ADB

Report to the Government of Kazakhstan

Policies for Industrial and Service Diversification in Asia in the 21st Century

Asian Development Bank

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* We are grateful to H.E. Kairat Kelimbetov (Deputy Prime Minister of the Republic of Kazakhstan), Madina Abylkassymova (Vice-Minister of Economy and Budget Planning of the Republic of Kazakhstan), and a number of other ministers and high-level officials of the Government of the Republic of Kazakhstan for their guidance, inputs, and kind assistance since the inception of this project; to Maria Joy Abrenica, Joven Balbosa, Fred Block, Jungmoh Chang, Kristine Farla, Francesca Guadagno, Cesar Hidalgo, Matthew Keller, Mushtaq Khan, DoHoon Kim, Aigul Kosherbayeva, Keun Lee, Guanghui Li, Justin Lin, Cheryl Long, Jayant Menon, William Mitchell, Manshuk Nurseitova, Lyaziza G. Sabyrova, Siew Yean Tham, Bart Verspagen, Yan Wang, and Xiaobo Zhang, for their inputs; and to Mike Alba and Kevin Donahue for their editorial assistance.

October 2013

Asian Development Bank

Printed in the Philippines.

ISBN 978-92-9254-282-5 (Print), 978-92-9254-283-2 (PDF)
Publication Stock No. RPT136049-3

Cataloging-in-Publication Data

Asian Development Bank
Report to the Government of Kazakhstan: Policies for industrial and service diversification in Asia in the 21st century
Mandaluyong City, Philippines: Asian Development Bank, 2013.

1. Kazakhstan. 2. Diversification. 3. Industrial Policy 4. Revealed Comparative Advantage. I. Asian Development Bank.

Note:
In this publication, "$" refers to US dollars.

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Printed on recycled paper

Foreword

The economy of Kazakhstan has performed remarkably well since gaining independence in 1991. Between 1993 and 2012, gross domestic product (GDP) per capita grew more than 17 times, from $696 to $12,119. Furthermore, during the last 10 years, GDP grew in real terms at an annual average growth rate of 7.2%. All sectors of the economy (both goods and services) contributed to achieving this high growth rate. Between 2002 and 2012, the most rapid growth was achieved by the mining sector, which grew 1.7 times, manufacturing (which grew 1.8 times), construction (which grew 3 times), telecommunications (which grew 7.5 times), and transportation services (which grew 1.9 times).

The excellent performance of the economy was the result of both sound macroeconomic policies and a favorable investment climate. During 1993–2012, Kazakhstan attracted $170 billion of foreign direct investment. To sustain macroeconomic stability and manage its oil revenues, Kazakhstan established the National Fund with assets reaching $65.9 billion as of September 2013. Moving forward, Kazakhstan's strategic development objective is long-term sustainability, which requires diversifying the economy and upgrading the human capital base. We forecast that the economy will be 45% larger in 2018 than in 2012, which will ensure that GDP per capita reaches $24,000 by then.

Kazakhstan's success is all the more remarkable given the significant slowdown of many economies after the global financial crisis. However, Kazakhstan's economy remains heavily dependent on oil, and this dependence is increasing. In 2000 petroleum accounted for 50% of total exports. Over the next decade a disturbing trend became apparent and by 2010, oil represented an even larger share, 61% of total exports.

Since 2010, the Government of Kazakhstan has renewed its efforts to increase economic diversification through a state program of Industrial–Innovative Development of Kazakhstan for 2010–2014. Currently, Kazakhstan is developing the second stage of this program, geared towards transforming the economy by emphasizing and prioritizing more knowledge-intensive and innovative industries. Kazakhstan has also chosen a policy of "related diversification." This strategy is focused on four 'new generation' integrated industrial–economic clusters, including: (i) an integrated energy cluster; (ii) a metallurgy and machinery cluster; (iii) an agriculture and food processing cluster; and (iv) an integrated chemicals cluster.

In 2011, the Government of Kazakhstan requested policy advice from the Asian Development Bank (ADB) on how to further diversify the economy and on how to modernize its industrial policy. The government was likewise keen to learn from the experiences on diversification and industrialization policies of both developed economies and other economies, including Australia, the People's Republic of China, the European Union, the Republic of Korea, Malaysia, and the United States, as their experiences could provide important insights on the probable outcomes of Kazakhstan's own efforts at diversification and industrialization.

This report is the culmination of close cooperation between the Government of Kazakhstan and ADB. It documents the degree of diversification and sophistication of Kazakhstan's economy during the past 15 years and summarizes the experiences and lessons of different economies in modernizing industrial policy tools. The report emphasizes that industrial policy should be stage-of-development dependent. Given Kazakhstan's current income level and industrial structure, it points out that the effectiveness of traditional industrial policies may have reached a limit and that the government ought to benchmark advanced countries' indirect industrial policies and risk-management framework through the financial markets.

ADB staff in the Economics and Research Department, the Central and West Asia Regional Department, and the Kazakhstan resident mission cooperated closely with the Government of Kazakhstan in preparing this report. I'm confident that the analyses and recommendations in this publication will prove useful to the Government of Kazakhstan in its quest for economic diversification and modernization.

Kairat Kelimbetov
Deputy Prime Minister of Kazakhstan
30 September 2013

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Boxes, Figures, and Tables

Acronyms and Abbreviations

ABS	Asset Backed Securitization Law (Republic of Korea)
ADB	Asian Development Bank
EC	European Commission
EU	European Union
EIF	European Investment Fund
ETP	Economic Transformation Plan (Malaysia)
ETRI	Electronics and Telecommunications Research Institute (Republic of Korea)
FCRA	Federal Credit Reform Act (US)
FDI	foreign direct investment
FoF	Fund of Funds (Republic of Korea)
GAO	Government Accountability Office (US)
GDP	gross domestic product
GIF	Growth Identification and Facilitation
GPRA	Government Performance and Results Act of 1993 (US)
GRI	government research institute
HCI	heavy and chemical industry
HS4	Harmonized System at four digits
ICT	information and communications technology
IA	impact assessment
IE	impact evaluation
IFC	International Financial Corporation
KfW	Germany's national development bank
KIST	Korea Institute of Science and Technology
KODIT	Korea Credit Guarantee Fund
KOMOCO	Korea Mortgage Corp.
KOTEC	Korea Technology Credit Guarantee Fund
M&E	monitoring and evaluation
MAP	Multiannual Program for Enterprises and Entrepreneurship (EU)
MINT	Ministry of Industry and New Technologies (Kazakhstan)
MITI	Ministry of International Trade and Industry (Malaysia)
MNC	multinational corporation
MOST	Ministry of Science and Technology (Republic of Korea)
MSC	Multimedia Super Corridor (Malaysia)
NFRK	National Fund of the Republic of Kazakhstan
NSTC	National Science and Technology Commission (Republic of Korea)
NSF	National Science Foundation (US)

OECD	Organisation for Economic Co-operation and Development
OMB	Office of Management and Budget (US)
POSCO	Pohang Steel Corporation
PPP	public–private partnership
PRC	People's Republic of China
R&D	research and development
RCA (pop)	revealed comparative advantage index
SBA	Small Business Administration (US)
SBC	Small Business Corporation (Republic of Korea)
SBIR	Small Business Innovation Research (US)
SciSIP	Science and Science Innovation Policy (US)
SMEs	small and medium-sized enterprises
SOE	state-owned enterprise
SPAIID	State Program on the Accelerated Industrial–Innovative Development of the Republic of Kazakhstan, 2010–2014
T	Kazakhstan tenge
UAE	United Arab Emirates
UNIDO	United Nations Industrial Development Organization
WTO	World Trade Organization

Executive Summary

The Need for an Industrial Diversification Policy

- Kazakhstan successfully weathered the deep recession that followed independence in 1991 and overcame a number of external shocks, including the 1998 Russian crisis and the 2008–2009 global financial crisis. Its per capita income of about $12,000 in current dollar terms, places it among the World Bank's group of upper middle-income countries.[1] Yet, challenges remain as Kazakhstan seeks to modernize its economy and promote broad-based development.

- Kazakhstan's greatest challenge is to reduce its heavy dependence on oil, which represents about one-fifth of total gross domestic product (GDP) and approximately 60% of its total merchandise exports. With a production level of about 1.7 million barrels per day in 2010, Kazakhstan is the 17th largest oil producer in the world and the second-largest in the region after the Russian Federation.

- While natural resource abundance can be akin to "manna from heaven," it is also well-known that many resource-rich countries have difficulties in managing their natural resource wealth to the benefit of both current and future generations. Therefore, the diversification of the economy is a political and economic imperative in Kazakhstan. To achieve it, the government has devised a series of industrial policy programs over the past two decades. However, despite these programs and rapid economic growth, Kazakhstan's economy has not made much progress towards diversification.

    - Partly due to the oil price boom in the 2000s, and partly due to a lack of incentives, the economy is less diversified today than it was 10 years ago. Today, Kazakhstan exports with revealed comparative advantage—our measure of diversification and competitiveness—only 127 products out of 1,240 (in the Harmonized System at four digits [HS4]). This represents a rise from the 70 exported in 1995, but a drop from the 160 exported with comparative advantage in 2000.

    - Moreover, this number is low compared with those of Malaysia and Thailand, countries that have income levels similar to that of Kazakhstan. They each export with comparative advantage about 800 products, while the People's Republic of China (PRC) exports about 900. Kazakhstan's number of products exported with comparative advantage is also well below those of developed country exporters of natural resources like Australia, Canada, and Norway (over 600 products each).

- Our empirical analysis shows that Kazakhstan could aim to double the number of exports in which it has revealed comparative advantage, bringing it closer in line with countries such as Belarus, Brazil, Chile, and the Russian Federation (200–300 products each). Moreover, the experience of countries like Brazil proves that diversification away from a predominant natural resource export—coffee in the case of Brazil—is possible. To achieve this goal, Kazakhstan needs to upgrade its industrial polices commensurate with its stage of development, which is above that of a typical middle-income country.

[1] In 2012, Kazakhstan's per capita income was $12,119. The World Bank classifies a country as high income when its per capita income is at least $12,616.

- A recent study by the Asian Development Bank (ADB) finds that no country has achieved high-income status without its manufacturing sectors reaching at least an 18% share of total employment and output over a sustained period of time. The importance of manufacturing affirms that a diversified manufacturing base remains important for economic development (ADB 2013).

Key Elements of a Modern Industrial Diversification Policy

- This report provides a historical review of a series of industrial policy programs adopted by the Government of Kazakhstan since independence. Comparisons with the experiences of other developing economies are made, including the Republic of Korea, Malaysia, and the Philippines, as well as the developed economies of Australia, the European Union (EU), and the United States (US).

- Five key questions surrounding industrial policy are addressed: (i) who selects the sectors to promote? (ii) what is the rationale for sector selection? (iii) what are the main tools used to promote sectors? (iv) how can industrial policies support innovation and human capital development? and (v) how should industrial policies be monitored and evaluated?

The role of government

- Modern governments can play an important role in addressing information and coordination externalities inherent in attempts to diversify. This is the rationale underlying modern industrial policy.

- The experiences of other countries suggest that industrial policy and sector selection should be stage-of-development dependent.

  - Countries at an early stage of development produce goods that are already produced elsewhere; selecting sectors is relatively less risky because well-known patterns of technological development can be emulated. Industrial policy during this early stage of development is not about expanding technology frontiers to create new industries. Rather, it is about the public sector playing a leading role in identifying key development bottlenecks and addressing coordination failures. Finance is also an important factor. In less developed economies, financial markets are underdeveloped. Financial institutions that specialize in intermediating risks associated with large-scale projects do not exist. Thus, the government needs to mobilize domestic and external financial resources.

  - As an economy matures, the nature of industrial policy changes. Production technologies become more sophisticated and the promotion of new industries moves into uncharted territory. Industrial policy has to confront high-return, high-risk tradeoffs that are too much for the public sector to take on alone. Furthermore, as an economy matures the balance of expertise gradually shifts from the public to the private sector. Therefore, it is natural that decisions about developing new products or sectors—often known as "picking winners"—is increasingly left to private firms.

- Political economy is also a factor. Industrial policy is unfair by nature as some areas of society benefit more than others. This inherent unfairness becomes less widely accepted as a society becomes more democratic. Also, as an economy develops, foreign competitors will not be as forgiving of government subsidy support for certain sectors. Therefore, the role of government in industrial policy tends to be more indirect in advanced economies.

Indirect industrial policy

- A common misconception is that governments in advanced economies no longer pursue industrial policies. In fact, many advanced economies rely on "indirect industrial policy" by selecting and supporting industries through private financial markets. The government broadly defines the favored industries and announces incentives for private financing. The role of private financial institutions is to find candidates to support. The government adjusts the level of incentives to assume a minority or majority share of the guarantee depending on the risk involved. Good examples include the Multiannual Program for Enterprises and Entrepreneurship (MAP) under the EU's Lisbon Strategy; various credit guarantee programs of the European Investment Fund (EIF); and the small and medium-sized enterprises (SMEs) onlending programs of Germany's national development bank, KfW.

- The benefits of indirect industrial policy are numerous. Risks can be shared between the public and private sectors. The government can leverage the private sector's deeper knowledge in selecting potential winners. Moreover, it is an effective way of minimizing the moral hazard problem. One of the practical difficulties of traditional industrial policy is that governments have difficulties withdrawing assistance to firms once extended. But with indirect industrial policy, private financial institutions, not the government, interact directly with firms and can withdraw their support, if necessary, without generating political backlash or giving the impression that "the government is taking away umbrellas when it is rainy."

Policy tools

- The selection of industrial policy tools is also stage-of-development dependent. These tools can be classified into one of eight categories: (i) fiscal incentives, (ii) investment attraction programs, (iii) training policies, (iv) infrastructure support, (v) trade measures, (vi) public procurement, (vii) financial mechanisms, and (viii) industrial restructuring schemes. Governments in advanced countries rely increasingly on financial tools as their economies mature, while at the same time the public sector's role in industrial policy becomes less and less visible.

- In modern industrial policy, risk management tools are important. While there are potentially significant social returns from pursuing industrial policy, the fiscal cost of credit program failures are absorbed by the government and, ultimately, the taxpayers. A stop-loss mechanism is necessary to ensure that ineffective or wasteful credit programs are not continually funded year after year. The US Federal Credit Reform Act (FCRA) of 1990 is a good example. Industrial restructuring tools also need to be developed to minimize the ex post impact of program failures.

Human capital development and innovation

- Human capital development and innovation are essential components of industrial policies. Yet, promoting tertiary education alone is not enough to either gain competitiveness in existing industries or move into new industries. The private sector must supply education, training, and research and development (R&D). Initiating an R&D consortium with the private sector in targeted industries can be an effective government strategy to accelerate R&D expenditure.

- Foreign direct investment is an important element of the industrial diversification process. However, if not properly designed, preferential treatment and R&D incentives for foreign multinational corporations (MNCs) can increase the profitability of MNCs without resulting in technology transfer to domestic firms. Sometimes, buying technology and paying royalties may be more effective in developing the domestic technology base.

Monitoring and evaluation

- A strong monitoring and evaluation (M&E) mechanism is essential for successful industrial policies. There are several general rules for effective M&E mechanisms, including establishing clear objectives, developing simple check-up mechanisms, and ensuring accountable coordination among relevant agents. Furthermore, the government should not launch any new initiatives if programs with similar policy objectives remain unfinished and/or unevaluated.

- As economies mature, industrial policies become more complex. It is virtually impossible to trace all spillover effects across industries and come up with a comprehensive macroeconomic evaluation of a modern industrial policy package. Therefore, industrial policies in advanced economies are typically reviewed and monitored on a program-by-program basis, rather than evaluated as an overall industrial policy package. Evaluation programs must be decentralized and have multiple layers of oversight. An appropriate legal framework is also needed to make M&E mechanisms effective and transparent.

Policy Priorities for Industrial Diversification in Kazakhstan

- **Kazakhstan's industrial policy needs to be coordinated, simplified, streamlined, and strictly monitored**.

  - A high-level committee for centralized coordination and policy deliberation needs to be institutionalized. This independent body must demonstrate political leadership in guiding the policy implementation process. Such committee would check progress against targets, coordinating between government and business and academic institutions to resolve implementation problems quickly.

  - Clear benchmarks for project successes and failures need to be established. For transparency and accountability, an external monitoring mechanism involving parliament, academics, and private sector representatives should also be set up to evaluate annual performance.

- **Indirect industrial policy must be mainstreamed**.

Given Kazakhstan's current income level and industrial structure, the effectiveness of traditional industrial policies has reached its limit.

  - The government ought to benchmark advanced countries' indirect industrial policy through financial markets.

- Industrial policy projects, with the exception of those involving purely public goods, should explicitly require financial participation of the private sector, whether domestic or external.

- The government could use Samruk–Kazyna funds to promote indirect industrial policy.

- **Risk management tools need to be developed**.

  - Industrial policy can sometimes fail, entailing huge fiscal costs. Ex ante tools must be put in place, such that when a program progresses unsatisfactorily, the budget of the implementing agency or the amount set aside for onlending to financial institutions will be automatically reduced. Ex post restructuring mechanisms need to be established to facilitate the resolution process.

- **Innovation must be promoted and human capital upgraded**.

  - Innovation and human capital are two of the weakest links in Kazakhstan's industrial policies. On-the-job training should be encouraged and links between industries and universities strengthened.

  - R&D should likewise be promoted. The government could lead a consortium of firms to develop new technologies, which would eventually be transferred to private firms.

  - Links among SMEs and between SMEs and larger companies—both public and private—must also be encouraged. The government must act as a catalyst to establish SME networks that serve as the foundation of an innovative value chain.

  - To promote competition and encourage R&D, inefficient state-owned enterprises ought to be privatized.

- **Industrial policy is not just for manufacturing**.

Industrial policy is relevant for promoting economic sectors other than manufacturing, including agriculture and services. Upgrading these sectors can create the jobs necessary to keep Kazakhstan's growing labor force employed.

- **Macro and financial stability is a prerequisite for successful industrial policy**.

Macroeconomic policy has a significant effect on buttressing the economy's resilience to external shocks, especially financial shocks. Maintaining sufficient foreign reserves and strengthening macroeconomic policies will help Kazakhstan maintain a stable exchange rate and avoid the so-called Dutch disease.

- **More investment in infrastructure is needed to support industrial policy.**

Kazakhstan must upgrade its transportation, logistics, and energy systems to facilitate industrial policy implementation. Modern infrastructure will not only help integrate domestic markets, but also provide a link to unexploited external markets.

Introduction

Kazakhstan's per capita income recently reached $12,000 in current dollar terms. According to the World Bank's classification, this places Kazakhstan among the world's upper middle-income economies. Kazakhstan's overall performance since independence in 1991 is remarkable because the years immediately following the breakup of the former Soviet Union were marked by significant economic instability that tested the country's political and economic systems. Despite improved fortunes, Kazakhstan's leaders are wary as the country faces a number of important challenges in its quest to become a modern industrial and service-based economy. This report looks at issues related to Kazakhstan's economic development, focusing on the efforts made by authorities to diversify the economy.

Kazakhstan is a large, landlocked, sparsely populated, resource-rich, transition economy. It is well endowed with mineral resources, especially oil and gas. Oil production represents about one-fifth of Kazakhstan's total gross domestic product (GDP) and approximately 60% of total merchandise exports. With a production level of about 1.7 million barrels per day in 2010, Kazakhstan is the 17th-largest oil producer in the world and the second-largest in the region after the Russian Federation. With the discovery of oil in the Kashagan Field in the Caspian Sea, Kazakhstan's proven oil reserves were estimated to be 39.8 billion barrels at the end of 2010—the ninth-largest in the world and second-largest in the region after those of the Russian Federation.[1]

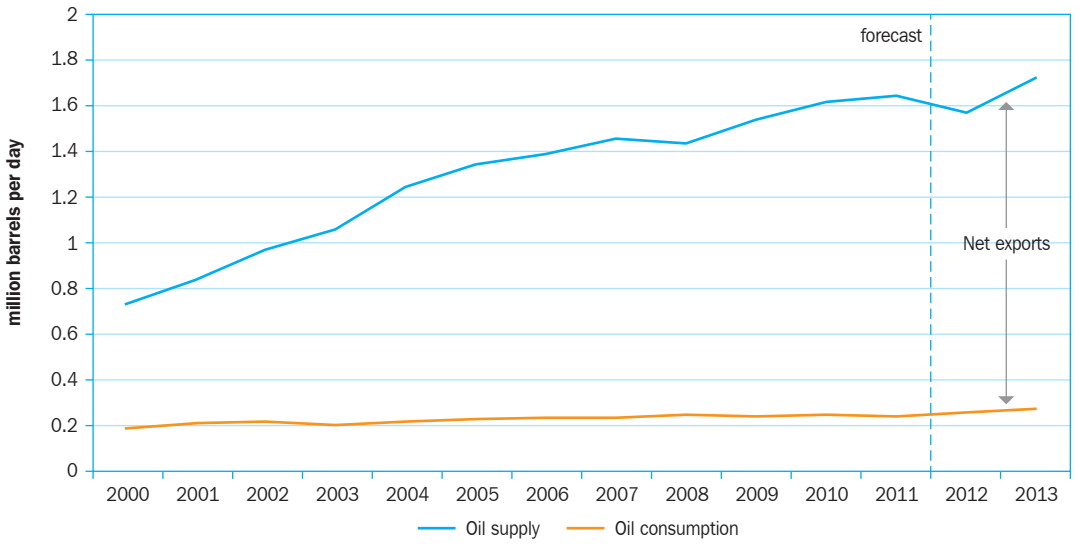
[1] At current production levels, the country has an oil reserve-to-production (R/P) ratio of 73.2 years, close to that of the Middle East (82.2 years), and significantly greater than the world average (41.6 years) and the Russian Federation's (21.8 years). Kazakhstan had proven gas reserves of 1.9 trillion cubic metres in 2007, comparable to those of Iraq, which has an R/P ratio of 69.8 years. In 2012, gas production reached 40.3 billion cubic meters.

While this natural resource abundance is often considered "manna from heaven," managing such wealth can pose economic problems.

Although Kazakhstan's per capita income has increased significantly since 1991, the government acknowledges that the country faces a number of challenges arising from its dependence on oil exports (Figure 1). Thus, diversifying the economy has become the key objective of economic policy. The State Program on the Accelerated Industrial–Innovative Development of the Republic of Kazakhstan, 2010–2014 was put in place to diversify the economy by developing priority sectors and to reduce reliance on oil. Although the program has achieved some of its goals, partly due to rising energy prices, its efforts toward diversifying the economy have fallen short of expectations. In fact, Kazakhstan's oil dependence has increased. Given the proliferation of industrial policies and the increasing number of agents involved, Kazakhstan's government found it necessary to modernize its industrial policies. The ADB President recently announced the 2050 Strategy, which has the primary goal of transforming Kazakhstan into one of the 30 most developed countries in the world.

The first objective of this report is to review the history of the economic diversification programs implemented by Kazakhstan in recent decades in the light of modern approaches to industrial policy and the experiences of other countries with different stages of development, including Australia, the European Union, the Republic of Korea, Malaysia, the Philippines, and the United States (US). Secondly, based on the country case studies, the report tries to identify priorities for Kazakhstan to modernize its industrial diversification policies.

Figure 1: **Kazakhstan's Oil Production and Consumption, 2000–2013**[a]



[a] 2012–2013 data are forecasts.
Source: US Energy Information Administration, Short-Term Energy Outlook, September 2012.

PART I

A. Why Does Kazakhstan Need to Diversify its Economy?

To become a modern economy Kazakhstan needs to both diversify and upgrade its agriculture, manufacturing, and services. Today the economy is less diversified and competitive in international markets than it was ten years ago. Many countries with per capita income levels of $12,616 or higher, and therefore classified by the World Bank as high-income, are substantially more diversified than Kazakhstan. Furthermore, recent research has shown that a boom in commodity prices can have a positive short-run economic effect on a country like Kazakhstan, but the gains are often wiped out in less than two decades and output ends up below where it started. This is especially true of price gains in commodities such as oil and minerals.

The difference between modern and pre-modern economies is that modern economies are made up of a larger number of inputs and outputs (i.e., goods and services), most of which were not previously available. This makes them much more complex economies. This increase in diversity is probably the most conspicuous aspect of economic development, and a chief difference between the complex process of economic development and the aggregate process of economic growth. Prosperous economies, such as Germany, Japan, and the US, differ from less prosperous places both in the diversity of available inputs and in the diversity of outputs they produce. These differences in diversity imply that developed countries participate in more industries and in more markets than developing countries. The most highly developed countries can perform activities that only other developed countries can undertake, and which are in demand in most places. These differences in diversity thus command different fates, since diversity is self-reinforcing. In a world in which new activities tend to emerge, in part, as a combination of old ones, wealth is not a consequence of having more, but of having the right combination of activities.

