head of InvestUkraine, Kiev 2011.

In particular, Invest Ukraine has prepared a number of products, freely available online, of potential use to investors, with topics covered including:[173]

- Financial services and insurance;
- Customs regulations;
- Intellectual property rights;
- Employment;
- Real estate and construction;
- Taxation;
- Foreign investment; and
- Setting up a business.

In particular, there are a number of guarantees and incentives for foreign investors, as laid out by the Foreign Investment Law.

Guarantees for foreign investors include:[174]

- Protection against nationalization;
- Guarantee for compensation and reimbursement of losses (where arising from non-discharge of duties by state or municipal agencies);
- Termination of investment activity: foreign investors can repatriate revenues and investments free from export duties within six months of termination of the investment activity; and
- Repatriation of profits.

The above guarantees are secured for a period of 10 years against legislative changes that may affect them, with the exception of matters relating to national security and defence, protection of public order and environment.

In principle, foreign investors are taxed on profits in the same way as other domestic enterprises, and in-kind investments are exempt from import duties. Additionally, Ukrainian companies with at least 10% foreign ownership may also establish subsidiaries, affiliates and branches in and outside Ukraine to conduct their commercial activities.

Projects' Marketplace

The State Innovation Financial-Credit Institution (SIFCI), the successor institution of the State Innovation Fund, with a mandate to develop strategic and innovative investment projects, is expected to provide the basis for a "Project Marketplace" as part of ongoing reforms. It will provide a marketing platform for investment projects on both domestic and foreign investment markets, and financial support for startup projects proposed by the public, private and municipal sectors, and for public-private partnerships.

[173] Source: http://investukraine.com/investors-guide/legal-overview
[174] Source: Foreign Investment in Ukraine, InvestUkraine and Baker & McKenzie: http://investukraine.com/wp-content/uploads/2011/10/Foreign-investment-in-Ukraine.pdf.

Such a Marketplace has the potential to be a valuable source of potential projects for investors. It is envisaged that the Project Marketplace will comprise an interactive data base of investment projects under different forms of ownership,[175] expected to be launched in 2012, including projects that may be:

- State-owned
- Private
- Municipal.

The Project Marketplace is not in itself a source of state support, but is instead intended to facilitate access to the range of support created by the investment reform of Ukraine, as well as other sources of finance.[176]

Ukrainian Institute for Scientific, Technical and Economic Information (UkrISTEI)[177]

Under the auspices of the State Committee of Ukraine on Science, Innovation and Informatization, UkrISTEI created and maintains databases seeking to facilitate the transfer of innovation technologies, which are accessible and searchable online. Other activities include publication of a magazine on "Scientific and technical information", again for dissemination purposes, as well as publicizing key Ukrainian developments in international publications, and organizing exhibitions, seminars and conferences.

Services offered include the possibility to make submissions to be included in an innovation technologies and development database, an investment projects database, as well as experts', partners' and investor databases (who are able to specify their particular field of interest, along with other key parameters). There are additional consulting and marketing services, including searches of these databases for experts, investors and partners in specific domains, as well as the market promotion services for new technology and developments.

The offer of free placement of information ("offers") on investment projects as well as new innovation technologies has allowed the construction and frequent updating of two elements of the intergovernmental ASFIMIR database, which are searchable online for potential investors in innovative projects.

At the time of writing, the database on innovation technologies and development included information on almost 2,000 "offers" in Ukrainian and Russian, and information on around 900 of these "offers" also provided in English. The database of investment projects included information on over 300 "offers" seeking investment financing in Ukrainian, with information on almost 200 of these also provided in English, and around 100 in Russian. "Offers" are classified according to around 100 fields, covering all key areas, although particularly prominent fields for potential investors include medicine and biotechnology, resource- and energy-saving technologies, applied chemistry, construction, engineering, agro-alimentary sector, transport, instrument making, materials and metallurgy.

[175] Source: Presentation by V. Kaskiv at Business Forum, PPP Days 2012, Geneva 23 February 2012.
[176] Source: Information provided during UNECE fact-finding mission, September 2012.
[177] Source: http://store.uintei.kiev.ua/transfer/eng/index.html.

State Fund of Fundamental Research (SFFR)[178]

The SFFR was founded in March 1992, and was the first in Ukraine to offer grants on a competitive basis to scientific and technical projects in all areas of basic science, as opposed to block grants to institutes and universities, which had been standard practice. There was also a remit to encourage international cooperation in basic research.

