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Sustainable Innovation Development of Kazakhstan: Challenges to Transform Science and Technology

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Abstract: Transition of the Republic of Kazakhstan to sustainable development is a vital necessity. The Republic of Kazakhstan is located between high-growth markets such as China, India and Russia. It benefits from vast energy and agricultural resources and nearly universal literacy. Technological development and innovation play a key role in the growth of Kazakhstan. In the future, information and communication technology (ICT), nano-technology and genomics are likewise expected to have a great impact on economic and social structures. This paper shows a process approach directing innovation towards sustainable development in Kazakhstan.

Key words: Sustainable development · Technological development · Innovation · Science and R and D policies

INTRODUCTION

Sustainable development and its guiding principles, places high demands on all of us; whether this is in creating modern innovation policy that prompts the development of new energy efficiency technologies, or by instilling environmentally conscious thinking into our day to day lives. Kazakhstan is experiencing rapid economic and social progress. Kazakhstan is experiencing rapid economic and social progress. While much of the world has suffered recession followed by sluggish growth, Kazakhstan continues to deliver impressive results. A country's science and R and D policies are crucial determinants of its economic vitality. For more developed nations with higher labour costs and greater skills, this often means implementing science and R and D policies that increase the supply of ideas and knowledge in an economy and then incentivizing their commercialization. For less-developed countries, it often means implementing science and R and D policies that enable the nation's organizations to adopt newer and better technologies than a currently in use. Underlying these policies is the fact that, without them, the level of innovation in an economy almost always is suboptimal from a societal perspective. Indeed, the significant spillover benefits from innovation mean that, even under 'perfect' market conditions, the private sector that produce innovation, including R and D. Furthermore, organization often fail to adequately adopt existing innovations, in part because of 'Learning failures', but also because spillover effects apply to companies investments in new capital equipment. Literature review.

Knowledge is not only becoming inevitably one of the most important drivers of sustained competitive advantage [1,2], but also always more complex and diverse. A necessary consequence is an increase in specialization of knowledge workers and organizations. At the same time, the speed with which various markets offer new products has increased tremendously and there are no signs that innovation speed is about to slow down in the near future.

Many authors devoted a considerable attention to the topic of innovation processes in the industry-university relationship [3,4]. Industries and universities benefit more from each other through close cooperation. Universities have easy access to commercialization of their new ideas in collaboration with industries, while; on the other hand, universities re the main source of

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fundamental knowledge and innovation for industries. However, it is harder than it sounds [5] argue that there is no universal model of industry-university cooperation.

Increasingly sustainability is a source of strategic change [6,7] and driver for innovation [8]. Sustainability-oriented innovations are changed processes/structures, enhanced or new products/services that are or in comparison to a prior version environmentally or socially superior [9-11]. More complex than conventional innovations [12-14] they are also termed as "better managed innovations" [15]. Therefore, companies need to strengthen their innovation capacity, for which knowledge and learning are central [16].

Institutions for governance and for developing incentive structures are an essential ingredient of any strategy for achieving sustainable development. Effective institutions must be able to: a) lengthen the time horizons for which individual and societal decisions are made; b) broaden the orientation of governments to the needs of the many over the long-term; c) enable individuals, firms, governments and entire societies to consider short-term sacrifices that offer long-term improvements and d) include the capacity for rapid, constructive response to evidence of unsustainability of a certain course of action.

Social science research (e.g., from political science, economics) has provided numerous insights about many of these issues, for instance; about the social and political conditions and the types of institutions that are associated with lengthening of time horizons for collective decision-making; about the circumstances that foster diffusion of desirable governance practices and the barriers that can prevent effective institutions from being adopted; and about the ways in which governments gain and maintain popular support and the circumstances under which these dynamics can shift the attention of narrowly-based governments to broader concerns about social, economic and environmental sustainability.

The qualities of governance that are most likely to foster sustainable development are hard to establish and maintain. Yet our increasingly interconnected world presents many new opportunities for influence, synergy and cooperation across national boundaries, which improves the possibilities for building appropriate institutions, even in inhospitable settings. It must be acknowledged, however, that even when effective institutional arrangements and incentives are in place, a successful transition to sustainability requires citizens that place a high priority upon meeting such goals.

Technological innovation for sustainable development.

Technological innovation plays an important role across the full range of issues. Technological innovation can be seen as a double-edged sword with respect to sustainable development. There is no doubt that much of the improvement in human welfare over the past century can be accounted for by technological innovations in areas such as public health and agriculture. But at the same time, many of the world's critical sustainability problems are unintended consequences of technological developments, especially those aimed at increasing production and extraction of natural resources.

In some cases, the primary need is to enhance implementation of existing technologies; but in other cases, the magnitude and fundamental characteristics of the challenges to be addressed are so great that radical technological advancements are required (for instance, with respect to the challenge of meeting the world's growing energy demands in a sustainable manner). Depending upon the issue involved, the scale of required efforts ranges from international-level technology development and dissemination programs, to grassroots innovations driven by individuals or communities at the local level.

Most countries distinguish between R and D policies that focus on the generation of new knowledge and industrial policies that focus on building and manufacturing capabilities. Convergence of these two approaches could foster the expanded use of existing technologies, while also building a foundation for long-term R and D efforts. This requires paying particular attention to technologies that have broad applications and profound implications for long-term economic transformation (for instance, ICT, biotechnology, nanotechnology and new materials).

Creating links between knowledge generation and enterprise development is one of the most important challenges facing developing countries. There are a variety of ways in which governments can help stimulate small and medium-sized enterprises; for instance, by supporting business and technology 'incubators', export processing zones and production networks that allow small enterprises to pool business services and labour pools. Targeted taxation regimes and market-based instruments and a wide variety of strategies for unlocking financial capital, are needed to create and sustain enterprises that contribute to sustainable development.