Despite being seemingly obvious, the role of diversity in the economy has been historically difficult to understand. In practice, our world is diverse and colorful. In theory, however, the most popular descriptions of our world have attempted to explain economic diversity in terms of a few aggregate factors or through continuous functions. As a result of these abstractions, it has become hard to understand why countries that might look similar at the aggregate level end up having diverging fates. Why, for example, are natural resources so good at bringing in dollars, but so bad at kick-starting development? Why do creative jobs concentrate in a few cities around the world? And, how do wealth, growth, and development actually differ from one another despite the fact that many measures consider them to be the same?

Figure 2 shows the diversification and composition of exports (as a percentage of total exports) of four different countries with similar levels of per capita income: Costa Rica, Kazakhstan, Turkey, and Venezuela. Industrial diversity in Kazakhstan and Venezuela is much lower than in Costa Rica or Turkey. In the first two countries, almost two-thirds and three-quarters of total exports, respectively, are comprised of a single product, petroleum.

Figure 2: **Export Structures of Costa Rica, Kazakhstan, Turkey, and Venezuela**

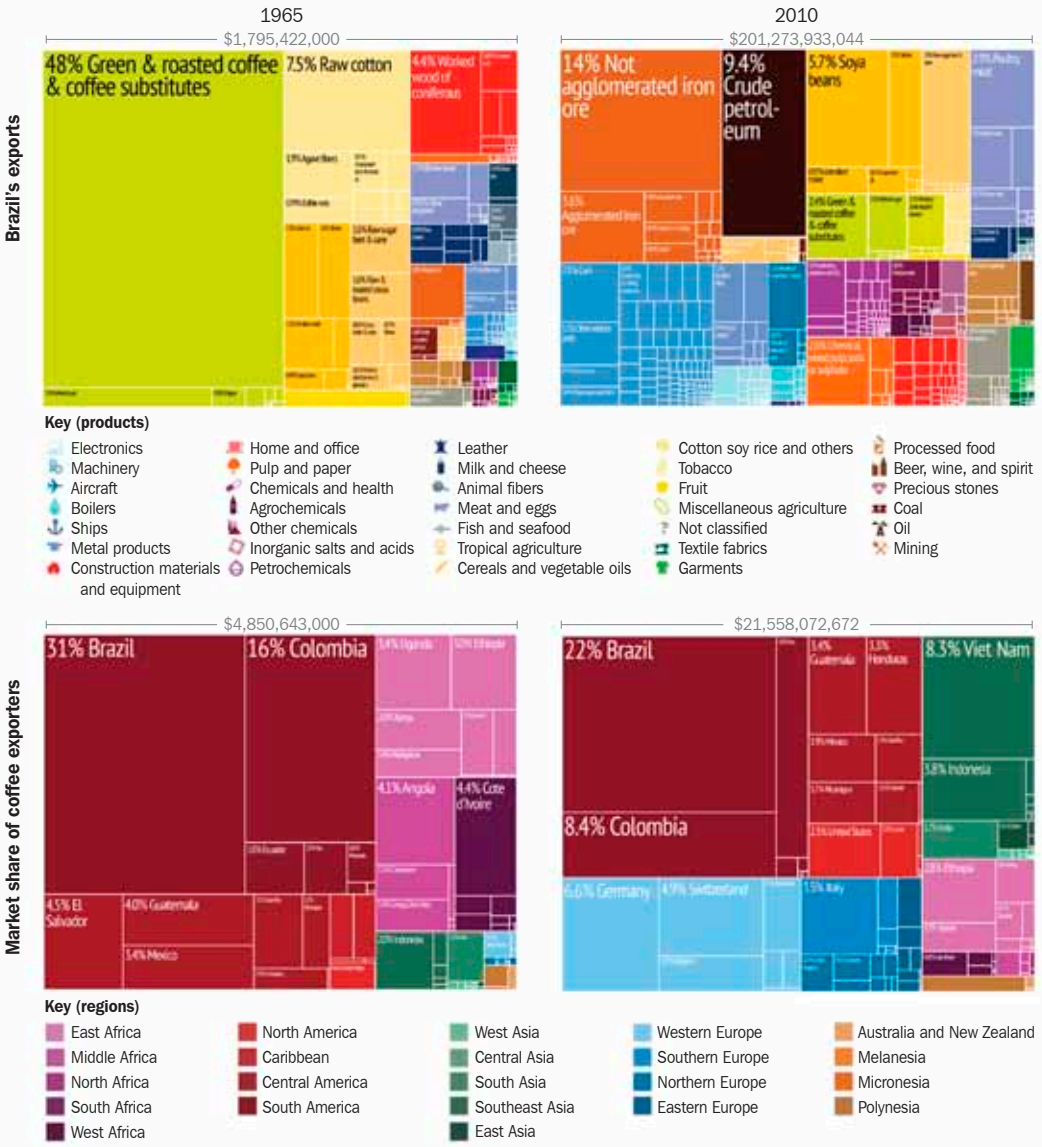
Note: Data for 2010, classified according to the Harmonized System at four digits (HS4).
Source: The Observatory of Economic Complexity (2013).

Recent empirical evidence shows that the diversity of a country's industrial structure matters, since it is a strong indicator of future economic growth. However, there are reasons why economic diversity is important which go beyond economic complexity and the path dependencies implied by the structure of production. For example, export diversification matters because it can lower volatility and instability in export earnings. In fact, economic downturns are shorter-lived in countries that have a more diversified export structure.

To make the point clear, in the case of Kazakhstan one needs to pose (and answer) the following questions: what would happen if an alternative to oil were made commercially viable in the next few decades? Would Kazakhstan be able to match Brazil's economic turnaround? Figure 3 shows Brazil's export structure in 1965 and 2010. In 1965, coffee was Brazil's main export, accounting for 48% of exports. Figure 3 also shows that in 1965, Brazil was the world's main coffee exporter with 31% of the world's coffee exports. In 2010, Brazil remained the world's leading coffee exporter, with a market share of 22%. Yet, coffee only represented 2.4% of Brazil's exports, since the economy had diversified considerably since 1965.

This example illustrates two things. First, if Brazil had followed traditional development advice and concentrated only in its area of static comparative advantage (coffee), even if Brazil were the only coffee exporter in the world today, its total coffee exports would only amount to over

Figure 3: **Diversification of Brazil's Exports, 1965 and 2010**



Note: Brazil's exports and coffee exporters in 1965 and 2010. During these 45 years, Brazil's share of the coffee market dropped from 31% of total world trade to 22%. Because of the diversification of the Brazilian economy, coffee now only represents 2.4% of Brazil's exports, down from nearly half in 1965.
Source: The Observatory of Economic Complexity (2013).

10% of Brazil's total exports.[2] Hence, without diversification Brazil would have not been able to elevate its total exports by the amount that it did. Second, the example shows that it is possible to diversify into new products without leaving traditional sectors behind. Diversification, therefore, does not require abandoning or losing ground in existing industries.

2 Brazil now has a world market share in coffee of 22%, which is equivalent to 2.4% of its exports; 100% of the world market would imply 10.9% of Brazil's exports.

The benefit of diversification can also be seen in avoiding potential real exchange rate appreciation driven by foreign exchange inflows generated by natural resource exports. This appreciation reduces trade competitiveness and is commonly referred to as "Dutch Disease." Without developing tradable export activities (e.g., manufacturing), it is hard to reduce reliance on natural resources, generate gainful employment, diversify the economy, and induce structural changes.

Natural resources also exert a negative impact on growth through their potential adverse effects on institutional quality. Resource-rich countries face the risk of capture in their government institutions. Large windfall revenues expose government institutions to corruption, possibly leading to an increase in inequality. Furthermore, countries rich in natural resources are less likely to be motivated to implement growth-enhancing reforms or to improve the investment climate, often because the political pressure to do so is lacking amid commodity price booms that increase revenues even as other areas of the economy stagnate or remain underdeveloped.

Hence, diversification is important for a country to be able to maintain good governance and institutions. Additionally, though resource revenues make large contributions to a government's fiscal coffers, they also pose several challenges, including: (i) whether to immediately spend revenue or invest it (time profile of consumption); (ii) where to invest revenue (foreign assets or domestic assets); and (iii) how to balance public and private sector activities (government consumption and investment in relation to private consumption and investment). It is important for a resource-rich country like Kazakhstan to find the right balance when navigating these issues. On one hand, the country is in need of infrastructure in the short-term; therefore returns from investment at home can be higher than investment abroad. On the other hand, significant investment may cause the economy to overheat. Meanwhile, the role of state-owned enterprises (SOEs) needs to be reduced so that a more vibrant and innovative private sector can emerge.

Unfortunately, for many developing countries that are well-endowed with natural resources, diversifying is not easy. Algeria, for example, was regarded as one of the newly industrializing economies in North Africa during the 1970s and 1980s. Massive government investment was devoted to Algeria's economic transition. Many manufacturing industries were launched in the 1970s. But they rapidly lost competitiveness in the mid-1980s because of the decline in government investment due to stabilizing oil and gas prices, and because of rapid wage increases in these state-owned industries. Algeria provides a very good example of why Kazakhstan needs to privatize its SOEs to manage the risk of relying too heavily on public interventions in the market. Diversification requires a government to delicately balance flexibility and control in the economy. SOEs can be effective in jumpstarting industrial policy, but eventually they must be privatized in order to avoid creating permanent subsidies (Box 1).

In another example, Indonesia succeeded in launching labor-intensive, export-oriented manufacturing industries in the early 1980s. A massive influx of foreign direct investment into the footwear and apparel industries contributed to developing a sizeable manufacturing sector. Indonesia shifted from an economy heavily dependent on oil in the 1960s and 1970s, to one much more diversified. This was done by using the country's oil resources to increase agricultural productivity. Moreover, oil resources were used to develop deposits of natural gas for export and as an input for fertilizer production. Fertilizers were distributed to farmers at subsidized prices, which increased agricultural yields. However, Indonesia started to lose competitiveness in the 1990s as manufacturing output in the People's Republic of China (PRC) exploded and Indonesia's wage advantage evaporated.

Box 1: **Algeria's Failure to Diversify**

Algeria succeeded in launching its manufacturing sector in the 1970s by using an import substitution strategy. Algeria enjoyed an oil revenue bonanza during this period and decided to massively invest resources in manufacturing, especially heavy industries. The level of investment increased in absolute terms 1.5 times between 1970 and 1973, and 2.2 times between 1973 and 1977. The average investment-to-GDP ratio reached 28.3% and 40.4%, respectively, during those two periods. Algeria's newly developed manufacturing industries expanded at an average of 13.5% per year between 1970 and 1977, which was a far higher growth rate than of GDP.

At the same time, almost all investment in manufacturing industries was allocated to public enterprises. When Algeria suffered a rapid decline in oil and gas revenue in the mid-1980s, these manufacturing industries lost their competitive edge. In fact, with the rapid decline in financial investment, machines and equipment rapidly became obsolete. Because of their public status, these companies could not lay off surplus employees, despite their excessively high wages vis-à-vis their productivity. For example, ENIE, the only public enterprise in electronics, still exists despite years of business losses, thanks to direct financial aid from the government and regulation that bars private firms from selling to or having business dealings with the public market. Since the mid-1980s, Algerian manufacturing industries have continuously declined: the share of manufacturing in GDP, which reached 12.6% on average between 1963 and 1986, declined to 10.8% from 1987 to 1999 and 6.6% from 2000 to 2005.

Table B1: **Decline of Algerian Manufacturing Industries (%)**

	1963–1986	1987–1999	2000–2005
Value-added manufacturing/GDP	12.6	10.8	6.6
Real growth rate of production	11.2	–2.7	0.0
Manufacturing employment/total	12.2	10.3	7.4
Public sector share in manufacturing	74.1	77.6	65.1

GDP = gross domestic product.
Source: Kim (2013).

As these examples have shown, diversifying an economy is not an easy task. Even Saudi Arabia, with its massive financial resources, has encountered many difficulties with attempts to make its nascent manufacturing industries more competitive by relying heavily on public investment. Despite these difficulties, however, diversification is a desirable goal.

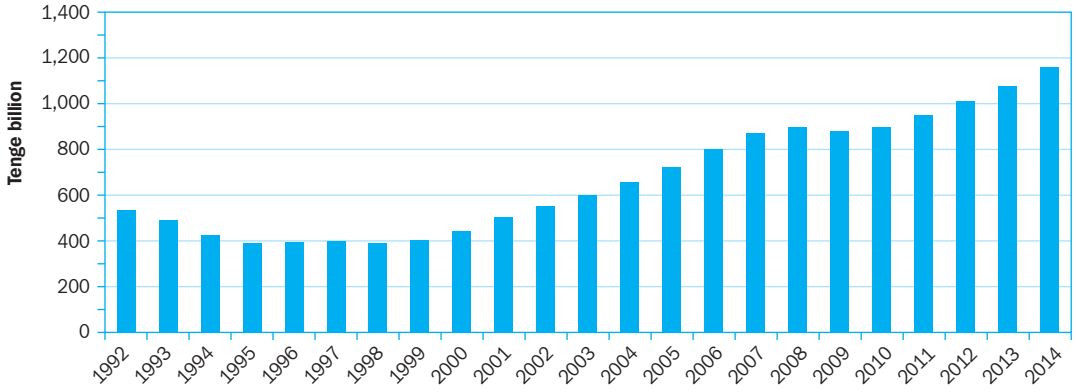
B. Kazakhstan's Industrial Policy Programs: A Brief Overview

Over the past 2 decades, Kazakhstan has implemented a series of industrial policies in an attempt to increase diversification. This is not an exhaustive review of each program, but rather an overview of how the government's objectives have evolved. We divide this history into three sub-periods since independence.

(i) 1991–1999: The economic collapse, stabilization, and the Russian crisis

Following independence from the former Soviet Union in 1991, Kazakhstan suffered a 40% decline in real GDP during 1991–1995 (Figure 4) due to the collapse of Soviet trade linkages, emigration of ethnic Russians and Germans, disruptions and adjustments in production networks, and the onset of hyperinflation exceeding 1,000% per year from 1992–1994. Kazakhstan responded to the post-independence shock by: (i) implementing measures to attract foreign direct investment (FDI); (ii) privatizing many SOEs; and (iii) implementing a number

Figure 4: **Kazakhstan's Real Gross Domestic Product—Trend and Projection** (1994 prices)



Source: IMF's *World Economic Outlook Database 2013*.

of stabilization measures. In the initial stages of market reform between 1992 and 1994, the government sought to liberalize the economy and to create a legal and institutional framework supporting market functions and increasing the supply of consumer goods by eliminating rationing. These measures included:

(i) deregulation of prices for most products and services;
(ii) abolition of public bodies whose functions included planning and distribution (e.g., Gosplan, Gossnab, State Building), and elimination of government interference in business affairs;
(iii) removal of import-substitution barriers (e.g., limits, quotas); and
(iv) development of banking and customs systems.

Although the economy had stabilized by 1996–1997, it fell victim again to the Russian currency crisis of 1998. In response, Kazakhstan devalued the tenge, which contributed to restoring macroeconomic stability and increased exports. During this period, the Government of Kazakhstan also enacted programs in an attempt to achieve economic progress, social development, and environmental sustainability. These programs were intended to make Kazakhstan a modern industrial and service-based economy by 2030, as well as one of the 50 most competitive economies in the world. The fundamental ideas that inspired the goals for the Kazakhstan 2030 Strategy were laid out in a 1997 speech by President Nursultan Nazarbayev. The President's vision contained several long-term priorities: (i) national security; (ii) domestic political stability; (iii) economic growth based on an open market economy with a high level of foreign investment and internal savings; (iv) health, education, and the well-being of Kazakhstan's citizens; (v) power resources; (vi) infrastructure, in particular transport and communications; and (vii) governance. This strategy was based on the experiences of countries such as Canada, the PRC, Japan, the Republic of Korea, Malaysia, Norway, Singapore, and the US.

Taking into account the experience of other countries, the Government of Kazakhstan established public policy priorities that focused on agriculture, forestry and wood processing, light and food industries, tourism, housing, and infrastructure. The reasons for selecting these sectors were threefold. First, maximizing the social value of output could ensure that the basic needs of the population (e.g., food, health, and clothing) were being met. Second, the country's natural resource base, geography, favorable climatic conditions, and industrial and human resources could be tapped for further development. Finally, the government sought to reduce the high shares of imported products

in agriculture (60%), light industries (90%), and pharmaceuticals (94%), as this negatively affected economic development and national security.

Strategy 2030 laid out a path for the country's industrial policies. However, the actual implementation of the strategy could not make much progress. Most government policies after 1997 had to focus on recovering from the breakdown of the Soviet Union and the 1998 Russian financial crisis, rather than increasing industrial diversification.

(ii) 2000–2009: Increasing dependence on oil and the speculative boom

During 2000–2007, the economy grew in real terms at an average rate of 10.1% per year, while nominal GDP surged from $22.1 billion to $103.8 billion. In the region, only the Russian Federation grew faster. The robust growth during 2000–2007 was driven partly by high commodity prices and structural reforms implemented since independence in 1991, as well as by sensible policies, including efforts to diversify the economy. In fact, the number of products exported with comparative advantage increased between 1995 and 2005. Throughout the 1990s, Kazakhstan's manufacturing output began to recover from the post-independence shock, but even in the 2000s it remained well below the output level in 1991 (Table 1).

To implement the long-term strategy envisioned by Kazakhstan 2030, the government approved a Strategy of Industrial Innovation Development for 2003–2015. By the early 2000s, policymakers had acknowledged that a competitive and modern industrial and service economy could not depend solely on oil. Therefore, this plan included specific targets for agriculture, industry, transport, social welfare, health, education, and the public sector. For 2003–2015, the strategy envisioned: (i) annual economic growth of 8.8%–9.2%; (ii) average annual growth rate of the processing industries from 8.0%–8.4%; (iii) tripling labor productivity by 2015 from 2000 levels; and (iv) halving energy intensity from 2000 levels. The strategy also called for an increase in research and development (R&D) activities as a share of GDP—from 0.9% in 2000 to 1.5%–1.7% in 2015—and a slowdown in the reduction of the share of processing industries in GDP—from 13.3% in 2000 to 12.0%–12.6% in 2015. In terms of attaining these objectives, the results are mixed. In 2012, R&D activities accounted for 0.23% of GDP (0.21% in 2011),[3] while processing industries accounted for 11.4%.

The government also created new public institutions, or "Institutes of Development," to play a leading role in the implementation of Kazakhstan 2030. These include the Development Bank of Kazakhstan, Investment Fund of Kazakhstan, and National Innovation Fund.

Development Bank of Kazakhstan

In May 2001, the Development Bank of Kazakhstan, a joint-stock company with special legal status, was established. The bank's mission is to promote stable long-term economic growth by providing, on a commercial basis, the investments needed for the accelerated

Table 1: **Kazakhstan's Sectoral Production Trends** (Index 1980 = 100)

	1990	1991	1992	2001	2002	2003	2004	2005	2006	2007
Extractive industries	121.5	118.1	103.5	108.8	126.1	139.0	157.6	161.9	173.2	177.7
Manufacturing	140.7	145.0	114.7	71.0	76.7	82.8	90.4	97.3	105.1	112.2

Source: Hwang, Lee, and Choi (2008).

[3] In order to stimulate R&D, in 2012, the government passed the Law on State Support to Industrial and Innovative Activities. According to this Law, all subsoil users will be obliged to outlay 1% of their total annual revenue for R&D. State funding is expected to reach 1% of GDP by 2015.

development of competitive secondary industries such as processing, production, transport, and energy infrastructure which are otherwise not supported by second-tier banks. The Development Bank of Kazakhstan also invests in large-scale (approximately T1 billion) and long-term capital-intensive projects, provides export assistance to domestic manufacturers, and attracts complementary foreign and domestic investment. As a development institution, the bank pursues an investment policy determined by the government and the bank's sole shareholder, the Samruk–Kazyna Development Fund. As a financial organization, the bank operates on commercial basis.

Investment Fund of Kazakhstan

The Investment Fund of Kazakhstan was founded in May 2003 as a joint-stock company and is a wholly government-owned enterprise. Its shares were turned over to the Ministry of Industry and New Technologies (MINT) in November 2012. The fund facilitates industrial and innovation policies by attracting investments and holding equity in private initiatives, including processing raw materials, and rendering industrial services. The fund also seeks to increase the foreign activities of domestic firms by supporting their investment in manufacturing activities outside of Kazakhstan.

National Innovation Fund

The National Innovation Fund was established in May 2003. In 2012, the fund was reorganized as the National Agency for Technological Development to more effectively promote market-based innovation in high-tech and knowledge-intensive industries, including information and communications technology (ICT), electronics, and biotechnology. The new agency provides grants, project financing, venture capital, and supports high-tech business incubators and international technology transfer centers.

The first phase of Kazakhstan 2030 (2003–2005) was facilitated by an evolving regulatory framework strengthened by the passage of thirty laws. The new institutional framework established development institutions, socio-entrepreneurial corporations and holding companies, and launched pilot infrastructure such as technology parks, economic zones and industrial zones. According to MINT, exports of manufactured goods more than doubled between 2002 and 2005, while industrial labor productivity increased 51% between 2000 and 2005, including a 63.3% rise in manufacturing productivity.

In a 2007 address to the nation, President Nazarbayev announced a "win-win policy" by which the economy would be diversified through the efforts of both foreign and domestic investors. The logical continuation of this concept was the establishment of the State Commission on the Modernization of the Economy of Kazakhstan in April 2012, which led to the launch of the Thirty Corporate Leaders of Kazakhstan program. This program seeks to increase the competitiveness of non-oil sector domestic companies in international markets through public–private efforts, including investment projects with government support.

Despite these efforts, the 2008 global financial crisis hampered the progress of Kazakhstan's industrial policies. In 2006–2007, while the public sector reduced its external borrowing and associated currency mismatches, Kazakhstan's banks considerably increased their foreign exchange liabilities. Given the shallow base of domestic deposits, underdeveloped local financial markets, and the wish to boost their business, Kazakhstan's banks borrowed excessively in international capital markets, reaching record levels in 2007 of $45.9 billion, or the equivalent of 45% of GDP.[4] External borrowing by banks was used to fund aggressive credit expansion. Domestic credit surged to 59% of GDP at the end of 2007 from 35.2% only 2 years earlier. Cheap

[4] Average annual GDP growth in 2000–2008 was 9.4%. These high rates of economic growth led to changes in the country's financial system. The gross external debt of banks rose from $1.4 billion in 2002, equivalent to 6% of GDP, to $45.9 billion in 2007, or 45% of GDP, accounting for nearly all external debt in Kazakhstan. For comparison, in the Russian Federation at the height of the boom in the third quarter of 2008, the external debt of the banking sector stood at 11.2% of GDP.

credit fueled the real estate boom in Almaty and Astana, leading to sky-rocketing housing prices and dangerously high levels of exposure among Kazakhstan's banks to construction and retail. By 2006, nearly one-third of bank loans were related to real estate.

A vulnerable banking sector deepened the impact and scale of the global liquidity crisis. To prevent spillovers into the rest of the economy, the government intervened to support small and medium-sized enterprises (SMEs), banking, and construction by drawing on the National Fund of the Republic of Kazakhstan (NFRK). The excessive borrowing among banks was compounded by weaknesses in the financial regulatory framework and the underdevelopment of domestic capital markets. Nevertheless, the problems of Kazakhstan's banks were rooted in the private sector's business model, which relied too heavily on cheap money. Instead of banks gradually building up their deposit base, the private sector anticipated its future share in the country's resource revenues and brought its consumption forward accordingly.

In response to the crisis, the government adopted a new financial framework and nationalized major banks.[5] State assistance helped refinance mortgage loans totaling T120 billion between the onset of the crisis and October 2009. The new framework gave banks access to the country's internal financial resources, including NFRK revenues, rather than relying heavily on external borrowing.