Commercialization is not the primary objective of the SFFR, which seeks to support fundamental scientific research in natural, technical and humanitarian sciences by scientific institutions, universities and scientists. However, it plays a key early stage role in providing early stage support in the innovation cycle for scientific and technical developments. Projects it supports may produce outputs of potential interest to investors, and an analytical database of all proposed projects is maintained, as well as a library.

State Intellectual Property Service of Ukraine (SIPS)[179]

The SIPS provides an online portal with a range of useful information relating to intellectual property in Ukraine – both in terms of its protection and commercial exploitation, and the legislative framework. This will be useful to potential investors in innovative, knowledge-based projects.

Ministry of Economic Development and Trade of Ukraine

The Ministry of Economic Development and Trade of Ukraine provides a range of information resources that may be of use to investors seeking innovative investment opportunities.

As well as providing information in relation to overall economic outlook and forecasts for Ukraine, development in economic and trade policies at the national level, and summaries of the relevant legislation[180] on commercial and trade related matters. In particular, there is a range of information provided in relation to investment and financial policy.[181] These pages contain a range of information on:

- Project preparation;
- Investment climate in Ukraine;
- Investors' Council under the Cabinet of Ministers of Ukraine;
- Investment projects;
- Credit resources to finance investment projects (European Investment Bank);
- Reference of institutional support for investment and innovation activity in Ukraine;
- Public-Private Partnerships;
- Concession activities (and their use in PPPs in Ukraine); and
- Legal basis of PPP in Ukraine

[178] Source: http://www.education.gov.ua/uk/joomla-license/2010-07-29-13-12-26.html.
[179] For further information, see http://sips.gov.ua/ua/aboutsips.html.
[180] See http://www.me.gov.ua/control/uk/publish/category/main?cat_id=32854.
[181] See http://www.me.gov.ua/control/uk/publish/category/main?cat_id=36525.

The Ministry also publicizes specific investment projects in Ukraine at the regional level, as submitted by the regional state administrations, outlining investment projects and funds required,[182] as well as providing a link to the national public procurement portal,[183] where interested parties are able to register to receive tender announcements.

Regional projects

A regional network of Centers for Investment and Development is available to provide support and advice to prospective investors[184]. 27 such regional Centers for Investment and Development are functioning within the organizational structure of the State Agency for Investment and National Projects. The work of each regional centre is concentrated in four main directions:

- "One-stop-shop" services for potential investors;
- National projects (their components) implementation;
- Investment promotion and investment attraction; and
- Marketing of the territories.

In order to offer a regional investment platform, a network of industrial parks is in the process of being established in Ukraine, and seeking investors (Table 28). In certain cases, industrial parks are being established in conjunction with Special Economic Zones.[185] At this stage, investments being sought relate largely to infrastructure of the parks themselves, which is generally being co-financed by the State. Once established, these parks have the potential to become focal points for innovative investment activities in the regions.

**Table 28. Regional industrial parks seeking investors**

| Oblast | Park | Area | Investment sought | Model |
|---|---|---|---|---|
| Lviv | Ryasne | 25 ha. | $50m for infrastructure development | Joint venture with city council |
| Rivne | Rivne | 145 ha. | $4.1m for infrastructure development | Rental |
| Zakarpattya | Solomonovo | 41 ha. | $98k for infrastructure development | Purchase of land plot |
| Khmenlnytsky | Kamyanets-Podilsky | 17 ha. | Dependent on project specificities | Rental or purchase of land |
| Zhytomyr | Korosten | 82 ha. + 74 ha. | Dependent on project specificities | Rental or purchase of land |

[182] See http://www.me.gov.ua/control/uk/publish/category/main?cat_id=50852.
[183] See https://tender.me.gov.ua/EDZFrontOffice/.
[184] See http://investukraine.com/regions/regional-centers-for-investment-and-development for more details.
[185] E.g., Rivne industrial park will be located in the Zakarpattya Special Economic Zone, in Zakarpattya oblast.