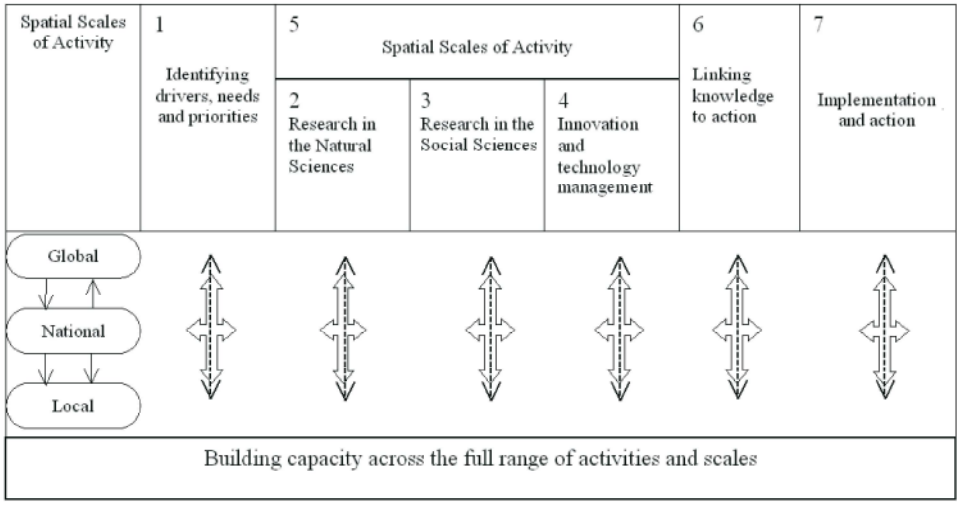

Fig. 1: Conceptual framework for harnessing science, technology and innovation for sustainable development

Figure 2. Kazakhstan: Innovation learning curve

Early Experimentation (1990s)	Stabilization (2000-2005)	Consolidation and expansion (2005-2010)	Development of a vision (2010+)	Strategy 2020
- New legal framework for investments;	- Set-up National Innovation Fund (2003);	- First FDI (foreign direct investments) success stories;	- Program for Development of Innovations and promotion of Technological Modernization for 2010-2014;	-State Health Program
- Creating of national ministries including Science and education;	- Experiences with Economic Zones;	- Merger of Samruk-Kazina;		- State Program on Accelerated Industrial Innovative Development
		- Law on State support of Innovation (2009);		
		- Programme for promotion of innovation and technological upgrading (2010);	- Plan for scientific and technological development to 2020 (2010);	- State Educational Program
		- Approval of the list of institutions for innovation development (2009);	- Strategic Plan for Development of Kazakhstan till 2020;	- State Languages Program
			- Nazarbayev university launched;	

Figure 3.Research and Development and Innovation Governance Structure-MICRO level

	Science	Innovation and Technological development
Institutional	Law on Science – February. 2011.	
	Higher Science and Technical Commission Science Fund, JSC	Law on State support of Industrial Innovation Activities – Jan. 2012.
		Council on Technological development
		National Agency for Technological Development, JSC.
Infrastructure	5 national scientific laboratories for shared use	7 Technoparks
	15 laboratories of engineer profile	4 design offices
	41 research entities	1 Free economic zone
	132 national universities in Kazakhstan, of which 22 are	2 International Technology Transfer Centers
	involved in Science and Technology.	9 Commercialization offices
Financial support	- Grants for basic research and industry targeted activity	-9 types of innovation grants
	- Approval of all Ministries research programs and budgets	-Technological business incubation services
		- Commercialization services
		-Project and Venture Financing (Equity)

The list above no means comprehensive, but it illustrates the depth of the challenges that need to be addressed and provides a valuable foundation for further analysis of the role of technological innovation in sustainable development.

A general conceptual framework to illustrate the interrelationships that exist among the various efforts needed for effectively harnessing science technology and innovation for sustainable development and the ways in which an

evolving research agenda can be integrated into this framework.

Figure 1 is a matrix that illustrates the different types of activities and different levels of integration among these activities, that should occur over a broad continuum of spatial and temporal scales. For the sake of simplicity, we specify three main spatial scales at which action may take place: global, national and local. Time scales are represented in the various feedback pathways.

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

The main programmatic document is the State Programmefor Accelerated Industrial Innovative Development (SPAIID) 2010-2014, part of the Development Strategy 2020 that was approved in 2010 and covers the period 2010-2020. In addition to the SPAIID, the Development Strategy 2020 includes a Health Programme, Education Programme, Language Programm and others (Figure 2). SPAIID has 13 sectoralProgrammes and ten functional Programmes.

There is a wide gap between the worlds of business and science in most countries. In Kazakhstan, the problem has been particularly acute given the legacy of the planned economy, where there was a rather strict separation between the research sector and companies. This legacy led to the lack of institutional development to facilitate these linkages (Figure 3).

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

CONCLUSION

Achieving a transition to sustainable development is inconceivable without meaningful dialogue and partnerships among the many different groups that should be involved in such efforts, including natural and social scientists, engineers and technologists, business and industry, development practitioners and development assistance agencies, policy makers and civil society groups.

Kazakhstan has put in place an ambitious strategy to foster economic diversification and knowledge-driven development. Indeed, policy puts a challenging emphasis on the promotion of innovation as a driver of economic development and diversification.

A main problem is the generally low business demand for research, technology and innovation in Kazakhstan, its inefficient structure and excessive edge toward the purchase of ready-made equipment abroad instead of implementation of own new developments. The efforts in supporting the implementation of research and the cooperation of research organizations with business should be further strengthened and projects among public research organizations higher education institutions and business be supported.

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