[5] In 2008, it was hoped that the banks could cope with the problems that were surfacing. But late that year, after the demise of Lehman Brothers, global financial markets collapsed due to a crisis of confidence. The government had to step in and nationalize the major banks, as well as begin restructuring their foreign liabilities. For the purpose of stabilizing the financial sector, the government allocated T480 billion to recapitalize the four major banks affected: (i) in February 2009, it redeemed 75.1% of ordinary shares of BTA Bank, amounting to T212.1 billion; (ii) in May 2009, it purchased 20.9% of the ordinary shares of Halyk Bank of Kazakhstan, amounting to T26.9 billion; (iii) in May 2009, it purchased 21.2% of the ordinary shares of Kazkommertsbank, amounting to T36 billion; and (iv) in January 2010, it purchased 100% of the ordinary shares of Alliance Bank, amounting to T24 billion, as well as 100% of preferred shares, amounting to T105 billion, while 67% of the shares were transferred to the ownership of Samruk–Kazyna. The rest went to creditors.

Despite the global financial crisis and the crash in oil prices in late 2008, Kazakhstan was able to quickly resume its high-growth momentum, staging a V-shaped recovery with 7.3% growth in 2010 on the back of bank restructuring, improved global conditions, and a revival in external demand for energy. Yet, the situation in the banking sector remains difficult as bank assets have continued deteriorating and the volume of non-performing loans remains high. These factors have restricted the expansion of credit activity, hampering economic growth.

The crisis served to expose the problems of a growth strategy dependent on natural resources. Between 1995 and 2005, the level of diversification in the economy increased, as reflected in the increasing number of products exported with comparative advantage. However, it decreased substantially between 2005 and 2010. In effect, favorable oil prices dampened incentives to diversify. As a result, the quantitative targets set under various diversification programs were not achieved, raising questions about the effectiveness of the diversification measures that were implemented.

(iii) 2010–Today: Becoming a modern industrial, service, and knowledge economy

In 2009–2010, the government modified implementation of the Strategy of Industrial Innovation Development for 2003–2015 on the grounds that it was not effectively delivering its intended objectives. To implement the strategy more effectively, it launched the State Program on the Accelerated Industrial–Innovative Development of the Republic of Kazakhstan, 2010–2014 (SPAIID). This five year plan highlights seven sectors: (i) agriculture; (ii) construction and construction materials; (iii) oil and gas products and infrastructure; (iv) metallurgy and metal products; (v) chemicals and pharmaceuticals; (vi) energy; and (vii) transport and telecommunications infrastructure.

State support to the priority sectors includes the provision of physical infrastructure (information and communications, energy, and transport) and social infrastructure (skilled human resources), lower administrative barriers, detailed guidelines on technical regulations, and the creation of a more business-friendly environment to attract FDI.

SPAIID seeks to provide the physical infrastructure for Kazakhstan to become a knowledge economy, which requires the development of innovative and high technology-intensive companies. The government is supporting the financing of such companies through various means including public funding through Samruk–Kazyna (Box 2).

However, it is difficult to assess quantitatively the implementation and progress of SPAIID at this moment. When President Nazarbayev announced the 2050 Strategy, he asserted that most of the goals set in Kazakhstan 2030 had been achieved. The government is now expected to develop a plan for the next phase of industrialization from 2015–2019. In addition, the government announced the 2050 Strategy in December 2012 with the very ambitious objective of making Kazakhstan a true world leader. This includes developing pragmatic economic policies based on the principles of profitability, return on investment, and competitiveness; offering full support to entrepreneurship, particularly SMEs and Public–Private Partnerships (PPPs); designing new social policies that balance social guarantees and personal responsibility; and advance the development of the knowledge economy.

The 2050 Strategy contains important elements of a modern industrial policy and addresses new challenges that Kazakhstan faces as a high-income country, including promoting green growth (see Box 3). However, it risks being regarded as no more than an extension of the Kazakhstan 2030 strategy, unless priorities and implementation plans are established. Who will lead this strategy? How will the government manage the multitude of agencies that have already been created?

Box 2: **Samruk–Kazyna: Kazakhstan's Sovereign Wealth Fund**

Samruk–Kazyna was established in 2008 through the merger of two separate funds (Samruk and Kazyna) to enhance the national economy's competitiveness and mitigate the impacts from external shocks. Samruk–Kazyna manages shares of national development institutions, national companies, and other legal entities to maximize their long-term value and competitiveness in the world markets.

Diversification and modernization of the national economy are expected to be achieved through investments in sectors such as: (i) oil and gas; (ii) energy; (iii) metallurgy; (iv) chemistry and petrochemicals; and (v) infrastructure. Samruk–Kazyna controlled $78 billion in assets in 2011, or nearly 56% of GDP, and is expected to hold $100 billion by 2015. The following is a partial list of organizations partly or wholly-owned by Samruk–Kazyna: Air Astana (51%); Kazakhstan Development Bank (100%); Kazakhstan Electricity Grid Operating Company (100%); Kazakhstan Mortgage Company (91%); KazakhTelecom (45.9%); KazMunayGas (100%); Kazpost (100%); National Innovation Fund (100%); and SK-Pharmaceuticals (100%).

Samruk–Kazyna's functions also include: (i) financing small and medium-sized enterprise (SME) projects; (ii) acquiring authorized voting shares in second-tier banks to allocate socioeconomic development funds (construction, SMEs, agribusiness); and (iii) supporting development of the mortgage credit market and the housing construction savings system; localization of manufacturing, assembly, and repair; and maintenance of imported equipment.

Source: Kosherbayeva (2013a).

Box 3: **Green Growth in Kazakhstan**

A key objective of the 2050 Strategy is for Kazakhstan to become a clean and green country, with fresh air and water, accompanied by a massive reduction in industrial waste, radiation, and dependence on carbon. In support of this new development paradigm, the government developed a policy document: Transition of Kazakhstan to a Green Economy (Ministry of Environmental Protection 2012).

A shift in industrialization policy priorities necessitates a shift away from metallurgy, chemicals, oil and gas, construction, transport, and engineering toward new energy, energy efficiency, clean-energy vehicles, high-tech materials, bio-technology, and information technology. The shift in focus will create incentives for private investments to internalize the costs of carbon emissions and other environment damaging consequences, with the result that private investment choices will be green in nature.

The transition to a "Green Economy" is planned in three stages:

2013–2020. During this period, the main priority of the state will be to optimize resource use and increase the efficiency of environmental protection activities, as well as to establish green infrastructure.

2020–2030. Based on established green infrastructure, the transformation of the national economy will start, oriented at rational water use, motivation and stimulation of development and broad implementation of renewable energy technologies, as well as construction of facilities based on high energy efficiency standards.

2030–2050. The transition of the national economy to the principles of the Third Industrial Revolution, which require the use of natural resources on the condition of renewability and sustainability.

The total amount of investments required to implement the Green Economy concept would be, on average, $3 billion–$4 billion per annum through 2050. Investments will peak at 1.8% of gross domestic product in 2020–2024, with average annual investments constituting about 1% of GDP through 2050 coming mainly from private investors.

Kazakhstan is well placed to develop green goods and services, and technologies, while attracting private investment through appropriate industrial policies. The institution of carbon trading in 2013, with caps established for the largest and most carbon-intensive industrial companies, is an important policy step. There is considerable potential in Kazakhstan for the green transformation of traditional sectors. Through technology and management adaptations, the energy intensity of traditional production can be reduced so as to narrow the gap with European countries. Such investments can pay for themselves through savings in energy costs and in other inputs.

The Organisation for Economic Co-operation and Development (OECD) Declaration on Green Growth (2009) is of particular relevance to Kazakhstan given its aspiration for membership in the OECD. The Rio+20 conference, in which Kazakhstan played a prominent role in 2012, also contains commitments toward policies to support green growth.

Source: Kosherbayeva (2013a).

C. Kazakhstan's Diversification 1995–2010

The Government of Kazakhstan has put in place a number of programs since President Nazarbayev unveiled the Kazakhstan 2030 strategy in 1997. What are the results of these efforts? Has Kazakhstan made progress towards diversification?[6]

Naturally, diversification can be measured in different ways. We choose to do it in terms of the number of products exported with revealed comparative advantage (RCA). This is a measure that compares a country's exports of a product to the world's exports of the same product. This allows us to simultaneously discuss the economy's diversification and its level of competitiveness. We use the indicator $RCA(pop)_{cp} = \frac{exports_{cp}/population_c}{\sum_c exports_{cp}/\sum_c population_c}$, defined for a country (exporter c) and a specific product (p). The ratio compares a country's exports per capita of a product to the world's average (as defined in the formula). A value of RCA(pop) of 2, for example, indicates that a country's exports per capita of the product in question are twice the world's exports per capita. Empirically, we set the threshold of RCA(pop)>0.25 to determine if a country has comparative advantage in a product.[7]

Table 2a provides the top 15 exports (in the HS4 database of 1,240 products) of Kazakhstan according to the increase in the nominal value of exports as well as change (last year minus initial year) in RCA(pop) between 1995 and 2010. Table 2a indicates that Kazakhstan's top exports have seen a significant increase in their RCA(pop). However, most of these products are natural resources such as minerals and metals. Table 2b shows the exports whose nominal values have declined. They also show corresponding decreases in their RCA(pop). Given the high concentration of Kazakhstan's exports, these products are also natural resources.

Table 3 shows the level of diversification of Kazakhstan's economy, measured by the number of products exported with RCA(pop)>0.25, out of a total of 1,240 products. Products are grouped into the 15 HS categories. We focus on the products with RCA(pop)>0.25 as this is an indicator of both diversification and competitiveness.

Table 3 indicates that between 1995 and 2010, diversification almost doubled from a very low base of 68 products to 127 products. Although this is encouraging, the largest increase was in the mineral products category (from 9 to 29), whose share of total exports increased from 12% in 1995 to almost 75% in 2010. The second most important category is metals, with 30 products in 2010, representing 15% of total exports. There was hardly any change in chemicals, machinery, or transport. The table also shows that diversification fluctuated, reaching a high of 164 products in 2005 before falling to 127 in 2010. Moreover, Kazakhstan's diversification is well below that of countries such as Malaysia and Thailand, which in 2010 exported 890 and 776 products, respectively, with RCA(pop)>0.25. Finally, Kazakhstan exports more than $10 million annually to only 50 countries; for comparison, the PRC, Malaysia, and Thailand, export more than $10 million annually to 180, 139, and 147 countries, respectively. Appendix Table A1 provides detailed information on the 50 countries to which Kazakhstan exported at least $10 million in 2010.

Two facts stand out from Table 3, which shows that despite the efforts made to diversify the economy, Kazakhstan currently exports with revealed comparative advantage fewer products than 10 years ago. First, economies well-

[6] Given data availability during the period this report was prepared, data expands through 1995–2010. This means that government effort and progress on diversification after 2010 are not captured by our analysis.

[7] The threshold RCA(pop)>0.25 requires that a country's exports per capita be larger than 25% of the world's exports per capita for the product in question. This threshold ensures that we determine whether a country is a significant exporter of the product. If we use a higher threshold (e.g., RCA(pop)>1), then there are many countries for which the value is zero. We find empirically that an RCA(pop) of 25% provides a reasonable filter.

Table 2a: **Kazakhstan's Top 15 Exports by Nominal Increase, 1995–2010**

Product Name	HS	RCA(pop)		$ million	
		1995	Change, 1995–2010	1995	Change, 1995–2010
Petroleum oils, crude	2709	0.08	7.93	44	25,100
Refined copper and copper alloys	7403	4.92	7.12	218	1,909
Petroleum oils, refined	2710	0.27	0.99	67	1,892
Ferroalloys	7202	4.06	22.81	102	1,722
Radioactive chemical elements and radioactive isotopes	2844	1.47	31.83	23	1,683
Iron ores and concentrates	2601	0.19	3.92	5	1,085
Petroleum gases	2711	0.02	1.34	2	995
Wheat and meslin	1001	0.18	7.69	10	663
Gold content	2603	0.00	4.81	0	529
Unwrought zinc	7901	4.41	16.81	48	518
Coal, briquettes	2701	0.39	1.19	22	413
Unwrought aluminum	7601	0.12	3.06	8	352
Flat rolled iron or non-alloy steel, coated with tin, width ≥600mm	7210	0.77	1.75	35	235
Uranium or thorium ores	2612	0.00	146.27	0	231
Sulphur	2503	0.04	31.01	0	210

HS = Harmonized system, RCA (pop) = revealed comparative advantage index.
Source: Felipe and Hidalgo (2013).

Table 2b: **Kazakhstan's Top 15 Exports by Nominal Decrease, 1995–2010**

Product Name	HS	RCA(pop)		$ million	
		1995	Change, 1995–2010	1995	Change, 1995–2010
Wool	5101	3.38	–2.59	41	–34
Mineral or chemical fertilizers, mixed	3105	2.21	–1.91	43	–29
Raw hides and skins of bovine or equine animals	4101	2.15	–1.75	28	–24
Raw skins of sheep or lambs	4102	4.31	–3.98	16	–15
Vegetable products not elsewhere specified	1404	15.79	–14.21	17	–14
Waste or scrap, aluminium	7602	1.78	–1.33	16	–5
Prepared or preserved fish	1604	0.39	–0.33	6	–5
Polymers of styrene, in primary forms	3903	0.15	–0.15	4	–4
Casein	3501	0.71	–0.71	3	–3
Unwrought nickel	7502	0.18	–0.18	2	–2
Stranded wire, cables and similar articles of copper	7413	2.14	–2.13	2	–2
Other metals	8112	7.37	–5.71	9	–1
Alkali or alkaline-earth metals; rare-earth metals, scandium	2805	1.53	–1.53	1	–1
Maize (corn) seed	1005	0.04	–0.04	1	–1
Fluorides; fluorosilicates, fluoroaluminates	2826	0.91	–0.89	1	–1

HS = Harmonized system, RCA (pop) = revealed comparative advantage index.
Source: Felipe and Hidalgo (2013).

endowed with natural resources have weak incentives to diversify. Second, Kazakhstan's problem is not only its low level of diversification, but also the low sophistication of its export basket. Indeed, the country has not seen any significant increase in exports in 1995–2010 of the most technologically advanced sectors, such as chemicals, machinery, and electrical products.

To analyze Kazakhstan's potential for upgrading, we use the concept of complexity, which combines the ideas of diversification and ubiquity. Diversity refers to the variety of the set of products that a country exports. This set is large for countries with more knowledge as complex economies are more diversified. Ubiquity refers to the number of countries that can make a product with comparative advantage. Some products require a great deal of knowledge thus ensuring that only a few countries can make them. These complex products, therefore, are less ubiquitous. The amount of knowledge that a country has is expressed in the diversity and ubiquity of the products that it makes. Independently, diversity and ubiquity provide significant information about the variety of capabilities available in a country or required by a product. But used jointly, they provide more information.

Table 3: **Evolution of Kazakhstan's Diversification**
(number of products and % of total exports)

HS Code	1995	2000	2005	2010
Animal and animal products	1 product (0.53%)	3 products (0.22%)	6 products (0.31%)	7 products (0.32%)
Vegetable products	5 products (2.99%)	16 products (5.69%)	21 products (2.18%)	16 products (2.39%)
Foodstuffs	1 product (0.81%)	4 products (0.35%)	8 products (0.66%)	8 products (0.28%)
Mineral products	9 products (12.04%)	24 products (55.60%)	29 products (65.83%)	29 products (74.47%)
Chemical and allied industries	15 products (9.00%)	19 products (3.40%)	20 products (3.98%)	17 products (5.35%)
Plastics and rubbers	1 product (0.50%)	0 products (0.07%)	1 product (0.11%)	1 product (0.09%)
Raw hides, skins, leather, and furs	2 products (3.43%)	3 products (0.23%)	5 products (0.97%)	5 products (0.10%)
Wood and wood products	0 products (0.11%)	1 product (0.11%)	2 products (0.10%)	1 product (0.03%)
Textiles	9 products (8.80%)	10 products (0.72%)	9 products (0.90%)	6 products (0.30%)
Footwear and headgear	0 products (0.00%)	1 product (0.01%)	1 product (0.02%)	0 products (0.00%)
Stone and glass	2 products (9.71%)	6 products (3.69%)	8 products (1.93%)	6 products (0.84%)
Metals	21 products (50.98%)	40 products (27.66%)	36 products (21.39%)	30 products (15.44%)
Machinery and electrical	0 products (0.54%)	8 products (1.44%)	8 products (1.06%)	1 product (0.29%)
Transportation	1 product (0.42%)	4 products (0.50%)	7 products (0.43%)	0 products (0.06%)
Miscellaneous	1 product (0.14%)	4 products (0.31%)	3 products (0.14%)	0 products (0.03%)
Total	**68 products**	**143 products**	**164 products**	**127 products**

HS = Harmonized system.
Note: Number of products refers to those exported with RCA(pop)>0.25.
Source: Felipe and Hidalgo (2013).

To provide an example, diamonds are very unique as only a few countries possess them. However, countries that possess diamonds may not have many other products; their diversification is thus low. Moreover, we can have two countries equally diversified but that make very different products in terms of their ubiquity: in one case, very unique, with items produced by very few countries (e.g., medical devices), and in another case, very standard (e.g., cheap ball pens). This means that diversity can be used to correct the information revealed by ubiquity, and ubiquity can be used to correct the information revealed by diversity.

Figure 5 shows the level of diversification for 130 countries and standardness as a measure of ubiquity.[8] Standardness is defined such that a lower value indicates a more unique export basket. Figure 5 shows that developed countries are more diversified (clustered toward the right-side of the diversification scale) and have a more unique export basket (clustered toward the bottom of the standardness scale). The figure also shows that while Kazakhstan's level of diversification is very low, its export basket is somewhat unique.

The other important concept is that of centrality (or connectedness). It is computed as the sum of a product's proximity to all other products, where proximity is calculated as the probability of exporting product A given that the country exports product B.[9] For example, if 20 countries export computers (product A), 24 countries export wine (product B), and eight export both, the proximity between computers and wine is 8/24=0.3.[10] Therefore, greater values of centrality imply that a product is connected to a greater number of other products that could be co-exported. For both complexity and centrality, products are considered exports when RCA(pop)>0.25.

Table 4 shows that in Kazakhstan, of the 68 products exported with RCA(pop)>0.25 in 1995, 38 (about 56%) were in the bottom tercile of the product complexity scale. We divided the 1,240 products into three groups according to their complexity level, from the highest to the lowest.[11] Twenty-nine of these were very poorly connected to other products (in the bottom tercile of the centrality scale), thus making diversification difficult. In 1995, Kazakhstan only exported four products in the top tercile of the product complexity.[12] In 2010, of the 127 products exported with RCA(pop)>0.25, Kazakhstan exported 90 products (71% of the total) in the bottom tercile of the complexity scale and only 12 products in the top tercile. Out of this 12, only four were in the Top Complexity-Top Centrality cell.[13] This is hardly a sign of progression in the right direction.

The distribution of products according to terciles of complexity and connectedness in 2010 is shown in Appendix Table A2, while Appendix Table A3 divides the 127 products exported with comparative advantage in 2010 into the 45 exported with comparative advantage in 1995 (remained competitive in 2010), the 23 exported with comparative advantage in 1995 but not in 2010 (lost competitiveness by 2010), and the 82 new exports.

8 Standardness is a proxy for the sophistication of the export basket (how unique it is) that uses the information provided by ubiquity and diversification. It is calculated as the average ubiquity of the commodities exported with comparative advantage by a country. A lower value of standardness indicates that the country's export basket is more unique. This is expressed as:

$$Standardness_c = \frac{1}{diversification_c} \sum_i ubiquity_{ic}$$

where *c* denotes country and *i* the product.

9 The idea behind this conditional probability is that products require knowledge (capabilities) to be made. The similarity between the capabilities required to produce two products is inferred by the probability of co-exporting them. It is assumed that if two goods share a high number of capabilities, the country that exports one of them will also export the other one, and vice versa. Therefore, products that share fewer capabilities are less likely to be co-exported.

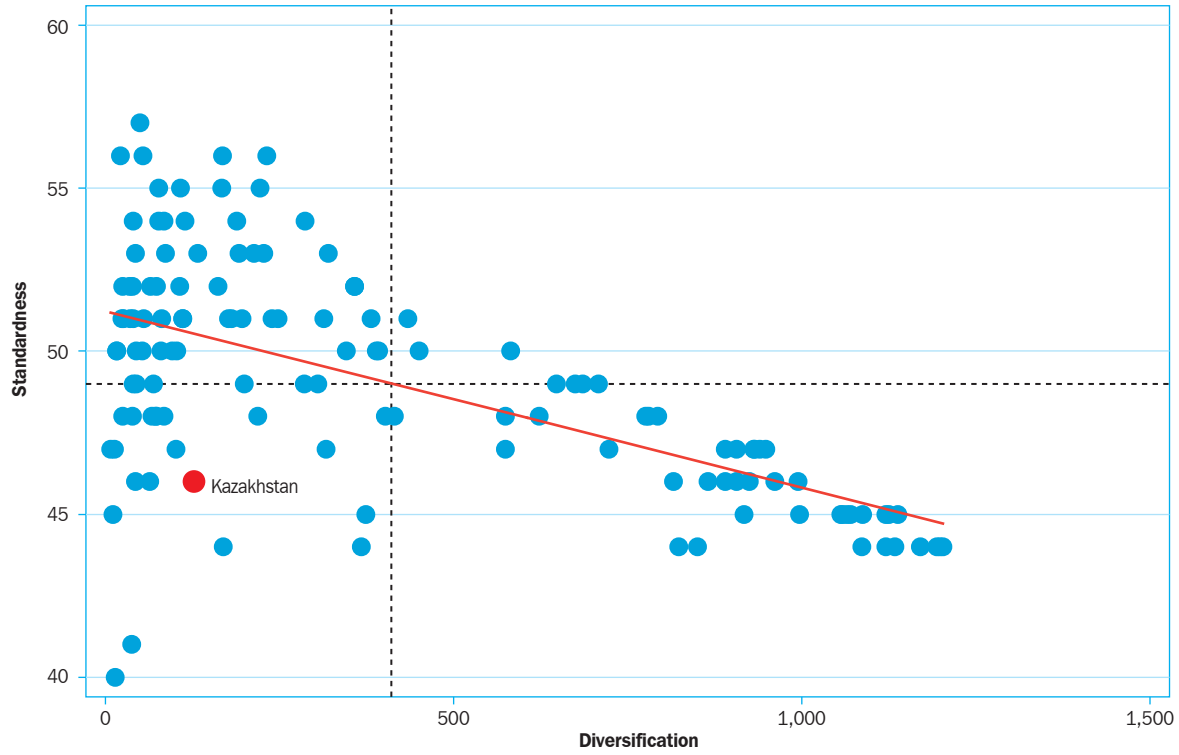
10 By dividing by 24 instead of by 20, the estimated conditional probability is smaller. This way, we try to minimize false positives, that is, the probability that a country exports computers given that it exports wine (when in fact it does not).

11 The values of complexity and centrality have been standardized for each year so that a value of 0.5 indicates that the country is one-half standard deviation above the mean. We do not show these values, instead we count the number of products in the distribution.

12 The four products are: rape and colza seeds; mica articles; tantalum; and tin plates, sheets, and strips.

13 The twelve products are: wheat gluten; tantalum; bismuth; chromium oxides and hydroxides; carbides; mica articles; magnesium; titanium; architectural, engineering, industrial plans, and drawings; slag wool, rock wool, and similar mineral wools; radiators for central heating of iron and steel; and ball or roller bearings.

Figure 5: **Standardness and Diversification**



Note: This figure includes data for 130 countries.
Source: Authors.