**Table 28. Regional industrial parks seeking investors *(continued)***

| Oblast | Park | Area | Investment sought | Model |
|---|---|---|---|---|
| Zhytomyr | Novo Park | 282 ha. | $5.6m – Phase I infrastructure | Rental or purchase of land |
| Vinnytsia | Vinnytsia | 84.2 ha. | $3.2m for infrastructure development | Rental or purchase of land |
| Zaporizhzhya | Invest-Melitopol | 198 ha. | $3.2m for infrastructure development | Land purchase |
| Kherson | Nova Kakhovka | 22 ha. | Dependent on project specificities | Land purchase |
| Crimea | Shcholkine | 142 ha. + 51 ha. | $80m for infrastructure development | Rent/sub-rent |
| Luhansk | Alchevsk | 82.5 ha. | $3.5m for infrastructure development | Rental or purchase of land |
| Luhansk | Lysychansk | 53 ha. + 43 ha. | Dependent on project specificities | Rental or purchase of land |
| Luhansk | Rubizhne | 37.6 ha. | $1.8m for infrastructure development | Land plot rental |
| Luhansk | Stakhanov | 53.0 ha. | $2.1m for infrastructure development | Land plot rental |

*Source:* http://investukraine.com/wp-content/uploads/2012/03/indastrial_parks-1.pdf.

Invest Ukraine provides a platform to publicize regional investment opportunities,[186] although as the regional industrial and business park network develops, the role of these parks may be expected to increase in terms of promoting individual investment projects.

Public-private partnerships

These are an innovative means of delivering public services in cooperation with the private sector, and as such have potential for a range of investment opportunities in fields as diverse as infrastructure, education and health. These have risen up the agenda in Ukraine, as in neighbouring countries, with an important step being the Law of Ukraine "On public-private partnership" adopted on October 31, 2010.

[186] See http://investukraine.com/investment-opportunities/regional-opportunities for more details.

This established several important principles in relation to public-private partnerships, and in common with European Union member states:[187]

- Equality before the law of public and private partners;
- Prohibition of any discrimination of rights of public or private partners;
- Accommodation of interests of public and private partners in order to obtain mutual benefit;
- Invariability for the full term of the contract;
- Recognition of public and private partners' rights and duties as provided by the legislation of Ukraine and defined by terms of the contract;
- Equitable distribution of risks between public and private partners; and
- Selection of private partners on a competitive basis.

Many of the "National Projects" have potential to be delivered through public-private partnerships. The demonstration effects provided by such large scale projects may be hoped to pave the way for a diverse range of smaller scale PPPs, as this means of delivering public services becomes better established.

## 4 Private investment opportunities

Basic information for private investors

The Chamber of Commerce[188] is a useful source of support and information for private investors in Ukraine. There are also a number of other institutions seeking to support business and improve dialogue with the public authorities, such as the Ukrainian Union of Industrialists and Entrepreneurs,[189] and web based portals designed to support businesses entering the Ukrainian market. A key recommendation of the OECD Investment Policy Review of Ukraine 2011 was to develop public-private consultations on business-related legislation and regulations with the business community, including foreign investors.

Companies in Ukraine may be established in the following forms:

- Joint stock company;
- Limited liability company;
- Company with additional liability;
- Company with combined liability; and
- Company with full liability.

Although the most common form of companies to be established are joint stock companies (JSCs) and limited liability companies (LLCs), both of which include the concept of limiting liabilities[190] that will be expected by most international investors.

[187] Source: Information Notice on PPP projects in selected countries presenting at the Business Forum, PPP Days 2012, Geneva 23 February 2012.
[188] See http://www.chamber.ua/.
[189] See http://www.uspp.org.ua/index.php.
[190] Source: Setting up business in Ukraine, Baker and McKenzie/ InvestUkraine.

Recent measures have focused on reducing the timescales required for establishing these key vehicles for foreign investors, and also establishing streamlined procedures for voluntary liquidations.[191]

Industrial Parks

The Law "On Industrial Parks" was approved by the Supreme Council of Ukraine on 21 June 2012.[192] This made a number of provisions, some of which are outlined here:

- Industrial parks may be between 15 and 700 acres in area;[193]
- Term use of land within the industrial park must be at least 30 years from the day the decision on the establishment of the industrial park; [194] and
- Eligible economic activities on industrial parks to include industrial production, R&D and activities in the field of information and telecommunications.[195]

30 year time frame is intended to give investors the certainty they need. In general, basic infrastructure will be provided on the site, reducing cost and uncertainty for investors. Land designation issues will also have been resolved for investors ahead of time (land being classified as agricultural has been an issue for some investors in the past).

Article 4 of this Law makes various provisions, including for competition in the selection of a management company for the state/ communal property used to establish industrial parks, as well as making provisions for state support in the creation of industrial parks and state incentives for investment in them.