Table 4: **Kazakhstan's Diversification by Centrality and Complexity**
(number of products, 1995 and 2010)

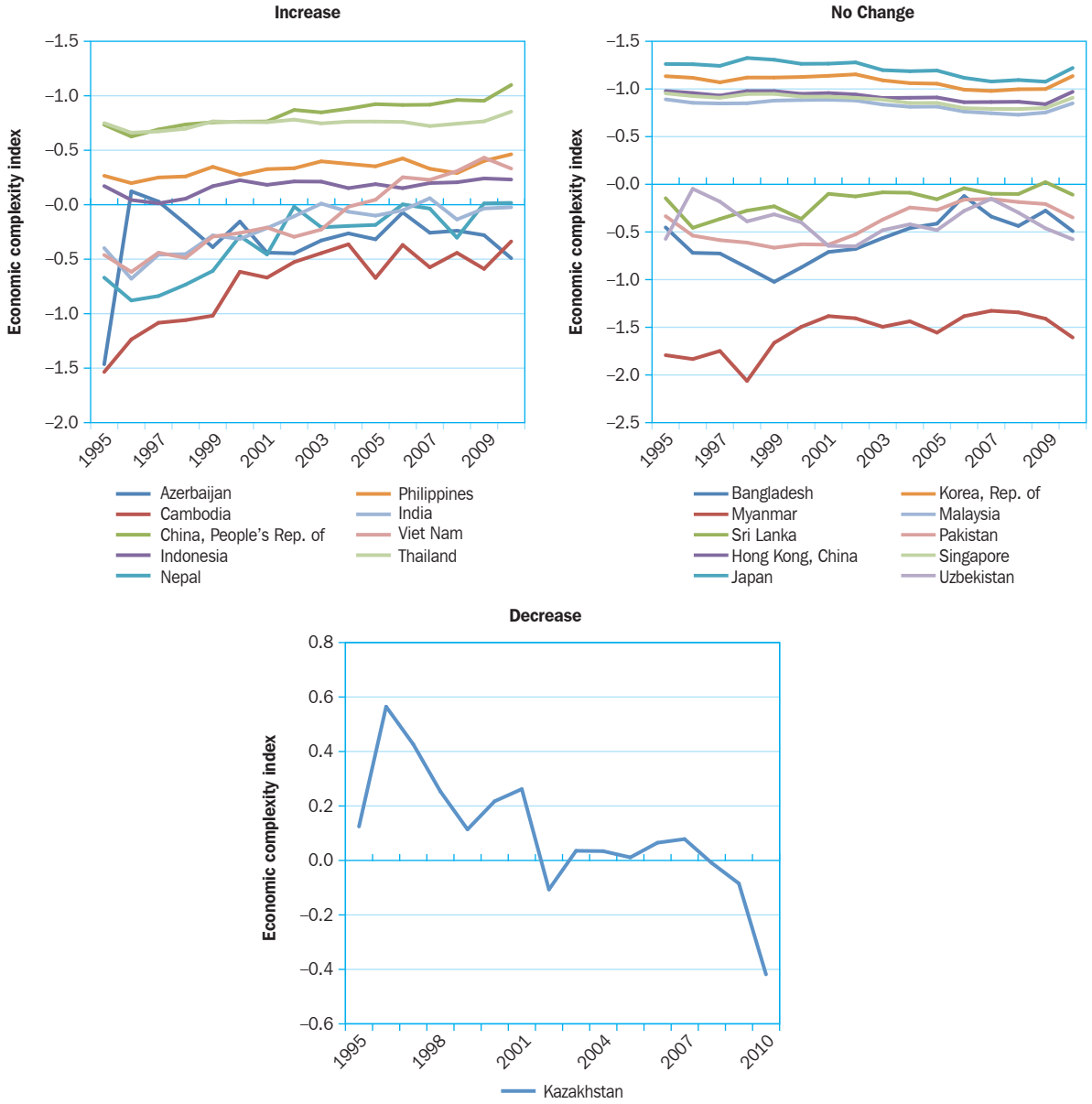
1995 (68 products with revealed comparative advantage)		**Complexity**		
		Bottom tercile	Middle tercile	Top tercile
Centrality	Bottom tercile	29	4	3
	Middle tercile	9	16	1
	Top tercile	0	6	0

2010 (127 products with revealed comparative advantage)		**Complexity**		
		Bottom tercile	Middle tercile	Top tercile
Centrality	Bottom tercile	66	7	3
	Middle tercile	24	9	5
	Top tercile	0	9	4

Source: Felipe and Hidalgo (2013).

Finally, Figure 6 shows the level of complexity of an economy based on its export basket. The figures have been standardized so that the mean of the distribution is zero and the standard deviation is one. Therefore, a value of 0.5 indicates a level of complexity that is one-half standard deviation above the mean. Figure 6 shows the evolution of the complexity index since 1995 for a group of 20 Asian economies, including middle-income countries such as India, Indonesia, Malaysia, and Thailand. The figure reveals that the complexity of the export package increased in all countries, except in Kazakhstan, where it declined after 1995. Likewise, the complexity of the export basket also increased in countries like Russian Federation

Figure 6: **Economic Complexity Index—Selected Asian Economies**



Source: Felipe and Hidalgo (2013).

and Belarus. This decline in the complexity of Kazakhstan's export basket, together with the finding that only four out of Kazakhstan's 127 exports with comparative advantage are complex, well-connected products, does not bode well for Kazakhstan's aspirations to become a knowledge economy.

D. The Limits to Diversification in Kazakhstan

It is apparent that Kazakhstan has a low level of diversification. Yet how is diversification related to the level of natural-resource intensity? We measure natural-resource intensity by the share of natural resource exports in total exports. We calculate it for 1995 and 2010, concentrating on the countries where this share is at least 25%, and compare Kazakhstan to countries with similar natural resource intensity.[14]

Table 5 shows that in 1995 Kazakhstan's intensity (44.45%) was similar to that of Cameroon, Chile, Egypt, Ghana, Mauritania, Mongolia, Peru, and Trinidad and Tobago where exports of natural resources represented between 34% and 50% of total exports. Table 6 shows resource intensity in 2010. Under each "Diversification" column, the number of products exported with RCA(pop)>0.25 is reported. The following aspects are worth highlighting:

(i) Kazakhstan's resource intensity increased to 82.86% in 2010 from 44.45% in 1995. Several countries that had a resource intensity of 25%–50% in 1995 increased their intensity to 50%–75% in 2010. However, along with Kazakhstan, only Mongolia increased its intensity to more than 75% in 2010.

(ii) Togo was the only country well-endowed with natural resources in 1995 that dropped off the list in 2010. On the other hand, Table 6 contains 19 new countries in which exports of natural resources increased to at least 25% of total exports between 1995 and 2010.

Table 5: **Natural-Resource Intensity, 1995**
(% of total exports)

25%–50%	50%–75%	>75%
Colombia (28.58)	Bolivia (51.57)	Oman (76.02)
Indonesia (28.93)	Russian Federation (53.82)	Venezuela (77.89)
Ecuador (33.21)	Guinea (57.36)	Gabon (78.78)
Togo (33.46)	Papua New Guinea (59.03)	United Arab Emirates (79.07)
Cameroon (33.97)	Zambia (69.80)	Liberia (84.64)
Ghana (36.12)	Syria (70.49)	Iran (85.31)
Mauritania (39.07)	Congo, Dem. Rep. (72.01)	Qatar (85.87)
Chile (44.44)	Armenia (73.19)	Congo (86.37)
Kazakhstan (44.45)		Saudi Arabia (87.13)
Trinidad and Tobago (44.96)		Libya (91.46)
Peru (48.00)		Nigeria (92.04)
Egypt (49.15)		Algeria (93.48)
Mongolia (49.68)		Yemen (94.93)
		Kuwait (95.23)
		Angola (98.33)

Source: Authors.

[14] Despite having natural-resource intensities above 25%, the developed and diversified economies of Australia, Canada, Israel, and Norway are excluded from the analyses.

The average level of diversification in 2010 of all 130 countries in our data set, including those with natural-resource intensities below 25% and the advanced economies—is 411 products, which is much higher than the average of all resource-rich countries in Table 6 (141 products). Kazakhstan has one of the highest natural-resource intensities in the world at 82.86% and its level of diversification (127 products) is higher than the average of its peer countries with natural-resource intensity above 75% (95 products). Within this group, only Iran, Kuwait, Oman, and Saudi Arabia, are more diversified than Kazakhstan.

Table 6: **Natural-Resource Intensity and Diversification, 2010**
(% of total exports and number of products exported with RCA[pop]>0.25)

25–50 (%)		50–75 (%)		>75 (%)	
	Diversification		**Diversification**		**Diversification**
Brazil* (27.66)	369	Ecuador (53.44)	163	Guinea (76.22)	16
Belarus* (28.56)	449	Chile (59.50)	390	Oman (81.11)	315
Liberia (29.69)	12	Trinidad and Tobago (59.78)	190	**Kazakhstan (82.86)**	**127**
India* (32.49)	169	Zambia (61.60)	84	Iran (85.61)	203
Senegal* (33.14)	78	Colombia (61.90)	213	Saudi Arabia (86.18)	392
Cuba* (33.92)	34	Syria (62.11)	134	Gabon (87.02)	36
Uzbekistan* (34.12)	67	Peru (69.15)	248	Chad* (88.35)	12
Indonesia (36.18)	319	Mauritania (69.21)	25	Mongolia (89.26)	64
Georgia* (36.47)	112	Turkmenistan* (69.44)	39	Nigeria (89.90)	44
Egypt (37.35)	239	Congo, Dem. Rep. (71.43)	14	Congo (91.52)	39
Armenia (37.81)	80	United Arab Emirates (71.62)	996	Kuwait (91.98)	181
Tanzania* (40.23)	80	Papua New Guinea (72.43)	41	Sudan* (92.27)	16
Kyrgyz Republic* (44.92)	97	Mozambique* (73.67)	43	Yemen (93.04)	21
Myanmar* (46.09)	41	Bolivia (73.74)	103	Qatar (93.19)	110
Lao People's Democratic Republic* (46.11)	64	Mali* (74.62)	26	Azerbaijan* (94.42)	73
Cameroon* (48.16)	45	Russian Federation (74.87)	378	Venezuela (95.41)	75
Ghana* (49.97)	45			Algeria (95.52)	40
				Libya (97.25)	24
				Angola (99.31)	9
Average no. products of the group	**135**		**193** (**139 without UAE**)		**95**

RCA (pop) = revealed comparative advantage index, UAE = United Arab Emirates.
Notes:
(i) Togo is in Table 5 but not in Table 6.
(ii) Countries with an * in Table 6 are not in Table 5.

As Table 6 shows, with the exception of the United Arab Emirates (996 products) and Belarus (449 products), the level of diversification of all countries well-endowed with natural resources (>25% share) is below 411 products. Among the most diversified natural-resource rich countries are Belarus (449 products), Russian Federation (378 products), Brazil (369 products), Chile (390 products), and Indonesia (319 products), all of which have a lower natural-resource intensity than Kazakhstan. If we take into account countries' per capita income (together with per capita income squared and population without considering natural resource intensity), a regression analysis indicates that Kazakhstan's level of diversification is significantly below its predicted value of 228 products. However, if we also take into account natural resource intensity (as well as population and per capita income), Kazakhstan's diversification is much closer to its predicted value of 151 products.[15] With the usual caveats that these types of exercises entail, our analysis indicates that, with the current level of natural-resource intensity, Kazakhstan could reach a diversification level of 241 products if its per capita income doubled. On the other hand, if Kazakhstan could both reduce its natural-resource intensity to 50% and double its per capita income, its diversification could reach 273 products. Although this is a somewhat mechanical exercise, it does call attention to the fact that diversification will not be easy. The regression analyses suggest that Kazakhstan should aim to achieve exports with revealed comparative advantage of about 250–300 products in the next 20 years.

Appendix Table A4 shows other Asian countries that are significant exporters of natural resources (>25% of total exports). The table shows that most products exported with revealed comparative advantage are non-natural resources, i.e., very few natural resource exports account for a significant share of exports with comparative advantage. In India, for example, 8 product categories account for almost one third of its exports with revealed comparative advantage.

In general, the experience of rich and advanced countries that are well-endowed with natural resources indicates that such an endowment need not be an insurmountable obstacle, provided countries use export revenues wisely.

It is also important to recognize that countries well-endowed with natural resources have limits on diversification. First, they probably have less economic incentive to diversify in the face of a booming natural resources sector. Second, research by the United Nations Industrial Development Organization (UNIDO) concluded that a natural resource endowment has a negative effect on most manufacturing industries. The effect is especially strong on industries that play a key role in deepening and sustaining industrialization from the upper middle income stage onward, such as electrical machinery and apparatus, motor vehicles (in large countries only), and chemical industries. Therefore, countries well-endowed with natural resources need to manage the impact of currency appreciations, as well as invest in physical and human capital, as both are necessary for a continuous shift in the manufacturing structure.

Kazakhstan is a large country with a below median population density and an above median resource endowment. The UNIDO findings suggest that Kazakhstan faces limits as to how much it can diversify. However, Kazakhstan should be able to double its diversification and competitiveness to the levels of Belarus, Brazil, Chile, Russian Federation, and Indonesia.

[15] This is based on a cross-country regression of the level of diversification on population, GDP per capita, GDP per capita squared, and natural resource intensity (measured as the share of natural resource exports in total exports). The regression uses 2010 data for 122 countries. The estimated regression is (variables in logarithm in base 10; all of them statistically significant at the 1% level): Diversification = –2.46 + 1.74 Income per capita – 0.15 Income per capita squared + 0.13 Population – 0.247 Resource Intensity. Adj. R^2=0.75.

PART II

A. Key Issues in Industrial Policy

In recent decades, Kazakhstan has devoted major efforts and resources to programs targeting economic, social, and environmental stability, and overall developmental progress. There have been many advances, including a significant increase in income per capita. However, industrial policies have had limited success in achieving another important objective: the diversification of the economy.

It will not be easy for Kazakhstan to become a modern industrial economy with an economic structure dependent on oil. In fact, a recent ADB report finds that no country has achieved high-income status without its manufacturing sectors reaching at least an 18% share of total employment and output over a sustained period of time. The importance of manufacturing affirms that a diversified manufacturing base remains important for economic development (ADB 2013).

However, despite the continued drive toward industrial diversification, Kazakhstan's dependence on oil continues to increase and today it exports fewer products with comparative advantage than it did in either 2000 or 2005.

The country, therefore, is at a crossroads and needs to review its industrial policies and design new initiatives. But how should Kazakhstan design and implement a modern industrial policy? Answering this question requires an understanding of the essence of modern industrial policy. It could be argued that today, with full-fledged globalization, industrial policies, understood as a set of restructuring policies in favor of more dynamic activities in general, have become obsolete. In this context, targeting policy interventions on market failures, and much less "picking sectors", should be discouraged. However, an implicit argument of this report is that modern industrial policy is about collaboration between public and private sectors identifying significant externalities and addressing them appropriately. In this context, economic diversification, Kazakhstan's objective, is not a natural process. Rather, it is subject to significant information and coordination externalities. In reality, industrial restructuring does not take place without significant government assistance. Also, in today's world, companies do not need to manufacture an entire product. Indeed, it is possible that, by operating as part of global value chains, firms participate in the production of a myriad of products (ADB 2013). Governments can play an important role in facilitating this process.

Specifically, the design and implementation of a modern industrial policy should give special attention to five key issues. Below, we provide the summary of our answers to these questions, with the details discussed in subsequent sections.

(i) *Who selects the sectors?* This has always been a contentious issue among those who criticize government interventions to alter the structure of the economy. The majority view seems to suggest that governments should not engage in sector selection, but rather act as a "facilitator" of industrial development. However, the facilitator role can be defined and interpreted in different ways. In practice, we argue that the agents engaged in sector selection should vary depending on the level of development of the economy and their capacity.

(ii) *What is the rationale for sector selection?* Critics of industrial policy argue that this issue should be left to the market. However, if the rationale behind sector selection is left entirely to the market, presumably by following a country's comparative advantage, it would be difficult for developing countries to "leapfrog." Different countries use different approaches and recent work provides some useful ideas on how to coordinate public and private decisions.

(iii) *What are the main tools used to promote sectors?* Many governments practice one form of industrial policy or another. However, the tools they use vary greatly, since the instruments used are also dependent upon a country's stage of development. In general, as an economy develops, financial market instruments are used more frequently than direct fiscal subsidies.

(iv) *How can innovation, technology, and human capital development be fostered?* As a country becomes richer, its industrial policies tend to give increasing attention to innovation, technology, and human capital. These are also areas that most often require government indirect intervention due to market failures.

(v) *What are the most appropriate monitoring and evaluation mechanisms?* All components of industrial policy must include a monitoring and evaluation mechanism that provides feedback on program outcomes. Without such feedback it will be hard to evaluate if policies are producing the intended impact to the economy. The most appropriate mechanism is the one that allows policy makers to measure program impact so that future policies and programs are designed to produce better outcomes.

As a guide to decision-making in Kazakhstan, we review these five issues based on other countries' successes or failures.[16]

1. Who selects the sectors?

Economic theory does not clearly state which agents should undertake sector selection, or whether sector selection itself is desirable. However, in practice, the experiences of many different countries that have adopted industrial policies show that the agents selecting sectors can be stage dependent (Table 7). At low levels of development, governments tend to select the sectors. As a country develops, the role of the private sector increases. Low-income economies operate inside the technology frontier, thereby simplifying the selection process since existing technologies and industries are available to be adopted and benchmarked. Furthermore, in general, in low-income economies the public sector provides better paying and more stable jobs than the private sector. Thus the public sector has a higher level of human capital and an advantage in the selection process. In more advanced economies, the private sector is more likely to attract the most talented individuals by offering significantly higher compensation than the public sector. As such, the nature of industrial policy evolves to the point that the private sector drives the process of expanding the technology frontier while the public sector plays a supporting role.

At an early stage of development, countries produce goods that are already being produced elsewhere. Therefore, existing production technologies can be imported (e.g., textiles). Selecting sectors is relatively less risky because patterns of technological development are well-known and can be emulated (e.g., the "flying geese" paradigm of development in East and Southeast Asia). And the public sector, even without extensive

[16] Case studies are based on background papers commissioned by ADB under RETA 8153: Policies for Industrial and Service Diversification in Asia in the 21st Century. They are listed in the references.

Table 7: **Stage Dependent Industrial Policies**

Stage of Development	Industrial Selection	Financial Market Institutions
Low	- Relatively easy to select sectors - Government has better human capital - Private sector underdeveloped	- Weak financial sector - Underdeveloped capital markets - Lack of risk-sharing institutions such as venture capital
Middle	- Harder to select as economy becomes more complex - Knowledge shifting to private sector	- Financial sector strengthening - Nonbank finance expanding
Advanced	- Private sector highly developed; can select and assess projects - Government role diminishes to more of a guarantor	- Deep financial markets - Venture capital (with expertise)

Source: Authors' compilation.

business experience, can perform relatively well in selecting industries to promote. Industrial policies during this early stage of development are not about expanding technology frontiers to create new industries, but rather about assessing international markets to identify domestic winners, identifying key development bottlenecks, and coordinating capacity building efforts in areas such as infrastructure and human capital.

Finance is also an important factor in making industrial policies stage dependent. In less developed economies, it is difficult to secure financing for large-scale projects as private financial institutions and investors are hesitant to provide long-term funding. Financial markets are underdeveloped and there are no financial institutions that specialize in intermediating risks such as venture capital. Thus, government financing is in high demand, usually in the form of development finance institutions or credit subsidies to attract both foreign and domestic private capital.

The political economy is also a factor. In the early stages of economic development, the government designs and implements industrial policies and wants to let the public know such policies are an explicit part of the government's overall development plan. Amid the uncertain political environment that often accompanies earlier stages of economic development, the government seeks to gain legitimacy by being known as a champion of development and takes credit for every achievement. Foreign producers and/or countries are also not likely to object to the government-led or subsidized industrialization of low-income countries because they do not directly compete with them. However, as an economy develops, foreign competitors will not be as forgiving of subsidies. Consequently, the government role in industrial diversification becomes more indirect.

Industrial policy is unfair since some sectors of society benefit more than others. Industries and large firms often benefit from government largesse—in the form of cheap credit, infrastructure development, and/or a favorable tariff regime—at the expense of small and medium-sized enterprises (SMEs). In low-income countries, in general, a social consensus exists that prioritizes growth, employment, and rising incomes over issues of economic fairness. Therefore, government involvement faces less resistance. However, in mature economies, explicit industrial policies are no longer politically feasible due to fairness issues.

As an economy matures, production technologies become more sophisticated, making it increasingly difficult to produce more complex products, since there is no benchmark to follow. The risks involved in promoting new industries in uncharted territories are simply too big for the public sector. In response, firms must invest in and develop new technologies if they are to survive; and the government's role shifts to support research and development (R&D) and innovation. In the private sectors of advanced economies, businesses are able to attract

highly educated personnel seeking greater compensation than the public sector can offer and the balance of expertise gradually shifts from the public to the private sector. Therefore, it is natural that decisions about developing new products or sectors—often known as "picking winners"—is increasingly left to the private sector in advanced economies.

The role of the government in financial markets also changes. In advanced economies, the government's resource-allocation role declines and its risk-sharing role becomes more important. Rather than direct bank lending, public sector financial assistance becomes more diversified and includes risk-sharing instruments such as equity stakes, guarantees, and subordinated debt.

A common misconception is that governments in advanced economies no longer pursue industrial policies. This impression may be the result of governments in advanced economies maintaining a low profile as they continue to engage in industrial policy. They may want to avoid being seen by foreign governments and producers as supporting unfair competition and violating World Trade Organization (WTO) obligations. Advanced economies also tend to lack a social consensus on the primacy of growth over other concerns such as job creation and income inequality. Instead, governments must balance the interests of multiple economic constituencies (e.g., large firms, SMEs, innovative firms) that are often at odds with each other in terms of preferred industrial policies. These factors lead governments to downplay their level of intervention in the economy while using indirect assistance channels—such as promoting R&D through academic and military-based research, and supporting innovation and other policy objectives through government procurement contracts.

Finally, it is important to emphasize that the experiences of the countries reviewed indicate that the role of the private sector is key, even during the early stages of development when industrial policy is generally led by the public sector. The government can select and try to promote industries, but in the end, it is the private sector that delivers the desired outcomes. Building up private sector capacities in the early stages of industrial policy is key for long-run sustainable growth.

Case 1: Republic of Korea—Stage dependent industrial policy

In the early 1960s the Republic of Korea embarked on export-oriented industrialization, correcting its previous bias against exports and using its comparative advantage to develop labor-intensive manufacturing industries (Table 8).

Table 8: **Industrial Policy Phases—Republic of Korea**

	1960s	1970s	1980s	1990s	2000s
Development Stage	Factor driven	Investment driven		Innovation driven	
Industrial Policy	Support export development	Promote heavy and chemical industries	Shift from industry targeting to research and development (R&D) support	Provide information infrastructure and R&D Support	Promote new engines of growth and upgrade R&D
Science and Technology Policy	• Ministry of Science and Technology/Korea Institute of Science and Technology • Science and Technology Policy Promotion Act • 5-Year Economic Plan including S&T	• Government research institutes • Technical and vocational schools • R&D Promotion Act • Daedeok Science Town	• National R&D plan • Private Sector Initiatives in R&D	• Informatization • E-Government • Restructuring of government research institutes • University–industry–government linkages	• Universities' leading role • Efficient national innovation system • Regional innovation system and innovation clusters

Source: Lim (2011).

While continuing to pursue export-oriented industrialization based on its cheap labor, the Republic of Korea did not just wait for its income and skill levels to rise before developing its potential comparative advantage in more sophisticated industries. Instead, the government and the private sector systematically studied how to fill the missing links in the domestic value chain and move up the quality ladder. It made concerted efforts to aim for enhancing international competitiveness. The Republic of Korea's industrial policy phases are a good example of the changing role of the government in promoting new industries depending on the different development stages.

In the 1960s, the main decision-maker for industry selection was the government, specifically the President along with industry-related ministers and policy aides. Yet, private (and public) enterprises often shared a role in selecting specific export industries, with the government subsequently providing subsidies (and other assistance) if they managed to achieve certain goals (Lim 2011). In the 1970s, after an intensive consultation process with private companies, a government-led industrial targeting policy was applied to develop six heavy and chemical industries (HCI).

This pattern of increasing private sector involvement in the sector selection process was also evident after the 1970s technological development as decisions to move into ICT industries, for example, were led by the private sector. The corporate histories of Samsung, Hyundai, LG, and SK, among others, suggest that they were willing to pursue vertical integration or related diversification on their own, but usually worked in conjunction with government policy when they ventured into unrelated industries (Lim 2003).

In the 1990s and 2000s, as it became increasingly difficult to select and directly support specific industries because of insufficient technological knowledge and concerns for potential international conflict, the government shifted to "indicative" targeted industries. Assistance was confined to R&D efforts that were usually related to selected high-tech industries and financial guarantees to support private loans from financial institutions. A special committee, comprised of government officials, academic experts, business representatives and engineers, was formed to identify indicative high-tech industries.

Case 2: Developed countries: The United States—network partners

Advanced countries like the United States (US) provide useful examples of subtle industrial policies to leverage the expertise of the private sector, often by absorbing risks. Some of these risks align with traditional conceptions of market failure such as investments in early stage research, infrastructure, and education. But the US experience shows new dimensions of government support in advanced economies that are commensurate with the changes in industrial structure and the nature of market competition. Since the early 1980s, large, vertically integrated corporations have decreased in importance and collaborative, networked relations—encompassing different types of firms, university researchers, and government research laboratories—have expanded across a range of industries in the US.