Consistent with this, in parallel with the development of this Law, work has also been taking place to identify suitable land plots for industrial parks, which may now include both brownfield and greenfield sites. At the time of the Review, according to a land plot inventory carried out by the State Agency for Investment and National Projects, 39 land plots in 19 regions have been identified as suitable for industrial park development. Support is being provided with regard to industrial parks' infrastructure development (access roads, electricity, water, gas supply, sewage, etc.) on these sites.

In addition, a new national project "Industrial parks of Ukraine" has been approved by the Cabinet of Ministers of Ukraine. It will be implemented in eight regions on ten pilot land plots.

Following this Law, the State Customs Service of Ukraine [196] clarified certain import exemptions from customs duty into the customs territory of Ukraine.

[191] *Ibid*.
[192] See http://zakon1.rada.gov.ua/laws/show/5018-17.
[193] Article 8.3.
[194] Article 9.3.
[195] Article 1.3.
[196] See Letter of the State Customs Service of Ukraine N 16/1-16.1/1702-EP, 15 August 2012 http://document.ua/shodo-zakonu-ukrayini-vid-21.06.2012-n-5018-vi-pro-industria-doc108990.html

According to amendments to Article 287 of the Customs Code of Ukraine, imports of the following into the customs territory of Ukraine are exempt from customs duty:

- Machinery, equipment and its components, materials that are not produced in Ukraine, which are not excisable goods and are imported by initiators of the creation – entities, who manage companies of industrial parks, for the installation (to equip) of industrial parks; and
- Machinery, equipment and its components that are not produced in Ukraine and are not excisable goods are imported by participants of industrial parks for economic activities within the industrial parks.

The lists of such equipment and its components and materials are approved by the central executive body to ensure implementation of the state policy in the sphere of investment activities and management of national projects according to the procedure established by the Cabinet of Ministers of Ukraine.

Procedures and mechanisms for the import of machinery, equipment and its components will be sent additionally, after approval by the Cabinet of Ministers of Ukraine.

Implementation will vary between regions and parks, with implementation being led by a range of public and private actors. An early example is a Memorandum on Cooperation[197] signed between the State Agency for Investments and National Projects and the Dnipropetrovsk Region. In this case, funding from the Agency will be the result of inclusion as one of its national projects, with the Dnipropetrovsk Regional Administration, Dnipropetrovsk Regional Council and the Agency developing joint plan for attracting foreign investments for 2012-2015, and an investment projects database. This is one example of regional information sources being developed for investors.

Key sectors for private investors

Ukraine has important endowment, skills and cost advantages in certain sectors, where the key to success will be framework conditions that do not obstruct investment and innovation, along with supporting public policy measures. There is generally already substantial investment in such areas, which will provide considerable demand for innovative investments in the future. The OECD (2012)[198] identified agribusiness (including grain and dairy value chains), energy-efficiency and renewable technologies (including the biomass value-chain), and machine manufacturing and transport equipment (including the civilian aircraft value chain) as sectors with key potential for attracting foreign investment.

All of these sectors have considerable innovative potential. For example, in the field of agribusiness, given supply chain disruption in the early 1990s and technological gap with leading European producers, there is considerable scope for investment in modernization, and tailoring of foreign technologies to best suit Ukrainian conditions. There is a similar situation in the fields of energy-efficiency and renewable technologies, for example in retrofitting

[197] See http://investukraine.com/5067-president-of-ukraine-has-approved-new-national-project-%E2%80%9Cindustrial-parks-of-ukraine%E2%80%9D-%E2%80%93-v-kaskiv

[198] See OECD (2012), Competitiveness and Private Sector Development: Ukraine 2011: Sector Competitiveness Strategy, OECD Publishing.

housing stock to increase energy efficiency and ensuring new build properties meet high standards. However, Ukraine is considerably closer to the knowledge frontier in certain subsectors, e.g. solar energy, and is likely to be targeting best practice in such areas as opposed to straightforward "catch up".

*Agriculture and food processing*

The OECD (2012) assessed the grain sector as enjoying significant competitive advantage, with production costs around half those of other European producers, and particularly highlighted the potential role for innovations in this sector:

- Improvements in quality standards to increase export potential; and
- Financing of small and medium-sized farmers.