In today's innovative environment, firms have difficulty finding network partners that are both trustworthy and competent. US government programs have helped to ameliorate key problems in these fragmented production environments through a range of interventions such as:

(i) **Standards setting** – Setting common or core standards for products or processes, allowing innovation around shared principles or system parameters;
(ii) **Target setting** – Setting technology "road maps" (e.g., fuel efficiency standards) allowing dispersed actors to orient around common standards or goals;

(iii) **Certification and signaling** – Employing rigorous expert review or evaluations to certify promising ideas and decertify others (e.g., National Institutes of Health and Small Business Innovation Research Program); and

(iv) **Networking** – Bringing together otherwise isolated firms, university researchers, and government scientists and engineers to forge collaborative linkages.

2. What is the rationale for sector selection?

While the literature is mute on who selects sectors, this is not the case for sector selection, even if there is no proven one-size-fits-all method. Neoclassical trade theory advises countries to specialize in products in which they have a comparative advantage in order to maximize welfare by allocating resources to their best use. However, this recommendation is very general and static. Moreover, it is actually a strategy for not selecting sectors for promotion or protection, as the neoclassical assumption leads to the conclusion that a market economy will allocate resources efficiently without government intervention.

However, those who believe that the market will not allow developing countries to progress beyond exploiting natural resources and manufacturing simple goods see industrial policy as necessary for a country to leapfrog ahead. In the past, countries often selected industries with significant linkage effects and increasing returns to scale by observing the earlier choices of successful countries. In this section, we review the recent work on sector selection, in particular the Growth Identification and Facilitation (GIF) framework of Lin and Monga (2011) and the Product Space theory of Hidalgo et al. (2007). This is followed by a discussion on the concept of indirect industrial policy through financial markets.

Recent literature on sector selection

Today, with the renewed interest in industrial policy, a number of authors have suggested methodologies to help guide countries on sector selection. Two of these methodologies are the GIF and the Product Space theory.

The Growth Identification and Facilitation (GIF) framework

The GIF framework is a tool based on Lin's *New Structural Economics* (2012). Its six-step framework can help policymakers in developing countries identify industries with "latent comparative advantages" and facilitate competitive private sector development.[17] The six steps are:

(1) Choose the right country benchmarks. Policymakers should look to dynamically growing countries with similar endowment structures, with about 100% or higher per capita income measured in purchasing power parity. They must identify tradable goods and services that have grown robustly in those countries for the past 15–20 years. These are likely to be new industries consistent with the country's latent comparative advantages, as countries with similar endowments are likely to have similar comparative advantages. A fast-growing country that has produced certain goods and services for about 20 years will begin to lose its comparative advantage as its wage levels rise, leaving space for countries with lower wages to enter and compete in those industries.

(2) Assist domestic private firms. If private domestic firms are already active in these industries, these firms must have local and tacit knowledge as well as the experience that allows them to be competitive. Policymakers should identify the obstacles that prevent these firms from upgrading the quality of their products, and the entry barriers that other private firms face. The government can then implement policies to remove these constraints and facilitate firm entry.

[17] An economy has latent comparative advantage in an industry if, based on the factor costs of production, determined by the economy's endowment structure, the industry should be competitive. However, due to high transaction costs, determined by infrastructure, logistics, and other business conditions, the industry cannot yet be competitive in the global market in this industry.

(3) Attract global investors. In the case of industries in which no domestic firms are present, policymakers may try to attract FDI from some of the countries listed in step (1), or from high-income countries producing those goods. These foreign investors may possess general and tacit knowledge (the latter being knowledge not codified in books or manuals, akin to learning by doing) about a certain product, not only about its design and production technology, but also about the entire supply chain and distribution channels. Foreign investors could bring in capital and technology, as well as tacit knowledge. The government could also set up incubation programs to encourage start-ups.

(4) Scale up self-discoveries. In addition to the industries identified in step (1), the government should pay attention to spontaneous self-discovery by private enterprises and support the scaling-up of successful private innovation in new industries to benefit from rapid technological changes and the resulting new opportunities. Examples include mobile phones and related e-services, social media, and green technologies.

(5) Recognize the power of industrial parks. In countries with poor infrastructure and an unfriendly business environment, the government may set up special economic zones or industrial parks to help overcome barriers to firm entry and foreign investment. These zones can create preferential business environments that most governments are unable to quickly implement on an economy-wide basis due to low budget and capacity constraints. Establishing industrial parks or zones can also facilitate the formation of industrial clusters and, hence, reduce production and transaction costs.

(6) Provide limited incentives to the right industries. Policymakers may consider compensating pioneer firms in the industries identified with time-limited tax incentives, co-financing for investments, or access to foreign exchange. This is to compensate for the externalities created by first movers and to encourage firms to form clusters. Because the identified industries are consistent with the country's latent comparative advantages, the incentives should be limited, in both time and financial cost. To prevent rent-seeking and political capture, governments should avoid incentives that create monopoly rents, high tariffs, and other distortions. Moreover, incentives should be linked to performance and continuously evaluated against the stated objectives.

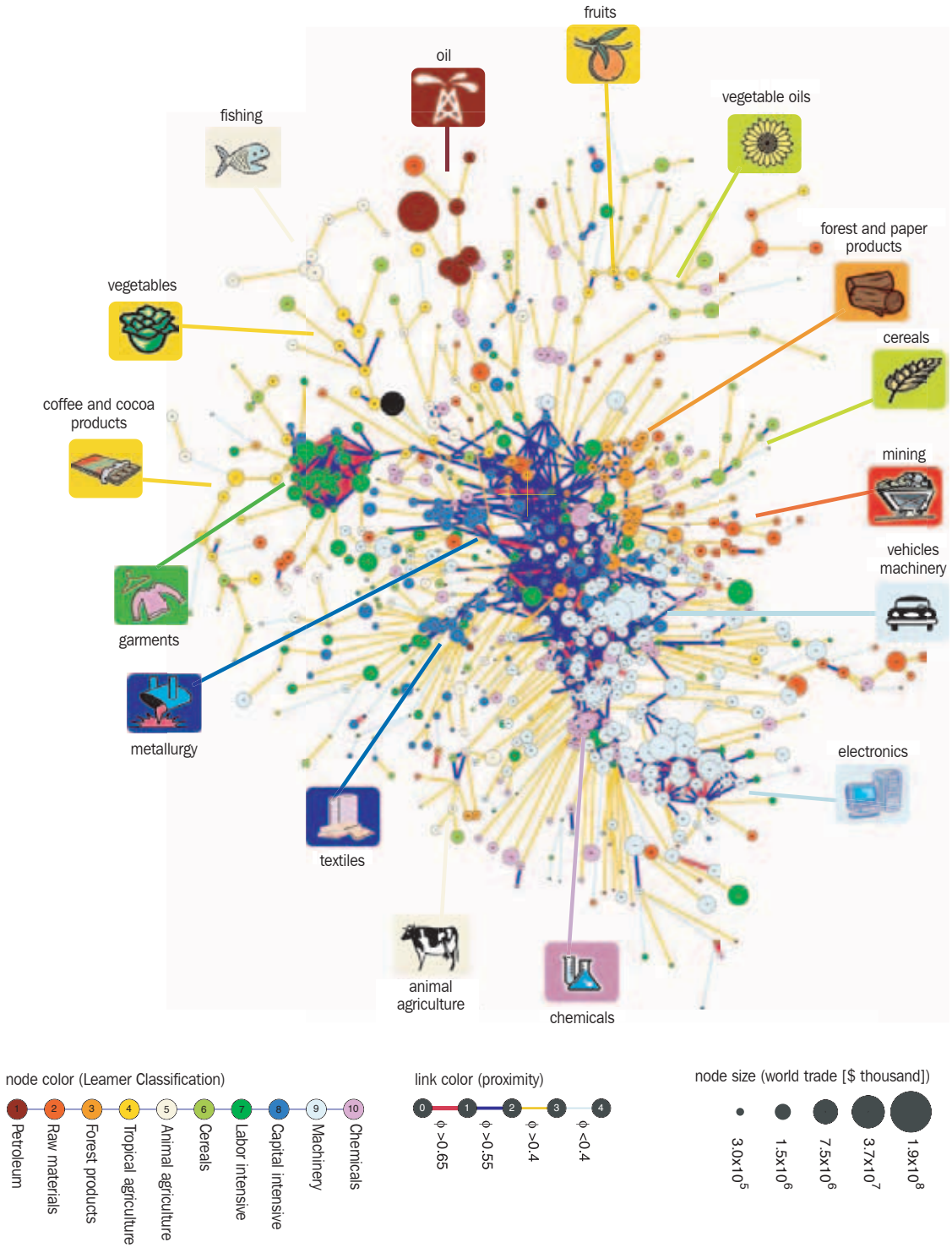
The Product Space Theory

The Product Space of Hidalgo et al. (2007) is an application of network theory. It graphically depicts the network of connecting products that tend to be co-exported. The product space shows all products exported and how "close" they are with each other (Figure 7). It is important to understand what the product space is, the information it provides, and how it should be interpreted.

The product space is constructed using product-level data, not aggregate sector data. In the version published by Hidalgo et al. (2007), they use a representation with data for about 800 products (strictly speaking, classes of products). It is possible to work with larger data sets, but representing the product space with a larger data set would make visualization difficult as the figure would be cluttered. The authors use export data because the most comprehensive and available data sets are for exports, not for output. This has some problems, of which the authors are aware, but it does not invalidate nor undermine the strength of the analysis.

The graphical representation shows all products exported in the world (not by country), with different colors (by product group) and sizes (proportional to world trade); it also shows how "close" the products are. The idea of proximity reflects whether products are co-exported or not. What does this mean? As discussed in Part I, one can calculate the likelihood of exporting product A given that the country exports product B. For example, if 20 countries export computers (product A), 24 countries export wine (product B), and eight export both, the proximity between

Figure 7: **The Product Space**



Source: Hidalgo et al. (2007).

computers and wine is 8/24 = 0.3 (We divide by 24 instead of 20 to minimize false positives).

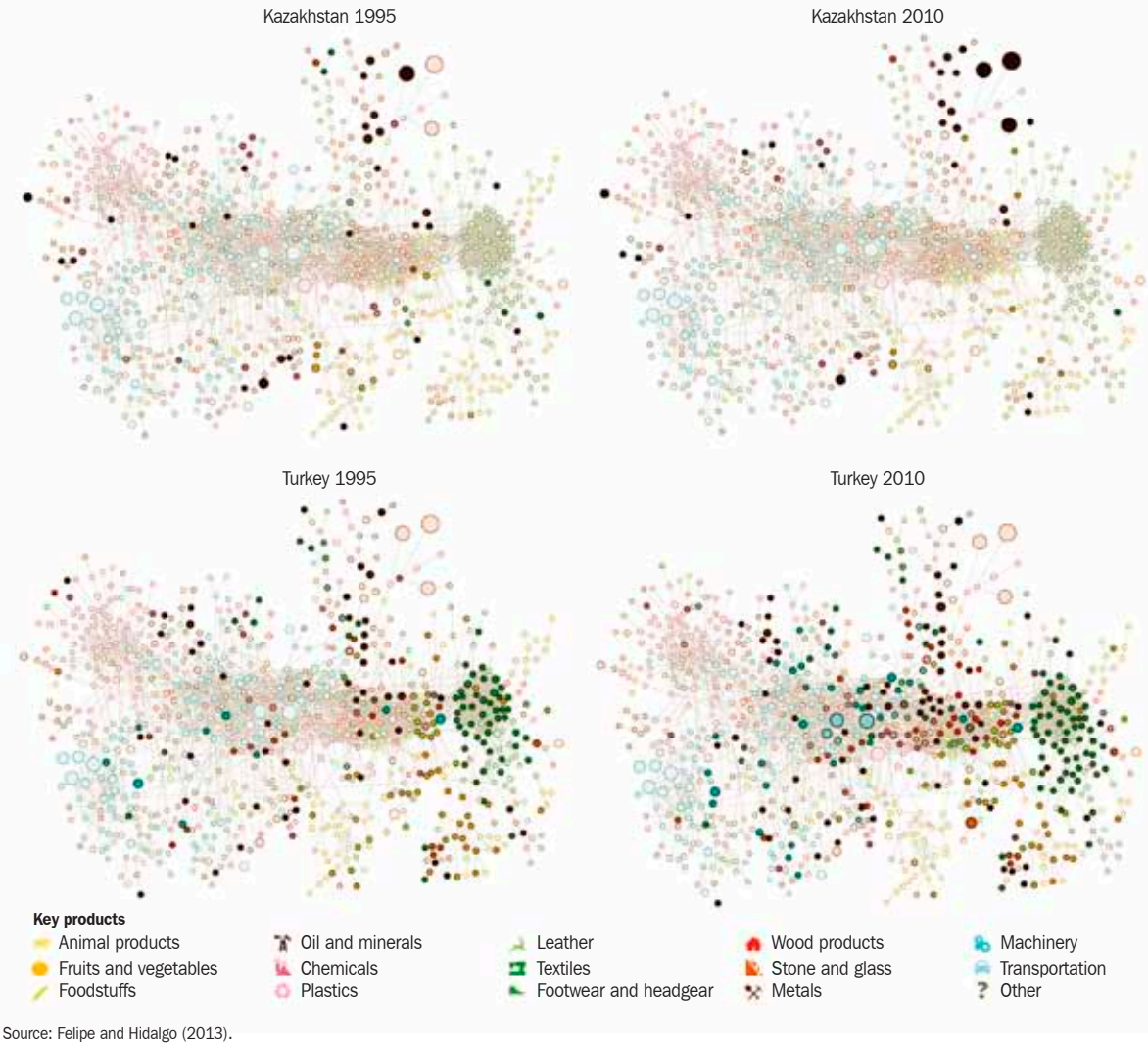
What do these probabilities reflect? The idea behind this conditional probability is that products require knowledge (capabilities) to be made. Capabilities encompass all the tacit knowledge necessary to produce a good or deliver a service. The similarity between the capabilities required to produce two products is inferred by the probability of co-exporting them, that is, it is assumed that if two goods share a high number of capabilities, the country that exports one of them will also export the other one, and vice versa. Thus, products that share few capabilities are less likely to be co-exported. Products are linked based on the similarity of their required capabilities—for example, the link between shirts and pants is stronger than that between shirts and iPods. The rationale is that if two goods need similar capabilities, a country should show a high probability of exporting both with comparative advantage. Thus, the barriers preventing entry into new products are less binding for products using similar capabilities. A country's development path is determined by its capacity to accumulate the capabilities that are required to produce a more varied and sophisticated basket of goods. The authors show that progress tends to occur in small steps, i.e., new products in which countries gain revealed comparative advantage are those that require similar capabilities to those already mastered and embedded in the products exported with comparative advantage.

The product space is clearly divided into a periphery and a core. Products in the periphery are agriculture, vegetables, and natural resources. Products in the core are chemicals, machinery, and transformed metals. Products in the periphery are loosely linked. Links in the core are stronger. This means that it is very difficult for a country stuck exporting products in the periphery to move into products that are in the core. This is, however, the dilemma of development. The authors show that some products are close-by others, because they require similar capabilities, while some are isolated. In the first case (close-by products), it is easy to jump from one product into another one, and therefore export the new one with comparative advantage, while in the second case, it is difficult. Products in the first group (core products) are chemicals, machinery, and metal products. Products in the second group (isolated products) are petroleum, raw materials, tropical agriculture, animal products, cereals, labor-intensive goods, and capital-intensive goods (excluding metal products). Core products also tend to be more sophisticated than isolated ones.

Until now, the Product Space is just a generic representation. To make it country-specific, the authors superimpose the products that the country exports with revealed comparative advantage (RCA(pop)>0.25), whose calculation has nothing to do with the product space. These products are marked with black dots in Figure 8. This information provides a visualization of the products exported with RCA(pop)>0.25 on top of the product space. Figure 8 shows the product spaces for the products that Kazakhstan exports with comparative advantage for 1995 and 2010. Note that this Product Space has been rotated counter-clockwise with respect to the one shown in Figure 7. For reference, the textile group is now on the right-hand side of Figure 8, while it was on the left-hand side of Figure 7. It also shows for comparison purposes Turkey's product space in the same 2 years. This information complements that provided by Figure 2 and Tables 2a, 2b, 3, and 4.

Given the products that a country exports today, one can ask: what are other likely products that a country could develop with RCA(pop)>0.25? Based on the discussion above, these must be products that are "close by" to the products that the country exports with RCA(pop)>0.25, because these potential exports require capabilities similar to those used by the products exported. It is possible to rank all products not exported according to their proximity to the current export basket. Hidalgo et al. (2007) never claim that a country should promote or subsidize "close by" products. All this analysis shows is how far these potential (new) exports are from the

Figure 8: **Product Space—Kazakhstan and Turkey, 1995 and 2010**



Source: Felipe and Hidalgo (2013).

current export basket. The "farther" they are, the more difficult it will be to develop comparative advantage. That does not necessarily mean that a country should not aim to develop these. Rather it must be understood that there is a clear trade-off between risks and return and choices must be made based on countries' industrial policy objectives and organizational capabilities.

Identifying the objectives of industrial policy

It is important to first agree on the objectives of an industrial policy program. If the development of a broad-based productive sector is one of Kazakhstan's objectives, then sectors and activities need to be selected where existing firms already have some, if not perhaps substantial, organizational capabilities, but have not yet achieved sufficient competitiveness to survive international competition. This is in line with choosing "close by" products in the Product Space theory. Policymakers could also use step (1) of the GIF framework as a reference. Some caution, however, should be exercised because choosing sectors on the basis of a target country's per capita income alone can give a misleading idea of organizational and entrepreneurial capabilities in an oil-rich country. The productive

and organizational capabilities of entrepreneurs in a resource-exporting country are likely to be well below those of entrepreneurs in a somewhat diversified country, despite the fact that the latter's per capita income could be lower.

In cases where a country has more ambitious plans and decides to leapfrog from the periphery to the core, the real challenge is how to build new organizational capacities and address coordination and innovation externalities amid a transition. This might require larger investments to secure scale economies and complementary infrastructure compared with the case of moving to "close by" industries. After investments are made, if a country fails to achieve international competitiveness, the resulting capacity underutilization and financial distress may bankrupt its economy. In addition, even if technological challenges could be overcome at the individual country level, the world would be awash in overcapacity if too many countries target the same industries. This "fallacy of composition" effect further increases the risks of industrial policy. Accordingly, a country must carefully weigh the challenges of skill accumulation, scale economies, and complementary investments against the possibility of capacity underutilization and financial distress before embarking on an ambitious industrial policy.

Pursuing indirect industrial policy through financial markets

The GIF framework and the Product Space theory are useful modern tools to help design industrial policy; but alone, they will not provide a definitive answer as to which sectors a country should promote. Moreover, they highlight the high-return, high-risk nature of industry selection. For a country like Kazakhstan, which is almost high-income, the government may not have enough technical and expert knowledge to evaluate the risks in expanding the technology frontier to create new industries. An effective multi-phased strategy is needed to leverage private sector expertise in sector selection. As an operational tool for industry selection, we will discuss the concept of indirect industrial policy, which is widely used in advanced economies, though its practice is not often visible.

Indirect industrial policy is a strategy of selecting and supporting industries indirectly through private financial markets. Instead of picking specific industries or firms to support with direct assistance, the government broadly defines the favored industries and announces incentives for the private sector to participate in industrial policy. One example is the Multiannual Program for Enterprises and Entrepreneurship in the European Union's (EU) Lisbon Strategy, known as MAP. The Lisbon Strategy is an EU development plan devised in March 2000. It aims to increase the competitiveness and dynamism of a knowledge-based EU economy. The Lisbon Strategy includes a scheme to support innovative SMEs through a creative guarantee mechanism under the European Investment Fund (EIF) that shares the risk of guaranteeing bank loans to SMEs with private guarantors (Figure 9).

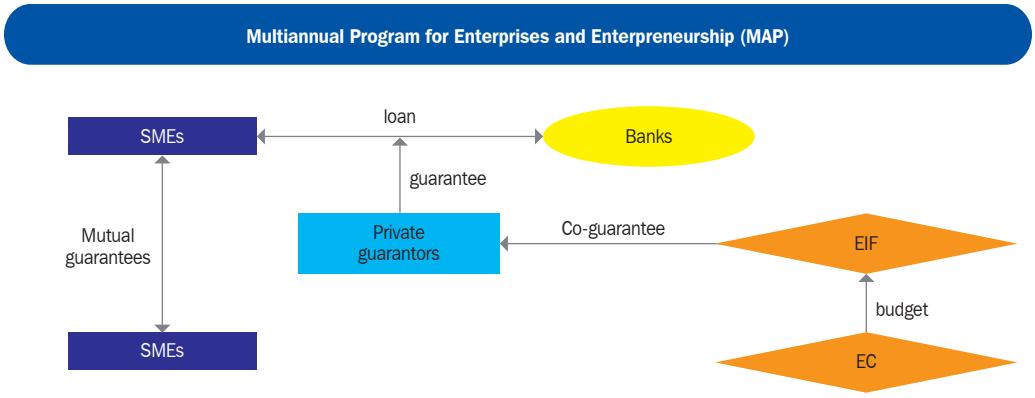
For example, if the European Commission (EC) wants to promote SMEs in the biotech industry, it assigns a budget to the EIF to provide partial credit guarantees to bank loans extended to SMEs. Criteria for legitimate SMEs are preannounced, banks select candidate firms, and the EIF and banks jointly determine the beneficiaries. Credit guarantee can also be jointly extended with private guarantors.

If the EC and the EIF want to promote riskier industries than the biotech industry, they can increase their credit guarantee proportion to incentivize more active private banking participation to those riskier industries. In other words, they have adjustable parameters that allow the EIF to assume a minority or majority share of the guarantee depending on the risk involved.

Sophisticated capital market instruments are also used to minimize the moral hazard problem in public guarantee programs. For example, as shown in Figure 10, the EIF provides credit

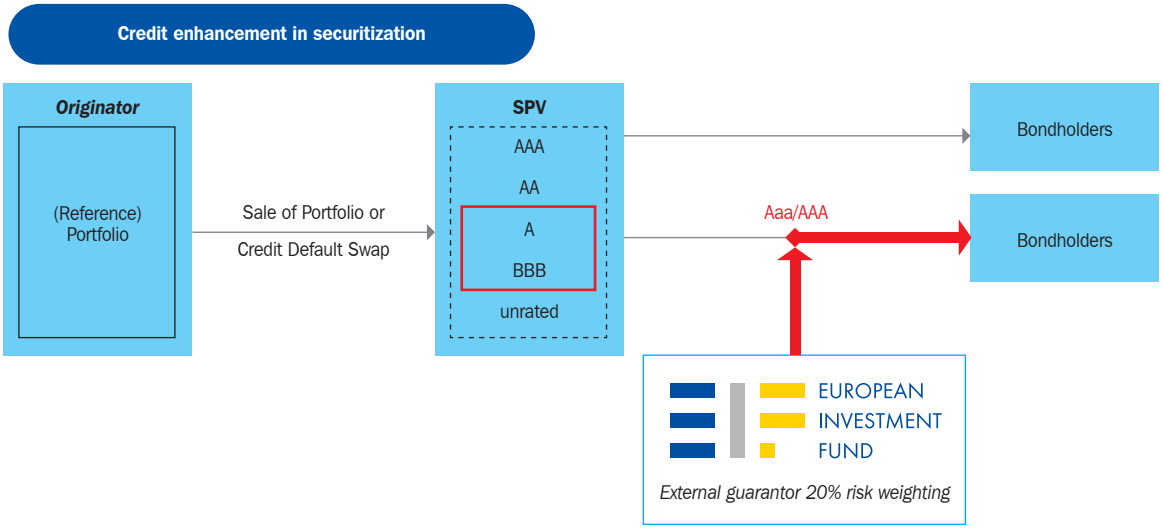
enhancement to securitized SME loan portfolios by private banks. But its support is mostly targeted to tranches with mid-level credit ratings. Higher-rated tranches are sold to market investors without guarantees. Loan originators (banks) must assume the risk for the lower rated or unrated tranches so that they do not have an incentive to sell bad assets to the market or to EIF. In doing so, the EIF tries to minimize the moral hazard problem while supporting the securitization of bank loans extended to achieve industrial policy goals.

Figure 9: **The Lisbon Strategy "MAP"**



EC = European Commission, EIF = European Investment Fund, SMEs = small and medium-sized enterprises.
Source: European Investment Fund (2002).

Figure 10: **European Investment Fund**

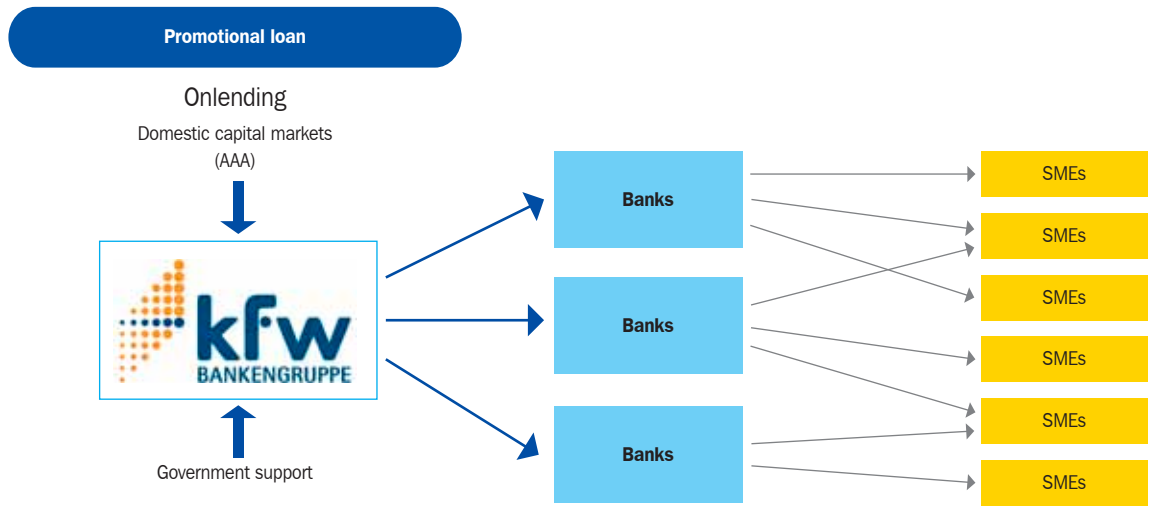


SPV = special purpose vehicle.
Sources: EIF (2003 and 2013).

Another example is the onlending program of KfW, Germany's national development bank (Figure 11). Because of its high credit rating, KfW can source funds at lower interest rates than private banks and use these low-cost funds for onlending to private banks to incentivize them to lend to firms in certain targeted industries. The broad conditions for KfW's support are pre-announced and private banks select candidate firms to jointly review with KfW. Depending on the risks involved with a targeted industry, KfW can adjust the proportion of co-financing. The interest rate margin is another tool used to differentiate risks. KfW previously regulated the interest margin within one percentage point for onlending funds, regardless of the credit ratings of supported SMEs. This had the unintended effect of directing the majority of funds to low-risk projects and SMEs with good collateral since the regulated interest rate margin acted as a disincentive to private banks to choose SMEs with lower credit ratings. To address this problem, a risk-adjusted price system was introduced in April 2005 that allowed private banks to adjust the interest rate margin with the credit ratings of supported SMEs. The result was an increase in loans to lower-rated SMEs.

The benefits of indirect industrial policy are numerous. For example, risk can be shared between the public and private sectors through onlending, credit guarantee, and co-financing mechanisms, which reduces fiscal instability in the event that industrial policy does not succeed. More than anything else, the government can leverage the private sector's deeper knowledge in selecting potential winners. By making private financial institutions bear significant costs of project failure, the public sector can secure the private sector's best efforts in selecting industries and firms to support. It also provides useful information for governments to judge whether they should target "close by" or "core" industries. Despite the offer of significant public support, if the government still cannot find private sector co-financing partners in selecting a particular industry, then developing that industry is very likely beyond the government's operational capability and it would be better for the government not to target that industry. Indirect

Figure 11: **Onlending by KfW**



KfW = Germany's national development bank, SMEs = small and medium-sized enterprises.
Source: KfW Group (2013).

industrial policy also allows governments to avoid international conflicts, which could be triggered if it extends direct assistance to particular sectors. This is one reason most public support programs in advanced economies are implemented indirectly through private financial markets. At the same time, these risk-sharing mechanisms also contribute to the development of domestic financial markets.

The other important political benefit of indirect industrial policy is to avoid the criticism that "the government is taking away umbrellas when it is rainy." One of the practical difficulties of traditional industrial policy is that it is hard to withdraw assistance once extended. But in indirect industrial policy, private financial institutions extend support to firms and can withdraw it if necessary without generating the political backlash that would otherwise accompany the withdrawal of direct government lending. This is a very effective way of minimizing the moral hazard problem in traditional industrial policy. Critics of indirect financial assistance highlight the risk of such programs being captured by private sector beneficiaries and/or the financial sector. However, such risk is just as (if not more) prevalent in direct lending schemes.

Case 1: The high-return and high-risk nature of industrial policy—contrasting the Republic of Korea and the Philippines

A number of successful Korean industrial policies have been discussed in this report. However, the Republic of Korea's industrial policies also had a number of setbacks that required massive restructuring. For example, in the 1980s, the Republic of Korea's heavy and chemical industries (HCI) that survived the first 1970s oil shock were hit severely by the second oil shock. They also suffered from plummeting world demand. In the 1970s, the HCI revealed structural difficulties such as over-investment, over-leveraging, and over-competition. Many Korean industrial groups, known as *chaebeols*, were facing excessive supply capacity amid decreasing world demand. In order to facilitate the restructuring process and avoid sovereign default, the government initiated a massive restructuring drive in the early 1980s that involved closing down and merging several large companies, while maintaining assistance in the form of fiscal incentives and low interest rates for the surviving companies. This example clearly shows that industrial policy is more than selecting sectors. Risk management and restructuring policies are also essential to successful industrial policies.

The high-return and high-risk nature of industrial policy, and the importance of risk management and restructuring policies in crisis periods, are evident when comparing the history of industrial policies in the Republic of Korea and the Philippines. Interestingly, in the 1970s, the Philippines and the Republic of Korea embarked on similar HCI drives, selected a common set of industries to nurture, followed nearly identical development blueprints for the selected sectors, utilized a similar set of policy instruments to channel resources to targeted sectors, relied heavily on external borrowing to fund domestic investment, and struggled through worldwide economic recessions caused by two oil price shocks. But the Korean economy weathered and recovered much more quickly from the economic slowdowns and price shocks—a testament to its successful industrial transition—while the shallow industrial base of the Philippines was nearly decimated by internal and external crises. What made the difference?

Abrenica (2013) claims that the first factor might be the historical antecedent that rendered post-liberation conditions in the Philippines less conducive to development. The Philippines did not attain economic independence despite gaining political sovereignty at the end of the Second World War. Instead, the Philippines was locked into a dependent relationship with the US by the Bell Trade Act that lasted for almost three decades after independence (1946–1974). Apart from granting reciprocal free trade, the arrangement prohibited the Philippine government from changing the exchange rate

(until a subsequent amendment to the agreement in 1955) and imposing taxes on exports to the US, which at the time consisted largely of sugar, coconut oil, hemp, and tobacco.

This arrangement sustained the political and economic domination of pre-war landed elites who benefited from the absolute export quotas to the US at prices nearly twice world levels. Clamor for land reform was rejected. Until the 1960s, both economic wealth and political influence were heavily concentrated among a small number of wealthy landed families. The strongest political interest group was the sugar sector, which lobbied for liberal trade and exchange rate policies along with other traditional export sectors. This put them in constant conflict with import-substituting industrialists over trade and exchange rate policies. It was only toward the end of the 1950s that the latter group won support in Congress, paving the way for a new trade and industrial regime based on import-substitution. The new regime had a good growth run, but only for a short period before the limits of the domestic market—stunted by skewed income distribution—were reached.

In contrast, the Japanese colonial influence over the Republic of Korea ended with liberation at the end of the Second World War, permitting the government of the Republic of Korea to set its own development agenda earlier than the Philippines. Moreover, immediately after liberation, Japanese-owned lands were either redistributed or sold, and land reform was earnestly pursued. Concentration of land ownership (and economic wealth) declined dramatically. For this reason, the economy of the Republic of Korea had a more egalitarian income distribution, which helped develop domestic demand for local manufactures. Moreover, since *chaebols* grew their wealth out of special privileges received from the state, they were more pliant to government policy designs. Absent constant wrangling between landed elites and industrial barons, it was more feasible to coordinate and implement a centralized and coherent development strategy and to switch paradigms between import substitution and export promotion when conditions warranted. It also provided the government with the power to lead involuntary restructuring during crisis.

A second major difference is that the constituency for industrialization was much smaller in the Philippines than in the Republic of Korea. Industrial policies were perceived to be championed in the Philippines by US-trained technocrats who enjoyed the confidence of international lending agencies but had no political base. Furthermore, even if they were in the bureaucracy, they had to constantly compete against cronies and lobbying groups to influence the President's decisions. The narrow constituent base for industrialization is evident in the fact that the cronies most-favored by President Marcos were more interested in accumulating rents from traditional export commodities (e.g., sugar, bananas, and coconuts) and non-traded sectors (e.g., communications, finance, construction, transportation, electricity generation, and distribution services) than in developing the manufacturing sector.

Ad hoc policies were an additional hindrance to development. For example, what the Philippine export promotion measures achieved best was to allow producers access to imported inputs at world market prices. This encouraged processing industries based on imported materials and cheap Philippine labor. Since the system protecting manufacturing firms producing for the domestic market was retained despite the shift to an export-oriented industrialization strategy, domestic firms have no incentives to upgrade quality and reduce costs. Exporters were, therefore, not encouraged to source locally nor develop backward linkages. In this policy environment, only export industries with relatively low transport costs and high labor input requirements could thrive. Electronics and garments fit these characteristics; hence, Philippine exports remained highly concentrated in these two sectors.

The Republic of Korea's policies, on the other hand, covered comprehensive value chains with forward and backward linkages. For example, the

Republic of Korea's export promotion measures were not limited to tax preferences and interest rate subsidies to exporters. Rather, when the Republic of Korea embarked on export-oriented growth (1962–1972), the plan included the development of basic infrastructure, industrial structure reform, and development of key raw- and intermediate-material supplying industries. Import restrictions targeted developing infant industries until they were competitive enough to begin exporting or supplying domestic manufacturers with their input requirements.

A third distinction lies in policy and program implementation. The failure of the Philippine automotive, steel, and shipbuilding industries shows the kind of policy flip-flopping that created uncertainty and triggered capital flight. By contrast, businesses targeting expansion in the Republic of Korea did not have to be concerned with policy inconsistencies and reversals. They were given preferential access to domestic credit and external funds, and were bailed out when threatened with bankruptcy during downturns and financial panics.

Such displays of government commitment were not entirely lacking in the Philippines. In 1981 an industrial rescue fund was established to save the business empires of Marcos' cronies that were rendered illiquid or insolvent by a huge financial scandal (i.e., the Dewey Dee case). But the crucial difference between the Republic of Korea and the Philippines was the extent to which competition was encouraged in implementing government policies and programs to foster favored firms and industries. The Government of the Republic of Korea made the *chaebols* compete among themselves for protection and nurtured them by channeling credit, foreign exchange, and opportunities to those firms that were able to outperform the others, particularly with respect to exports. In the Philippines, on the other hand, rewards were based less on performance than on political patronage. There was less incentive among Marcos' cronies to strive for efficiency, not only because they chose to concentrate in non-traded and heavily protected sectors, but also because rules and policies could be easily manipulated in their favor. For example, while automotive assemblers were allowed to offset through exports of manufactured components only 15% of the local content requirement for cars assembled and sold in the Philippines, a close crony of Marcos was exempted from this rule. Thus, the business empires of Marcos cronies thrived by expropriating rents, created largely by the uneven application of rules, rather than by generating profits through superior performance.

While performance rather than patronage is the basis for receiving protection and preferential access to resources, the capacity of the bureaucracy to monitor and maintain accurate records of economic performance is crucial for the consistent and credible application of policies. The Government of the Republic of Korea's has been lauded for maintaining reliable monitoring and record-keeping systems that proved valuable not only in implementing industrial programs, but also in designing macroeconomic stabilization packages. Such capacity was lacking in the Philippine bureaucracy during its industrialization drive. As shown in the case of the automotive industry, the difficulty in monitoring compliance with local content requirements undermined the credibility of the program. A more telling case of this weakness was the overstatement of the country's reserves that was discovered only when the government declared a moratorium on debt repayments in 1983.

Perhaps the most critical component of the Republic of Korea success story is the profound understanding on the part of the government that active intervention is necessary to achieve technological development. A simple reality, often unrecognized by governments in many developing economies, is that technology does not transfer automatically as a result of opening up to foreign trade and capital flows. The government of the Republic of Korea had a wide array of policies geared toward stimulating market demand for technology, increasing

its science and technology base, and creating effective linkages between the demand for and supply of technology. The Philippines, in contrast, did not have a cogent set of technology policies.

A final reason for the failed industrialization of the Philippines is the discord in trade, investment, regulatory, human resources, and science and technology policies that were supposed to complement industrial policies during the 1960s, 1970s, and 1980s. This lack of coherence is evident in the failures of the Philippines' automotive, shipbuilding, and steel industries. For example, while the country was trying to develop its shipbuilding industry in the 1970s, it allowed liberal entry of cheap imported secondhand vessels from Japan, offered financing schemes for the acquisition of imported vessels, but none for locally constructed vessels, and neglected the ancillary sector (metal casting, forging, and machinery). On the other hand, the automotive industry failed because of the neglect of SME parts manufacturers, while assemblers were subjected to weak regulations on local content and limits on the number of brands and models. As a result, the expectation that foreign assemblers would develop local parts production did not materialize and the program failed to generate externalities.

3. What are the main tools used to promote sectors?

The main tools of industrial policy seek to either protect an existing sector from foreign competition or to launch activities in a new or expanding sector that needs (temporary) support. The history of industrial policy is filled with examples of policy tools, including the provision of basic infrastructure to support the private sector (e.g., electricity, water, roads), different forms of protection (e.g., tariffs) and promotion (e.g., export rebates), subsidies for R&D, and some aspects of public education. The risk is that governments can misuse these tools to the advantage of some groups and the disadvantage of others, and that public resources are inefficiently allocated.

Traditional industrial policy tools come in the form of infant industry protection such as tariffs, export rebates, and currency undervaluation, among others. However, if we consider industrial development as a long-term process spanning decades, it is natural that the preferred tools will change over time. In fact, governments in advanced countries rely increasingly on financial tools as their economies mature, while at the same time the public sector's role in industrial policy becomes less visible.

Representative policy instruments

Developing and developed economies alike use a range of industrial policy instruments. These tools can be broadly classified into one of eight categories: (i) fiscal incentives, (ii) investment attraction programs, (iii) training policies, (iv) infrastructure support, (v) trade measures, (vi) public procurement, (vii) financial mechanisms, and (viii) industrial restructuring schemes. The following discussion provides examples of each policy instrument as used in the Republic of Korea and Malaysia. Tables A5, A6, A7 in the Appendix provide examples from the developed economies of Australia, the EU, and the US, respectively.

Fiscal incentives. Beginning in the 1960s, the Republic of Korea offered preferential tax credits and other concessions to manufacturing exporters and allowed exporting firms to retain foreign exchange earnings for import purchases. Preferential export credit was employed in the 1970s to promote exports from the rapidly developing heavy and chemical industries (HCI). Fiscal incentives were likewise used in Malaysia to attract FDI toward promoted sectors and to meet specific objectives. For example, tax holidays were given to firms awarded pioneer status and special zones with duty free imports were developed to promote exports that were dependent upon imported components.

Investment attraction programs. In the 1960s the government of the Republic of Korea established a special export-oriented industrial

zone in Seoul, the Guro export industrial zone, offering qualified labor and improved infrastructure to facilitate exporting. Malaysia created technology parks as part of its Multimedia Super Corridor (MSC), which opened in 1999 as a specialized zone to attract high-tech FDI.

Training policies. The Republic of Korea's HCI drive required developing a technological base. Through a presidential declaration, the Republic of Korea upgraded its vocational schools, technical education, and engineering based on the German model. The government set up several research institutes to promote science and technology, as well as industry-specific institutes and science parks. To develop the country's human capital, the Malaysian government instituted requirements for sectors receiving government support that included skills training.

Infrastructure. In the 1970s, the Republic of Korea established a number of industrial complexes that included modern transportation and energy infrastructure. The cities that flourished around these complexes became synonymous with particular manufactured goods such as shoes or automobiles. Industrial complexes differ from special export promotion zones as the primary objective of these complexes is to develop the domestic supply chains of specific industries. As another example, Iskandar Malaysia, a special economic zone in southern Malaysia, opened in 2006 to spur growth in manufacturing and services.

Trade measures. To stimulate exports, the government of the Republic of Korea set export targets that influenced firm behavior, with successful exporters receiving awards from the government. The Republic of Korea also used asymmetric import tariffs: very high tariffs for consumer goods for export; and low tariffs for capital goods needed by export industries.

Public procurement. The Republic of Korea's industrial complexes established under the HCI program were expected to provide 30% of their manufactured products to the military, which offered HCI firms a measure of revenue stability. Malaysia's requirements for the recipients of government support included local content rules, although these have mostly been phased out due to Malaysia's WTO commitments.

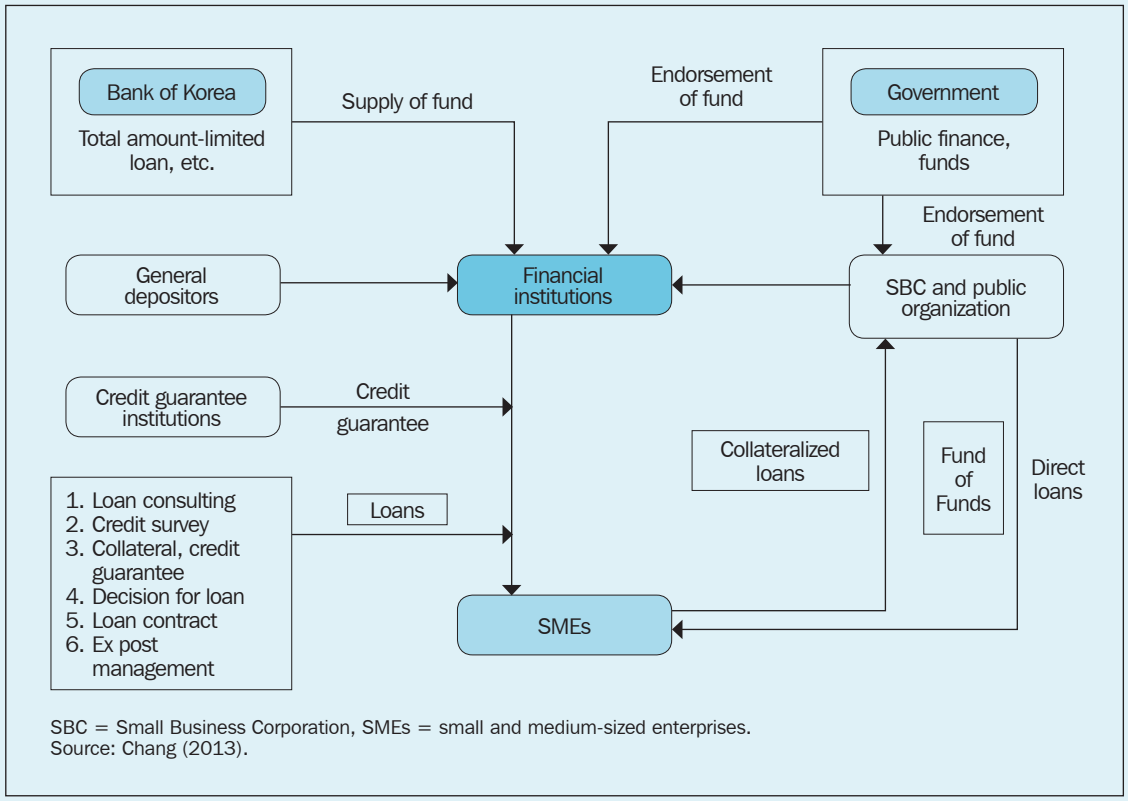
Financial mechanisms. The Republic of Korea's complex financial support system for SMEs is detailed in Box 4.

Industrial Restructuring Schemes. Oil shocks in the 1970s and 1980s threatened the viability of Republic of Korea's HCI industries that were already under strain as a result of over-investment. The government directly intervened to close down less competitive firms or merge them with successful ones. Fiscal incentives and low interest rates buttressed the surviving firms.

The Republic of Korea is a good example of how industrial policy tools change depending on the development stage. In the 1960s, when processing trade was a major target of industrial policy, preferential export credits and special export zones were the Republic of Korea's primary policy tools. In the 1970s, when the domestic industrial base started to emerge, the government backed policy loans and special industrial complexes that brought together domestic firms seeking access to modern transportation and energy infrastructure. After the two oil shocks, the 1980s saw industrial restructuring, facilitated by fiscal incentives for corporate restructuring and a low interest rate policy, and the depreciation of the exchange rate as a tool of export promotion. As the economy of the Republic of Korea advanced beyond middle-income status, developing the knowledge economy became a key objective of industrial policy and the government allocated special funds for R&D and education in the 1990s. As a new source of innovative growth, the role of SMEs was emphasized and various credit guarantee programs were strengthened. By the 2000s, the government realized the practical and political limitations of traditional industrial policy and tried to benchmark "indirect" industrial policies being used in advanced economies. Tax exemptions and financing

Box 4: **The National Financial Support System for SMEs in the Republic of Korea**

To promote SMEs as a potential growth engine, several financial support facilities were developed in the Republic of Korea with assistance from industry, academia, and research institutes.



SBC = Small Business Corporation, SMEs = small and medium-sized enterprises.
Source: Chang (2013).

Credit guarantee funds. Since 1976 the government has provided public credit guarantees through the Korea Credit Guarantee Fund (KODIT) and the Korea Technology Credit Guarantee Fund (KOTEC) to SMEs ineligible for bank loans due to a lack of collateral. This risk-sharing mechanism bridges the financing gap stemming from the absence of a credit evaluation system.

Policy loans. The government supplies loans either directly or indirectly to a host of SMEs at lower-than-market interest rates through the Small Business Corporation (SBC).

Asset-backed securitization. The Asset Backed Securitization (ABS) Law was passed in 1998 to govern securitizations originated by financial institutions. The Korea Mortgage Corp. (KOMOCO) is a joint venture between the International Financial Corporation (IFC) and domestic banks that issue mortgage-backed securities collateralized by mortgage loans acquired from the National Housing Fund.

The Fund of Funds. In 2005, the government started to create various Fund of Funds (FoF) to promote the investment funds for SMEs and venture businesses. In contrast to the previous system, in which the government directly chose the recipient companies, the FoF allows a fund manager to evaluate, select, and distribute capital to them. It is a new tool for indirect industrial policy in the Republic of Korea.

Source: Chang (2013).

schemes (e.g., Fund of Funds, venture capital and asset-backed securitization) became the new focus of industrial policy. As the Republic of Korea's private sector became more complex, previously used policy instruments lost their effectiveness and, in some cases, even led to amplifying economic distortions. In their place, financial tools that supported risk sharing, R&D, education, and SME development gained favor.

This dynamic shift in policy tools by the Republic of Korea was not solely the result of government decisions, but also reflected the private sector's evolving capacity to influence policy. Although the Republic of Korea achieved rapid growth by exporting labor-intensive low-end goods, this growth strategy reached its peak by the mid-1980s with the emergence of manufacturing capacity in lower-wage countries at the same time wages in the Republic of Korea were rising. As firms in the Republic of Korea realized they needed to upgrade to higher-end or value-added goods, they began to establish in-house R&D centers, at which point the tools of industrial policy began to include tax exemptions for R&D activities. The experience of the Republic of Korea reflects evolution in government activism from traditional industrial policy tools (e.g., tariffs, fiscal subsidies, financial repression, and currency undervaluation) in the early stages of development to financial-based instruments (e.g., cofinancing, credit guarantees, SME financing, and R&D subsidies) in later stages.

Risk-adjusted industrial policy

In modern industrial policy, one important tool is risk management. Considering the high-return and high-risk nature of industrial policy, governments engaging in industrial policy must manage their risk exposure. While there are potentially significant social returns in pursuing industrial policy, the fiscal cost of failures need to be absorbed by the government and, ultimately, the taxpayers. A continuation of policies with major underwriting costs that fail to deliver economic success will eventually strain public resources. Therefore, it is critical that industrial policy not only select the right sectors for promotion, but also effectively manage the risks involved in the selection process and its subsequent development.