In the dairy sector, costs are also around half those in Western European countries. Again, scope is identified for innovations and technological advancements to improve the quality standards of outputs from the dairy sector, and increase productivity, with yields lower than in many neighbouring countries. In addition, alignment with international quality standards and WTO membership[199] have potential to stimulate innovative investment in the sector. There is also considerable potential for growth in the meat sector, where livestock headcount has decreased by 82% since 1987, the poultry/ egg market, and in the food processing industry, which makes up almost a quarter of Ukraine's total exports.[200] Food processing is a sector that has grown strongly over recent years, has been less affected by the crisis than other sectors and also benefits from a dynamic domestic market, as consumption patterns converge with those of higher income countries.[201] This is a promising sector for a strategy to ensure value added is captured from a strong domestic resource base.

Given restrictions on land sales, leasing is a common practice in the agricultural sector, with large agribusinesses currently leasing over 3.5 million hectares of land. These large, vertically integrated agribusinesses currently operate on 10-15% of total arable land in Ukraine, with commercial large-scale production accounting for only around one third of total output,[202] and controlling around 20% of leased agricultural land in Ukraine. Statistics also shows leasing to be common practice among smaller players, although to a lesser extent.

In addition to land reform, a number of other policy recommendations in the OECD Sector Review (2012) have potential to open up new investment opportunities in this sector – including human capacity building policies, extension programmes to develop producer skills, strengthening the role of producer cooperatives and credit guarantee schemes to foster access to finance for mid-size farmers. The EBRD (2010) also noted the importance of a focused investment approach and regional differentiation in the Ukrainian agribusiness sector. While such policy measures represent work in progress, there have been concrete policy measures

[199] *Ibid.*
[200] Source: Industry Overview: Food Processing and Industry Overview: Agricultural Industry, Deloitte/ InvestUkraine.
[201] See page 74, OECD (2012) and Industry Overview: Food Processing Industry, Deloitte/ InvestUkraine.
[202] Source: Industry Overview: Agricultural Industry, Deloitte/InvestUkraine.

emerging recently, such as a "Land Bank" to reduce the cost of financing for farmers, recently announced by the Ministry of Agrarian Policy and Food.[203]

*Sustainable Energy*

There is broad consensus on the need to increase energy efficiency in Ukraine, due to the fact that historically low energy prices have led to a high energy intensity of GDP. In particular, as world energy prices remain high, and Ukrainian prices converge to these higher levels, there will be a considerable incentive to both increase the energy efficiency of production and consumption, and to seek new sources of energy production.

The OECD (2012) particularly identified biomass as being a promising sector for development, with Ukraine having large volumes of agricultural and forestry waste. The OECD Investment Policy Review of Ukraine (2011) also identified sustainable energy as a high priority, emphasizing the importance of complementing energy efficiency measures with investment in developing renewable energy resources, and reforms to liberalize energy pricing to give incentives for private investors.[204]

There is evidently ongoing significant investment in insulating and retrofitting both domestic and commercial properties to enhance energy efficiency. Ukraine has already taken early steps to boost its solar energy production. The Okhotnykovo and Perovo solar parks, located in the Crimea region and a key element of the "Natural Energy" national project that were completed in 2011, rank among the largest solar parks in the world. With a combined power of 180 MW,[205] these represent an enormous step forward in the solar energy sector. Prior to construction, total solar power capacity in the country stood at just 7 MW,[206] and the project now represents Europe's largest completed solar park.[207]

A further development with EBRD support is planned for the Vinnytsia region for six solar power plants with a total capacity of 50 MW.[208]

*Information Technology*

Ukraine is a significant exporter of IT services. Strengths of the IT sector in Ukraine are IT outsourcing, software development and systems integration.[209] While the global financial crisis resulted in a severe contraction in the sector's activity, it has also been quick to rebound.

The IT sector is a further strength in terms of innovative development, as it is one of the sectors in which start-ups are most prevalent in Ukraine. As a sector with a young demographic and with often low entry costs, this is perhaps unsurprising. However,

[203] See http://en.for-ua.com/news/2012/10/05/125325.html.
[204] OECD (2011), Investment Policy Reviews: Ukraine 2011, OECD Investment Policy Reviews, OECD Publishing, Paris.
[205] See http://www.pvresources.com/PVPowerPlants/Top50.aspx.
[206] See http://www.mfa.gov.ua/greece/en/news/detail/74089.htm.
[207] See http://www.bloomberg.com/news/2011-12-29/europe-s-biggest-solar-park-completed-with-russian-bank-debt-1-.html.
[208] See http://en.for-ua.com/news/2012/10/05/142215.html.
[209] Source: "Information Technologies in Ukraine", Deloitte/ InvestUkraine.

successful start-ups in this sector can help, by demonstration, to encourage greater entrepreneurship in the wider economy, and to promote knowledge-based development.