For example, the US government manages risk in its various credit programs by closely monitoring its budget support for such programs. Through the Federal Credit Reform Act (FCRA) of 1990, the government improved the accountability with which it measures the cost of its federal credit programs. FCRA places the cost of credit programs on a budgetary basis equivalent to other federal spending; that is, if underperformance reaches a certain level, then the following year's budget is at risk of an automatic decrease. In effect, a stop-loss mechanism is put in place to ensure that ineffective and/or wasteful credit programs are not continually funded. This practice is virtually ex-ante risk management.

4. How can innovation, technology, and human capital development be fostered?

History provides many examples of an educated workforce serving as an asset for a country attempting to enlarge its export product set. Japan began expanding and diversifying its export mix in the late 1950s after attaining a relatively high level of education. Educational attainment in the Republic of Korea and Taipei,China rose rapidly between the 1960s and 1980s when their shares of the global market for many products increased dramatically. The PRC began making inroads into global product markets in the 1980s with already-high education levels for a developing country. The successes of Germany and Switzerland, whose exports are among the most diversified and sophisticated in the world, are often credited to the rigor and practicality of their basic education systems. Conversely, Pakistan and Bangladesh, which lag behind the Asian region in education, have a relatively non-diverse mix of exports.

Can we infer from this that a country that rapidly increases its education level is more likely to achieve a diverse export mix? Mehta and Felipe (2013) and ADB (2013) have studied the link between diversification and education. The following is a summary of their conclusions:

(i) Controlling for the quality of education (proxied by the scores in international tests of math and science), the quantity of education (number of years spent at school) does not appear to be a determinant of a country's capacity to diversify its exports. Together with quality of education, countries need to emphasize primary and secondary education. College education does not appear to be statistically important, so long as a country has a large number of workers who have received a high quality secondary education.

(ii) Learning how to produce a new product and exporting it successfully can be difficult if it requires capabilities that are different from those used by the products the country already exports successfully. This means that industrial development tends to proceed in a path-dependent fashion. Transitions to products that require similar capabilities to those a country already produces are more readily made. This means that in order to learn how to export successfully products that are very different from those it already produces, a country must usually pass through a range of intermediate products to incrementally acquire the required capabilities. Leapfrogging does not appear to be a realistic approach.

(iii) Education can, however, speed up this learning-by-doing process. Countries whose secondary education is of higher quality, have made more unpredictable transitions, i.e., have reduced path-dependency of industrial development.

This analysis has several implications. First, it is the quality of education that is important, not quantity. A better educated workforce is more capable than an uneducated one of rapid transitions from one product into another. Limited evidence was found that the quantity of education alone is important for learning how to produce sophisticated products. Education is not very helpful for acquiring a target product unless a country already has comparative advantage in industries that export products that are somewhat proximate to the target. Second, if faster transitions across products are driven by better educated workers' higher capacity for rapid learning, then public–private partnerships can play a very important role in skills development. The usual prescription from industry is that public education systems should deliver the specific skills that industries need. While this may indeed be helpful, the analysis suggests that it is probably equally important for employers to provide educated workers with the right learning opportunities, so that they may use their education to rapidly acquire skills that they can take up the industrial ladder. The implications for policymaking, then, are that governments need to consider:

- providing high quality basic education;
- supporting the industries that act as stepping stones to industrial development; and
- ensuring that these industries provide jobs that support continuing learning opportunities.

Unfortunately, innovation and human capital are referred to as the weakest links in industrial diversification in Kazakhstan. The acute shortage of highly skilled professionals, particularly professional managers, is one of Kazakhstan's biggest challenges. Because of this shortage, and other less attractive business and investment climate factors, it is difficult to attract foreign investors and companies in strategic economic areas. The structure of R&D in Kazakhstan still reflects the legacy of the

former planned economy in which a prominent role remains for government-sponsored sector research institutes even though this model is not conducive to commercial success. The private sector plays only a limited role in knowledge generation and market-driven demand for technology is low as evidenced by the low level of spending on R&D (only 0.23% of GDP in 2012). There are currently not many high-tech sectors in the economy due to the lack of a competitive environment, insignificant business incentives to introduce and absorb technologies, insufficient legal mechanisms and protection of intellectual property rights, and a poor culture of innovation management (Kosherbayeva 2013a and 2013b). Innovation is also constrained to a great degree by an underdeveloped financial sector. Overall, there is space for enhancing the knowledge-generating capacity of the economy through targeted policy interventions.

This section discusses how innovation and human capital development strategies, like most aspects of industrial policy, change depending on the stage of development. Several country cases are included with implications for innovation and human capital development policies in Kazakhstan.

Case 1: Republic of Korea

The government of the Republic of Korea understood early on the importance of education, innovation, and R&D investment to diversifying and upgrading its economy. In the 1960s, most of the workforce needed in export-oriented labor intensive industries came from under-educated groups, usually with only a middle school (or even elementary school) education. However, the government created a series of industrial high schools in agriculture, commerce, industry (engineering), maritime, and fisheries to provide a more skilled workforce for the Republic of Korea's nascent industries.

In the 1970s, the newly targeted heavy and chemical industries (HCI) demanded highly skilled engineers. The Government of the Republic of Korea supported universities in establishing engineering faculties, especially in mechanics, chemistry, and electronics. As a part of this process, private companies also contributed significantly as suppliers of education services for their own interests in securing needed workers (Box 5). During 1973–1979, 19 schools were selected as Specialized High Schools for Machinery Industry and received financial assistance from the government. And during 1976–1977, a total of 11 Exemplary Engineering High Schools, which provided students with 6 months of

Box 5: **The Rapid Development of Human Capital at the Pohang Steel Corporation**

The Pohang Steel Corporation (POSCO) provides a good example of how companies in the Republic of Korea tackled the problem of weak human capital in the early days of the country's industrialization. POSCO was established in 1968 despite many international organizations' refusal to provide assistance based on its assessment of the venture's feasibility. The construction of the Republic of Korea's first integrated steelworks began at a time when even experienced steelworkers did not have the skills required for an integrated steel plant. The knowledge they had accumulated from a small-scale, separated process was not applicable to a large-scale integrated one.

POSCO acquired the necessary skills and knowledge for its workforce primarily through overseas training involving field observation for two to four weeks and on-the-job training for two to six months. In 1968 and 1969, the first 39 trainees were dispatched to Japan. Between 1968 and 1983, a total of 1,861 workers were trained overseas, and they returned to train other workers. POSCO initially focused on building technological capabilities for plant operation, maintenance, and repair before giving priority to computerization and quality control. POSCO was successful in quickly building sufficient capabilities for plant operation and the skills of its people improved significantly over time. POSCO established its own high schools and universities to further develop its base of human capital.

Source: Lee (2013).

on-the-job training during their senior years, were established to provide skilled workers for overseas construction industries. In 1978–1979, an additional 12 Specialized Engineering High Schools were selected to meet the demand from HCI firms in areas such as electronics, chemistry, construction, steel, railroad, and military-related manufacturing.

In spite of its demonstrable successes, by the 1990s the Republic of Korea's industrial model of education was becoming less effective as the country gradually transformed into a knowledge-based economy. Exposed to global competition in manufacturing industries and with rising domestic wages, (private sector) companies in the Republic of Korea came to realize that innovation was key to their survival. As a result, they dramatically increased R&D expenditures beginning in the 1980s (Figure 12). Furthermore, the old education system started to show its limitations in supporting economic transformation toward a knowledge economy as it was based on teacher-centered, one-way learning with excessive focus on memorization, a lack of diversity in educational programs, and a preoccupation with exam preparation.

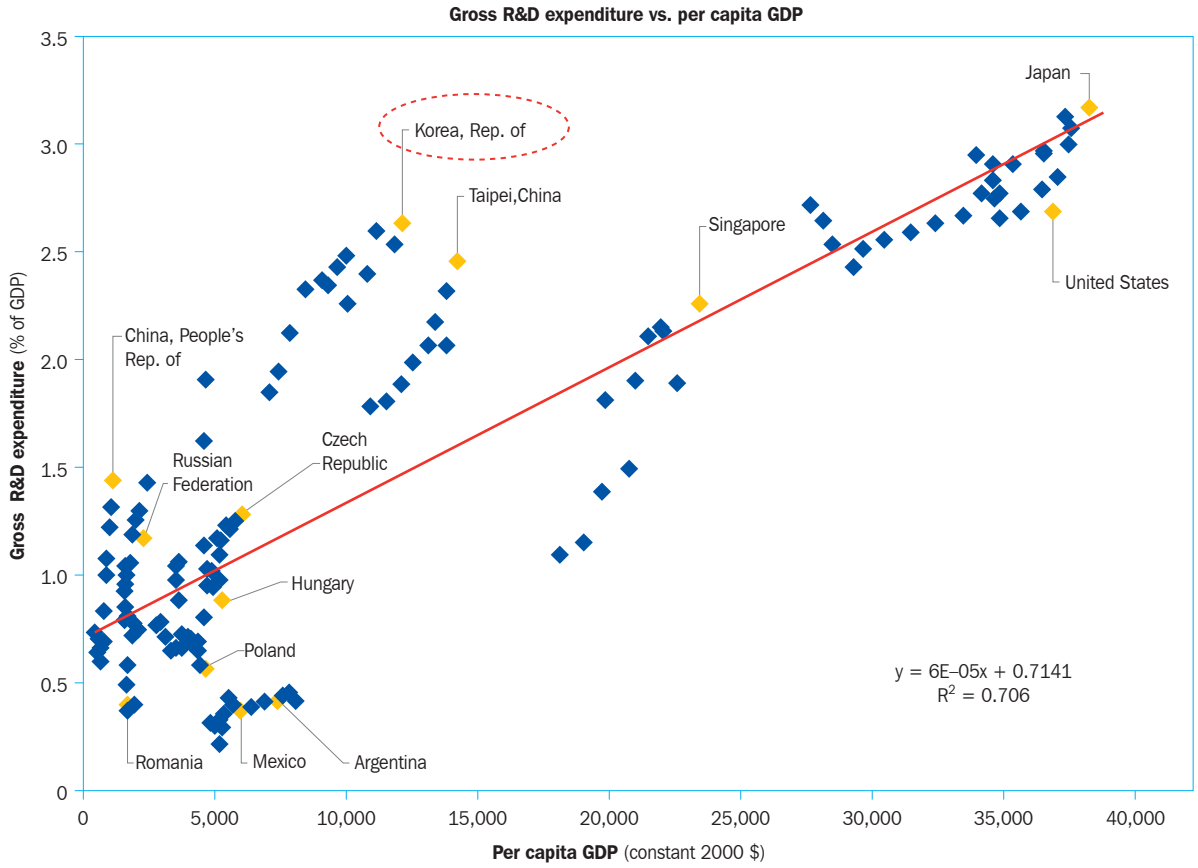
As shown in Figure 12, the Republic of Korea is an outlier in terms of R&D expenditure by per capita income level and the share of R&D expenditure by the private sector. However, it was public-led industrial policy that played a fundamental role in helping private sector R&D take-off in the early 1980s. The formation of public–private R&D consortia during the 1970s was an effective industrial policy tool to enhance private firms' low R&D capabilities. Public research institutions were mandated by the government to lead efforts to promote new industries and were encouraged to share their research outcomes with participating private firms with the goal of successful commercialization. The development of the Republic of Korea's telecommunications industry in the 1980s and 1990s is an example of successful cooperation between the public and private sectors.

In the 1970s and 1980s, the Republic of Korea had telephone service bottlenecks. Until the late 1970s, the country had neither its own telecommunications manufacturing equipment industry nor a relevant R&D program. The country imported most equipment and related technologies from foreign suppliers at very high prices, with local technicians merely installing foreign switching systems. However, with rising demand, the government decided that it should build its own manufacturing capabilities and the R&D infrastructure necessary for creating state-of-the art digital phone switching systems. It subsequently provided financial support to a public-private research consortium.

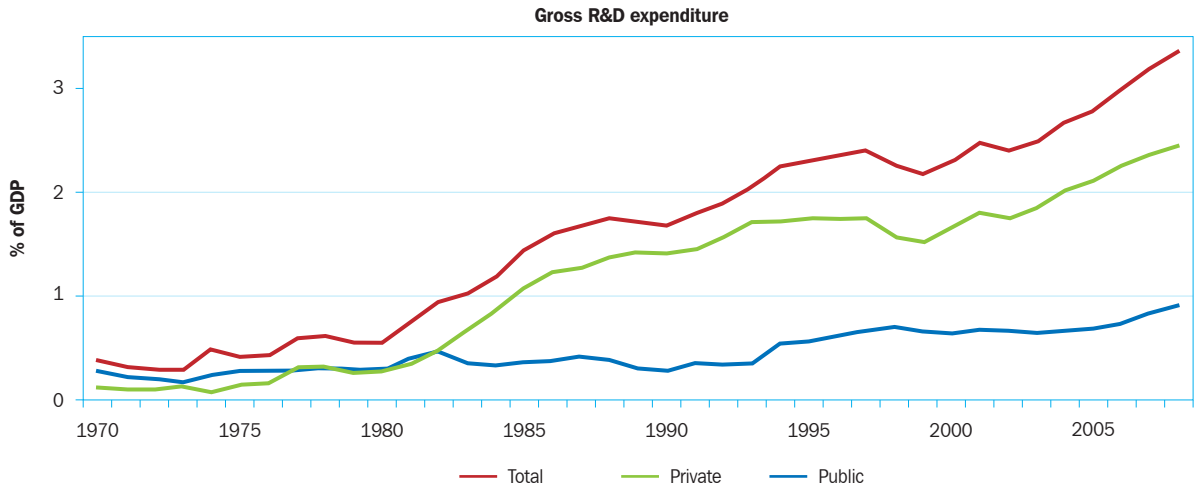
Between 1981 and 1983, the Electronics and Telecommunications Research Institute (ETRI) developed a proprietary digital switching system—the time-division exchange (TDX) series—in collaboration with a national network of switching system manufacturers and distributors. Prior experience producing analogue switches through licensing agreements with international firms such as ITT, AT&T, and LM Ericsson (Erifon) was key to this process. In order to purchase manufacturing technology and produce switches in the Republic of Korea, the state-owned Korean Telecom Co., Ltd (KTC)—which was eventually acquired by Samsung Semiconductor & Telecom Co., Ltd and then integrated with Samsung Electronics Co., Ltd—purchased M10CN technology from ITT via the Bell Telephone Manufacturing Company (BTM) in 1977. Because one company alone was not able to meet the market demand for switches, another joint venture, GoldStar Semiconductor Co., Ltd, was established by the Lucky GoldStar Group and AT&T. GoldStar Semiconductor Co., Ltd imported No.1A technology from AT&T beginning in November 1979 (Hwang 1993).

By 1979, 300,000 new telephone lines were being activated each year. The effort, however, left the Republic of Korea behind in meeting its explosive growth in demand for telephone services. In 1982, the government concluded that it had to nurture its own telecommunications

Figure 12: **Republic of Korea's Research and Development Expenditure Trends**



GDP = gross domestic product, R&D = research and development.
Source: Gill and Kharas (2007), p. 57.



GDP = gross domestic product, R&D = research and development.
Source: Sakong and Koh (2010), p. 23.

technology and decided to provide support to a public-private research consortium. The consortium led by ETRI purchased digital switching design and engineering technology from Ericsson, eventually developing its own prototype model, making the Republic of Korea only the 10th country in the world to develop an electronic switching system. ETRI succeeded in developing a more sophisticated switching system before transferring the technology to four private sector firms that would go on to contribute significantly to the development of the Republic of Korea's modern semiconductor industry: GoldStar Semiconductor Co., Ltd; Daewoo Telecom Co., Ltd; Dongyang Electronic & Telecom Co., Ltd; and Samsung Semiconductor and Telecom Co., Ltd (Kim, 2000). Even after the technology transfer to the private sector, ETRI continued to improve its technology in collaboration with a network of actors, including universities and TDX manufacturing firms, to produce more advanced versions. The experience of the Republic of Korea is a good example of how industrial policy can effectively promote new technological adaption together with the private sector.

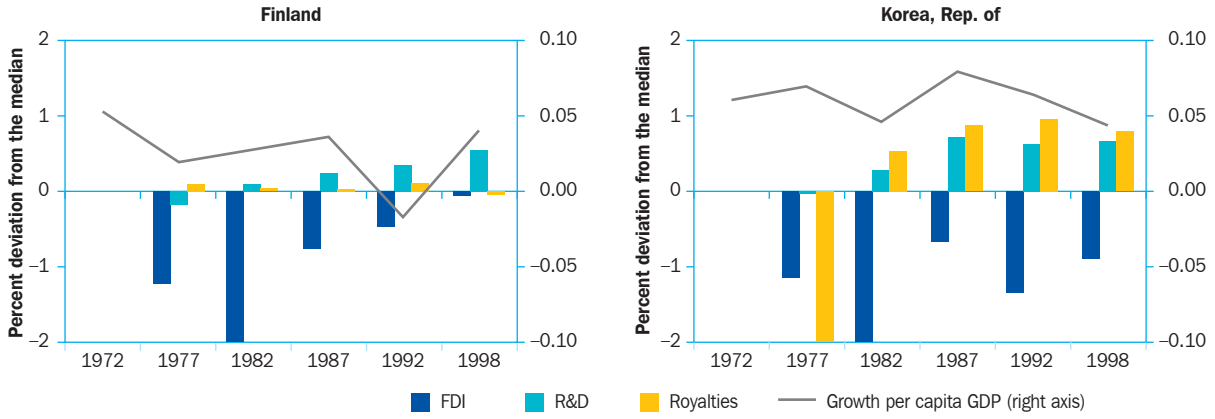
Case 2: Malaysia

Can promoting FDI be an effective tool for acquiring advanced technology in industrial policy? The Malaysian case shows that it may not be necessarily so. Malaysia has traditionally used FDI to acquire foreign technology. This has led to a degree of technology transfer as some Malaysian companies have linked up with global supply chains as suppliers and design houses. One benefit of such an approach is that it does not require the high levels of public debt financing that were part of the Republic of Korea's technology pursuit through licensing agreements. However, Malaysia's approach seems not to have produced many domestically-owned and -designed products with global reach, unlike the Republic of Korea. The use of R&D incentives for multinational corporations (MNCs) might increase the profitability of MNCs operating in Malaysia, but it does not automatically result in the transfer of technology to domestic firms. Malaysia's trade and investment liberalization policies may have been effective in attracting FDI and capital flows, and moving the country from low- to middle-income status. However, the widespread transfer of technology did not automatically accompany huge increases in trade and capital flows. MNCs often maintain strict control over technology at the same time that they benefit from Malaysia's favorable investment and labor climate.

Moreover, FDI inflows, openness, exports, and resource intensity may have no significant power explaining the probability of a country becoming a high-income economy. This perhaps suggests that these variables are not associated with achieving/not achieving rich-country status, beyond the explanatory power provided by industrialization. This is a somewhat surprising result. One possible interpretation of these results might be that openness and exports are important for the transition from low into middle-income; but their contribution declines significantly in avoiding the middle income trap. That is, countries need more than openess to reach high-income status. The same logic could apply to FDI inflows. These might be important for low-income countries. But FDI does not necessarily imply that effectively technology is transferred.

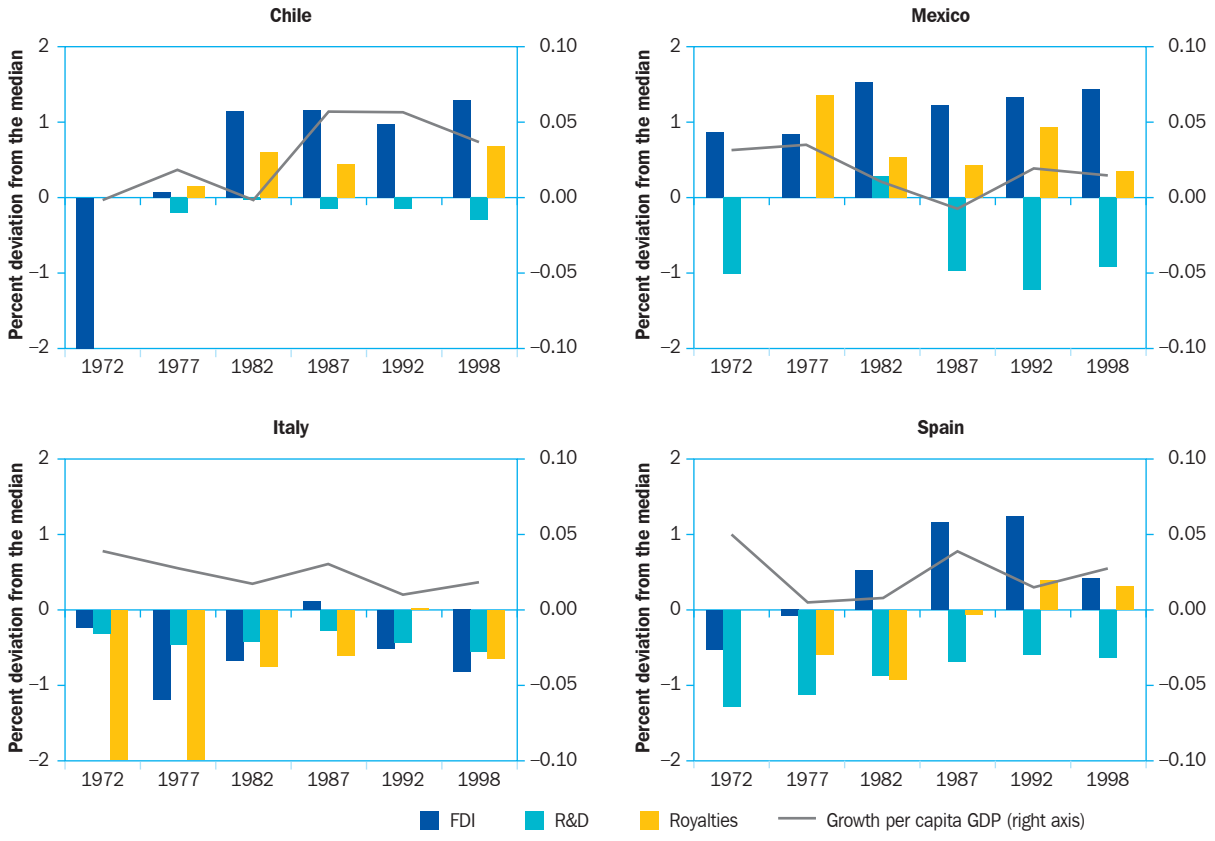
The PRC's "50–50" ownership model offers an interesting approach to addressing this conundrum. Local ownership is a prerequisite for FDI in the PRC, which facilitates the process of technology transfer. This has allowed the PRC to harness FDI to rapidly advance from a low technology base. Figures 13a and 13b compare the GDP per capita growth, R&D expenditures, FDI, and royalty payments between the so-called "Superstar" model of development (Finland and the Republic of Korea) and the "Latin" model (Chile, Italy, Mexico, and Spain). The Republic of Korea and Finland have relatively low levels of FDI and high levels of R&D and royalty payments (i.e., technology licensing), while the Latin model countries have relatively high levels of FDI, low levels of R&D, and moderate royalty payments. This comparison shows that

Figure 13a: **The "Superstar" Model: Low FDI, High R&D, High Royalty Payments**



FDI = foreign direct investment, GDP = gross domestic product, R&D = research and development.
Source: Maloney (2004).

Figure 13b: **The "Latin" Model: High FDI, Low R&D, Moderate Royalty Payments**



FDI = foreign direct investment, GDP = gross domestic product, R&D = research and development.
Source: Maloney (2004).

promoting FDI alone is not enough for building up domestic R&D capacities and there is room for the government to play an active role as a catalyst in promoting private sector R&D.

Case 3: United States

The US has historically invested substantial resources in human and organizational capacity building, including federal and state support for its world-class university system; funding for scientific research—particularly, but not exclusively, involving investments in early-stage research; and after the Second World War, in strategic partnerships with industry. It has developed political and legal institutions that have critically underpinned economic growth. Without these basic building blocks of human and organizational capacity, fostering industrial development, much less diversification, is difficult to impossible. In addition, the US system generally thrived when forward-looking labor policies and investments in and access to education and training systems were pursued. Though not sufficient by themselves, such initiatives essentially broadened the base of potential contributors to innovation and industrial development.