There is scope for debate regarding the role of outsourcing – in some senses it may involve the transfer of knowledge, but higher wages may also discourage IT professionals from establishing risky start-ups. The sector is increasingly well-catered for in terms of informational events for potential investors, for example, the Investor Day in Central and Eastern Europe (IDCEE) event has been hosted in Kiev in 2011 and 2012.[210] While the start-up ecosystem remains in the early stages of development, there have been a number of recent success stories for Ukraine in this area:

**Box 6. IT start-ups in Ukraine**

***Viewdle*** focuses on face, object, and gesture recognition technology products for smartphones, tablets, and other camera-enabled devices.[i] It was founded in 2006 in Ukraine, but is now headquartered in Silicon Valley, and was successful in raising around $12.5 million in venture funding since launch, including a $10 million Series B round in 2010. At the time of this Review, the company had just been purchased by Google's Motorola Mobility unit.[ii]

Other examples include ***Jelastic***, a U.S./Ukrainian/Russian provider of a cloud-based deployment platform for Java apps that secured $2 million in Series A funding from Russia and CIS-focused investors in early 2012.[iii]

At any one time, there are a large number of early stage start-up projects, and this is a dynamic sector. At the time of this Review, ***FindGuru.me*** had been established as an online marketplace for education seeking to match tutors with students through an auction system allowing tutors to optimize their schedule in a way similar to yield management for the airline industry. FindGuru is initially specializing in the SAT exam preparation, with planned expansion to other exam preparations. The team is currently in Boston, USA, for business development. Team members are from four different cities in Ukraine, having come together in Kiev to start the project after receiving investment from Eastone.[iv] Development funding has been secured from a range of investors based in Ukraine and the USA. At the time of this Review, ***Findguru.me*** was one of two teams to have successfully raised a round of investment in addition to Eastlab's seed investment.

[i] See http://viewdle.com/about.html for further information.

[ii] TechCrunch, "Confirmed: Google's Motorola Mobility Acquires Image And Gesture Recognition Company Viewdle", 3 October 2012.

[iii] TechCrunch, "Java Application Deployment Platform Jelastic Raises $2 Million from Russian Venture Funds", 25 April 2012.

[iv] Information provided by Eastlabs during UNECE fact-finding mission, September 2012. For further information, please see www.eastlabs.co and http://launch.findguru.me/.

In addition to the start-up sector, Ukraine has been a well-established centre for IT outsourcing/ software development and system integration. The largest IT outsourcing companies operating in Ukraine by income in 2010 were GlobalLogiv Ukraine, EPAM

[210] See http://www.idcee.org/about/ for further information.

Systems, Ciklum, SoftServe and Infopulse Ukraine. The largest system integration companies by income in 2010 were Incom, Sitronics, BMS Consulting, S&T Ukraine and S&P Ukraine.[211]

While there is no special tax regime for the IT industry, there is provision under current Ukrainian legislation to allow establishment of free economic zones, where additional privileges and benefits may be granted in respect of foreign investments in the IT sector. There are also tax holidays for startups with annual sales of $375,000 or less, where there is a 0% rate of corporate income tax, a regime expected to remain in place until 2016. It is also possible to subcontract individual programmers on the basis of civil contracts rather than employing them, meaning they may be eligible to pay income tax under the Unified tax regime (i.e. 5% rather than the standard 15%-17%), and reduced social contributions.[212]

The current policy priority being given to creating a supportive environment for innovation is likely to provide further support to the developing IT sector – for example the national project BIONIC Hill, which will result in a significant new IT and high-tech park within Kiev city limits.

*Other sectors*

This Annex can give only a brief overview of some of the innovative investment opportunities that are available. There are a number of other strong areas for Ukraine. In its Competitiveness and Private Sector Development report, in addition to the sectors the OECD (2012) also highlighted machinery and transport equipment, particularly civilian aircraft manufacturing, as an area where Ukraine possesses the necessary skilled labour. The most significant engineering subsectors at a macroeconomic level with potential for further innovative development include: electrical machinery and apparatus, medical and measuring equipment, as well as transport vehicles and equipment.

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[211] Source: Industry Overview: Information Technologies, InvestUkraine/ Deloitte.
[212] *Ibid*.

# 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.