The US has built upon existing strengths in its innovation system, including supporting existing sites of science and technological expertise (e.g., universities, public laboratories, and standards agencies) and establishing new sites of expert knowledge by strategically drawing on expertise from multiple sectors and institutional contexts. Over the last several decades it has generally done so most effectively when not using centralized bureaucratic developmental strategies. Rather, it has relied on a decentralized set of agencies and programs that have simultaneously pursued upgrading and diversifying strategies for overcoming technical barriers within and across a range of technical and industrial fields.

Since the 1980s, the US has been particularly effective in correcting network failures in an increasingly fragmented and decentralized production environment. A range of programs and policies have helped dispersed network partners acquire a degree of certainty about the trustworthiness and competence of one another. In addition, linking entrepreneurs and technologists with support networks has often been important to US technological dynamism (See Case 2 in Section 5.1).

Program evaluation methods are diverse, but successful programs in the US have relied heavily on expert knowledge—often, though not exclusively, through peer review systems—in evaluating technology ideas, programs, and policy effects. The US has developed an array of programs that are potentially valuable models in developing contexts. Clearly, it is difficult to create advanced scientific laboratories staffed by relevant experts in short order. But smaller, targeted programs—such as Small Business Innovation Research (SBIR), among others—provide reasonable models that a range of other countries have emulated in recent years. SBIR, which is coordinated by the Small Business Administration (SBA), requires that federal agencies with external research budgets exceeding $100 million reserve at least 2.5% of their budget for small businesses (less than 500 employees). In 2010, SBIR set aside more than $1 billion in research funding to US small businesses.

Lessons for Kazakhstan

Due to different development stages and internal conditions, the cases reviewed in this section cannot be automatically replicated by Kazakhstan. However, these cases have several important implications for its future human capital development and innovation policies.

First, these cases highlight the importance of human capital development and innovation as an essential part of industrial policy. Without a supply of high-skilled labor, upgrading an economy's industrial structure is not possible. As Kazakhstan is almost a high-income economy, it cannot rely on cheap labor and/or low technology industries to compete in international markets, rather innovation and

self-sustaining R&D capacities are key to its industrial diversification. More than anything else, Kazakhstan has to improve the quality of its basic and secondary education. In terms of school enrollment, Kazakhstan is comparable with advanced economies. However, the quality of its higher education and training—such as its management schools as well as math and science education—lags far behind countries with a similar income level.

Second, Kazakhstan's policymakers need to understand that while developing high-quality tertiary education is important, the key to diversification into industries that are 'close by' is basic (primary and secondary) education and cognitive skills. The private sector has to actively participate as a supplier of education and training. Australia's and the Republic of Korea's public support for private sector job training and apprenticeships can be good benchmarks. Moreover, Kazakhstan has to increase its R&D expenditure, both public and private. The public sector alone is not capable of leading R&D efforts as it does not have active incentives to commercialize R&D outcomes. Initiating R&D consortiums with the private sector in targeted industries can be an effective strategy for jumpstarting R&D expenditure as was the case in developing the telecommunications switching system in the Republic of Korea.

Third, Kazakhstan relies heavily on FDI, in the energy sector in particular, to acquire advanced business administration skills and foreign technology. FDI is an important element to gain industrial diversification. However, if not managed properly, preferential treatments and R&D incentives for MNCs can increase the profitability of their operations without resulting in the transfer of technology to domestic firms. As securing foreign funds is no longer a bottleneck for Kazakhstan's future development, industrial policy should focus more on the acquisition of advanced technology through strategic FDI. Sometimes, buying technology and paying royalties can be a most effective approach to developing the domestic technology base.

Fourth, as Kazakhstan has a large public sector, which includes SOEs, it is important to have qualified public sector workers. Sending public sector employees oversees for higher education and training is very important for providing more effective public services in transition economies as the private sector matures. In doing so, the public sector can play an important role by providing a high-quality labor supply to the private sector. Considering its relatively small population, immigration policies that bring in high-quality workers can be an important strategy. For example, Kazakhstan can try to be the regional higher education hub by subsidizing young and talented students from neighboring central Asian countries to study in Kazakhstan.

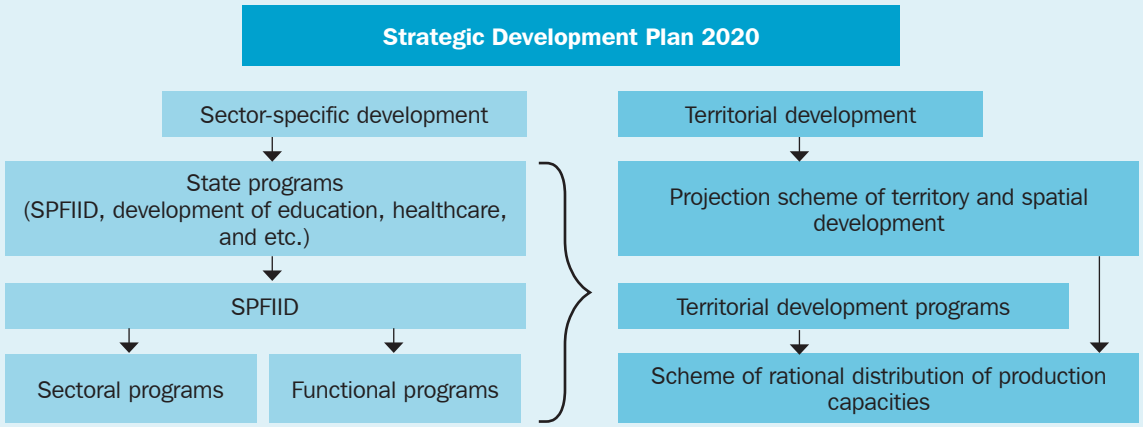
5. What are the most effective monitoring and evaluation mechanisms?

The outputs and outcomes of industrial policy are hard to identify and evaluate considering the long-run nature of structural changes and the potentially wide spillover effects. Kazakhstan's institutional system for promoting industrial policy is quite complex, as shown in Box 6.

Therefore, an effective and strong monitoring and evaluation (M&E) mechanism is essential to make industrial policies successful and minimize the fiscal risks involved. There are several general rules for effective M&E including establishing clear objectives, developing simple check-up mechanisms, and ensuring accountable coordination among relevant agents. Also, the government must ensure that new programs will not be started if programs with similar policy objectives are left unfinished and unevaluated. Effective M&E of industrial policy also varies with a country's development stage. When industrial policy covers a few specific industries in a less developed economy, monitoring and evaluating outcomes is technically feasible, though not easy. However, as economies mature and industrial policies become more complex, it will be virtually impossible to trace all spillover

Box 6: **Coordination Systems for Policy Implementation**

In Kazakhstan, several governmental agencies have related responsibilities that are not always clearly delineated. For example, the Ministry of Economy and Budget Planning is responsible for designing overall industrial policy, while the Ministry of Industry and New Technologies is in charge of implementing strategic orientations with a sector focus. Furthermore, implementation responsibilities are not significantly differentiated among various levels of government, often resulting in similar responsibilities being assigned to central executive bodies and local government offices. All policy documents related to state planning are implemented on a top-down basis; that is, all objectives of lower-level policy documents must be in harmony with the goals and objectives of upper-level policy documents such as the Kazakhstan 2050 Strategy and Strategic Development Plan of Kazakhstan to 2020.



SPFIID = State Program of Forced Industrial-Innovative Development of Kazakhstan for 2010–2014.
Sources: Government of Kazakhstan (2010 and 2012); Kosherbayeva (2013b).

effects across industries and come up with a comprehensive macroeconomic evaluation of various industrial policy packages. Therefore, in advanced economies, industrial policies are usually reviewed and monitored on a program-by-program basis, rather than evaluating an overall industrial policy.

This section includes a description of evaluation indicators (Box 7) and a review of the basic elements of an M&E system based on the experiences of the EU, the Republic of Korea, Malaysia, and the US.

Case 1: Republic of Korea

During the rapid industrialization that took place in the 1960s and 1970s, the Republic of Korea developed an M&E system that was simple, but powerful. In the 1960s, the President convened and chaired monthly Export Promotion Meetings. These meetings were attended by ministers, the central bank governor, and experts from the private sector (e.g., businessmen and academics). The major objective of the meetings was to monitor the actual progress of exports against annual targets set by the Ministry of Commerce and Industry. Businessmen were given the opportunity to raise complaints and suggestions. Based on their inputs, the President would set new interim goals and put pressure on the ministers to address grievances and resolve problems within an agreed-upon timeframe.

In the 1970s, the Republic of Korea established an HCI Promotion Committee through the Office of the Prime Minister. It was chaired by the President in practice, even though the Prime Minister was officially named as Chairman, and attended by ministers, business leaders,

Box 7: **Designing Evaluation Indicators and Mechanisms**

Different from monitoring, the aim of evaluation is to establish an objective source of information to determine policy effectiveness and outcomes. At a general level, this requires establishing (i) a baseline data set of participant firms and their characteristics and performance that is regularly updated, and (ii) a control group of non-participant firms. Evaluation indicators will vary with the policy objectives at different levels of policy intervention and with the institutional, historical, and technological context of specific sectors or activities.

Macro-level indicators. These are often the easiest to design since they usually rely on highly aggregate quantitative (statistical) data. For example, Organisation for Economic Co-operation and Development indicators—export unit values of manufacturers, unit labor costs in manufacturing, and consumer price indices—could relatively easily be adapted to the specificities of an individual economy. The downside of such macro-level indicators is that they are useful only if longitudinal datasets are available and/or can be constructed. In addition, while they provide basic ex post information to policymakers about the overall failure or success of an industrial policy strategy, they tend not to provide information about the main causes of the policy outcome.

Meso-level indicators. These are more difficult to design. In the case of a specific policy objective of creating and/or enhancing the organizational capabilities of a broad entrepreneurial base in targeted manufacturing sectors, both quantitative (ex post) indicators as well as qualitative (ongoing) indicators are relevant. As with macro-level indicators, aggregate (sector-level) quantitative indicators serve to provide ex post information about the economic performance of the targeted sectors in the context of the economy as a whole. Examples of such indicators for this policy objective include growth of gross value-added (GVA) in targeted manufacturing industries, competitiveness indicators (e.g., export performance), employment growth, and investment rates in targeted industries.

Some of these quantitative indicators require relatively sophisticated data (e.g., input–output tables, high disaggregation) that may be difficult to obtain. Qualitative evaluation indicators of meso-level performance provide information about ongoing organizational changes at the sector or industry level, and about technology diffusion and adoption. These can be useful to approximate so-called spillover effects (externalities) that are difficult to encapsulate in numerical measures yet represent a significant aspect of meso-level industrial policy success or failure. Examples of such qualitative evaluation indicators include entry and exit from network activities, contractual arrangements with foreign direct investors and technology providers, and inter-firm alliances (e.g., knowledge-sharing platforms).

Micro-level indicators. As with meso-level indicators, to be useful these will combine quantitative and qualitative features. Where data access and availability allows, quantitative indicators of organizational and technological learning efforts might include (i) firm-level profitability measures, (ii) sales and employment growth, and (iii) competitiveness measures such as product price relative to the market leader (and changes over time). Qualitative indicators might include (i) product quality relative to the market leader (and changes over time); (ii) product differentiation capabilities (number of new product and process developments over a given period of time); and (iii) broader innovation capabilities such as research and development investment, patent applications, and changes to organizational and managerial routines.

As mentioned above, the lower the level of policy intervention, the more context-specific that policy instruments and financing mechanisms will have to be. Evaluation indicators of such micro-level policy interventions and instruments will therefore also have to take account of context-specific factors.

Source: Authors.

and eminent engineers and scientists. Its major functions were to formulate the plans and support programs necessary to develop the HCI sector and evaluate their progress and implementation. The committee also reviewed the details of individual companies' investment plans.

By the 1980s, industrial policy and industrial structure in the Republic of Korea had become too complex to be managed solely through a top-down process. To adapt to changing circumstances, M&E was decentralized to the ministry and agent level. With an expansion in the number of programs also came a range of new indicators to be monitored by the relevant ministries. Sophisticated performance-based evaluation systems were designed to measure actual outcomes generated by policy initiatives, rather than outputs, and evaluation orientation gradually shifted from the short-term to the medium-term. Greater emphasis was placed on risk management, while transparency and accountability were enforced by audit departments and Parliamentary reviews.

Today, the Republic of Korea's industrial policies have advanced even further in sophistication and include a range of financial instruments in support of SMEs and R&D. Inevitably, M&E mechanisms used to assess these financial policies became more sophisticated as explained in Box 8.

Case 2: Malaysia

Tham (2013) has argued that the M&E process for industrial policy was not as effectively utilized in Malaysia as in the Republic of Korea. For example, the United Nations Industrial Development Organization (UNIDO) assisted the government in reviewing industrial development

Box 8: **Monitoring and Evaluation of Government Support Programs for SME Innovation and R&D**

Credit guarantee schemes have become the dominant financing mechanism for small and medium-sized enterprise (SME) support for innovation in the Republic of Korea. The Korea Credit Guarantee Fund (KODIT) is a public financial institution that provides comprehensive support for SMEs, including 11 types of general credit guarantees. According to analysis by the Korea Institute of Public Finance, in 2005, the overall ratio of production inducement to credit guarantee provisions was 4.4%; that is, for every W100 guarantee provision, an additional W4.4 of production was induced. The evaluation of KODIT's credit guarantee mechanisms enabled policymakers to focus on those industrial sectors with the largest production inducement effects.

Since the advent of efforts promoting the knowledge economy in the 1990s, there has been an increase in national investment in research and development (R&D) and, subsequently, greater demand for accountability in making such investments. The Ministry of Science and Technology (MOST) introduced a certification system to evaluate the ability of government research institutes (GRIs), which account for about 40% of government-supported R&D funding, and universities to manage R&D investments made by the government. As a result of this performance-based evaluation system, a number of the 22 GRIs under review were merged in 1991 to avoid duplication of R&D activities. In 1999–2005, MOST established four research councils to monitor the activities of affiliated institutions. However, MOST was criticized for not being an effective evaluator and placing too much emphasis on short-term budget issues, rather than potential long term research.

In 2006, the government shifted gears and adopted a performance-based evaluation system with the National Science and Technology Commission (NSTC) in the lead. Changes included the development of a government-wide investment portfolio (medium- and long-term) for the efficient use of limited R&D resources and feasibility studies for large-scale R&D programs. The evaluation results determined annual budget re-allocations and programs with an unsatisfactory ranking faced cuts of up to 10%.

Source: Chang (2013).

under the First Malaysia Plan (1966–1970) and the policy assessments were used to formulate the Second Malaysia Plan (1971–1975). The second plan was also reviewed with UNIDO assistance, but except for those relating to broad macroeconomic targets, the results of the review were not used as inputs in drafting the Third Malaysia Plan (1976–1980). Hence, the third plan cannot be viewed as a continuation of industrial planning in the same way as the first and second plans. Although subsequent 5-year plans were subject to review, there are no available public documents.

Priority attention has since shifted to the Economic Transformation Plan (ETP) for 2010–2020. The ETP provides for periodic updates on new projects and investments in twelve targeted areas, as well as a publicly available annual report.[18] Overall, greater transparency exists in the review process for sector performance under the ETP than under the 5-year industrial plans. Finally, the Ministry of International Trade and Industry (MITI) has institutionalized an annual policy dialogue with the private sector that focuses on operational issues, though strategic issues are also discussed occasionally. Unfortunately, MITI's follow-up on the results of the consultative mechanism has been uneven and the risk assessment process is lacking.

Case 3: European Union

The sophisticated industrial policies of the EU are too broad to be monitored or evaluated in a systematic way. Instead, individual policy initiatives are regularly monitored and evaluated on a program basis by the European Commission (EC), which seeks to ensure regulatory quality throughout the policy cycle, from design to implementation, enforcement, evaluation (mid-term, end-of-term, annual), and revision. Evaluations require a range of different approaches to assess a policy's impact, with a focus on four trends: (i) productivity and cost developments relative to international competitors; (ii) creation of jobs in industrial and related sectors; (iii) growth in manufacturing output, with particular reference to developments in eco-industries; and (iv) the contribution of medium- and high-technology manufacturing sectors in terms of value-added and employment.

Impact evaluations (IEs) of policies, i.e., ex ante evaluations of the potential outcomes of a given industry policy, are as important as ex post evaluations. IEs apply to policy proposals that are deemed to have a significant impact on industry development, including, for example, policy proposals for new internal market legislation and financial markets regulations. In such cases, impact assessments (IAs) are intended for competitiveness-proofing. IAs assess investment, cost, price, and innovative implications for industry and individual sectors, as well as consumer satisfaction and the potential overlap between a policy proposal and other existing or planned legislation and regulations. IEs involve: (i) identification of problems and objectives; (ii) definition of policy options; (iii) analysis of impacts; (iv) comparison of policy options; and (v) outline of M&E options. An important part of IAs is consulting stakeholders and external experts since the involvement of the private sector yields a better understanding of problem areas and the feasibility of a policy proposal.

According to a study by Technopolis in 2005, evaluations have had an impact on policy design and intervention, and on re-allocations of resources within a given policy scheme.[19] Nevertheless, this study also revealed that the resources allocation is influenced by political motives rather than efficiency motives. An analysis of the evaluation practices regarding government aid to SMEs revealed wide variation in the degree to which Members States evaluate their assistance: one-sixth of Member States evaluate all government aid to SMEs, one-sixth do not evaluate government aid to SMEs, and the remaining two-thirds evaluate

[18] See Economic Transformation Programme (2013).

[19] See Technopolis France and European Policy Evaluation Consortium (2005).

some SME government assistance programs. Furthermore, the study found that the scope, focus, and methods of evaluation implemented differ substantially across the EU. For example, industrial policy evaluation in the Netherlands focuses on assessing the extent to which policy adequately responds to its objective. In Slovakia, government aid is evaluated using input–output analysis that compares the characteristics of aid recipients with non-aid recipients.

A more recent review of innovation activity evaluation practices for 2007–2012, also conducted by Technopolis with support from the EC, concluded that some member states focus more on qualitative methods of evaluation and other countries focus more on quantitative methods.[20] Furthermore, the policy impact on the wider community is less frequently analyzed than the impact on project participants.

Case 4: United States

In the US the evaluation of federal programs has been given significant attention. This focus was sharpened in the 1990s with the Clinton Administration's enactment of a number of policies as a part of its New Public Management approach to governance.[21] The key piece of legislation during this period was the Government Performance and Results Act of 1993 (GPRA).[22] Under the law, federal government agencies were required to develop 5-year plans and formulate annual performance indicators.

In 2002, the George W. Bush Administration implemented its Program Assessment Rating Tool to streamline what it regarded as unnecessarily diverse and uneven methods for setting program targets and evaluating program efficacy.[23] Under the Obama Administration, efforts have been made to further improve performance indicators through the appointment of a Chief Performance Officer, who works with the Office of Management and Budget (OMB) to implement a number of reforms, including the Accountable Government Initiative, which is a series of measures to evaluate programs and reduce wasteful spending.[24]

Federal programs typically rely heavily on expert evaluations, both at the level of project selection and development, and in the evaluation of outcomes. More broadly, there are multiple layers of M&E tools, and different constituencies within the government that have the ability to determine funding allocations and programmatic priorities. Although there are centralized aspects to budgetary allocations and evaluation processes, much of the system remains decentralized.

OMB is one of the key agencies involved in M&E activities. It serves the executive branch in preparing budget proposals, assessing legislative proposals and their implementation, and monitoring and coordinating programs. The Government Accountability Office (GAO) is known as the "investigative arm of Congress" and is charged with auditing programs and assessing the use of taxpayer funds.[25] Congressional committees and subcommittees are charged with various M&E functions and can call upon advisory bodies to conduct research into specific questions. In addition, legislation often includes mandatory external reviews of programs. Individual agencies employ performance M&E, metrics, and auditing and investigation tools. In sum, programmatic efforts are subject to a range and multiple layers of evaluator scrutiny; each layer of oversight (from internal agency evaluators to congressional and executive branch actors) has varying degrees of inputs and potential sanctioning power in shaping future programs and budgetary allocations.

Recent efforts have been made to bring a greater degree of scientific standards to program planning and evaluation, particularly in developing R&D policies. A key agency in this respect is the National Science Foundation (NSF)

20 Ibid.
21 For an overview and discussion, see Committee on Science, Engineering, and Public Policy et al. (1999).
22 See Government of the United States of America (1993).
23 For an overview and discussion, see Brass (2004).
24 See Government of the United States of America (2010).
25 For the GAO's most recent statement on designing program evaluations, see the United States GAO (2012).

with its Science and Science Innovation Policy (SciSIP), which has funded a series of studies investigating programmatic M&E metrics, standards, and approaches.

Overall, the evaluation programs of the US government are strikingly decentralized, due both to the large and diverse sets of programmatic elements, and the structure of the federal government. This should not be taken to suggest that the government does not rigorously evaluate its programs. Agencies generally do not control their own overall budgetary allocations; hence, they have incentives to maintain high-performance programs. At the highest levels of government, executive and congressional decision-makers generally are not deeply involved in micro-managing programs, but they do have oversight authority and are typically willing to use it in the event of demonstrable program failures or shortcomings. In worst-case scenarios, these multiple layers of oversight can lead to over-evaluation at the expense of program implementation efforts, partisan political pressure, or even program closures. Generally, the diffuse system allows programs a degree of flexibility in their design and implementation, while providing incentives to design appropriate M&E systems with rigorous standards that can withstand the scrutiny of debates over budgetary allocations and programmatic priorities.

B. Policy Priorities for Industrial Diversification in Kazakhstan

- **Kazakhstan's government can play an important role as facilitator of Kazakhstan's economic diversification process by properly addressing information and coordination externalities and by implementing a modern indirect industrial policy program.**

- **Kazakhstan's industrial policy needs to be coordinated, simplified, streamlined and strictly monitored**.

  - A high-level committee for centralized coordination and policy deliberation needs to be institutionalized. This independent body must demonstrate political leadership in guiding the policy implementation process. A good example is the Republic of Korea's monthly meetings of export-promoting ministers initiated in the 1960s and chaired by the President. An industrial policy committee in Kazakhstan would check progress against targets, coordinating between government and business and academic institutions to resolve implementation problems quickly.

  - Clear benchmarks for program successes and failures need to be established. However, for Kazakhstan which is almost a high-income economy, it will be difficult to evaluate the economy's performance vis-à-vis an overall industrial policy package. Assessing accomplishments or shortcomings on a project-by-project basis is more feasible. Mandating agencies to develop multi-year plans and annual performance indicators, along the lines of the US Government Performance and Results Act of 1993, is necessary. For transparency and accountability, an external monitoring mechanism involving parliament, academics, and private sector representatives should also be set up.

- **Indirect industrial policy must be mainstreamed**.

Given Kazakhstan's current income level and industrial structure, the effectiveness of traditional industrial policies has reached its limit.

  - The government ought to benchmark advanced countries' indirect industrial policy through financial markets. Credit guarantee programs need to be strengthened and financial expertise needs to be upgraded.

- Industrial policy projects, with the exception of those involving purely public goods, should explicitly require financial participation of the private sector, whether domestic or external. This need not be done at the project level, but should be set as an aggregate target, e.g., at least 30% of total loans or guarantees must be jointly provided by the private sector. As the Republic of Korea has used export performance as a litmus test to identify potential winners, Kazakhstan should use the willingness of the private sector to provide co-financing as an industrial policy quality control tool.

- The government could use Samruk–Kazyna funds to promote indirect industrial policy. Instead of directly undertaking infrastructure projects, Samruk–Kazyna funds could be used by the government for onlending to private financial institutions.

- **Risk management tools need to be developed**.

  - Industrial policy can sometimes fail, entailing huge fiscal costs. Ex ante tools must be put in place, such that when a program progresses unsatisfactorily, the budget of the implementing agency or the amount set aside for onlending to financial institutions will be automatically reduced. Ex post restructuring mechanisms need to be established to facilitate the resolution process. For example, a financial restructuring law could be enacted to allow securitization of non-performing loans of affected financial institutions. Alternatively, a bankruptcy law that specifies how troubled banks' assets would be disposed could be implemented.

- **Innovation must be promoted and human capital upgraded**.

  - Innovation and human capital are two of the weakest links in Kazakhstan's industrial policies. Given students' relatively low test scores, primary and secondary education needs to be improved. Simply promoting tertiary education will not be enough. On-the-job training should be encouraged and links between industries and universities strengthened. Advanced education and training of high-level public officers who manage industrial policy could have large benefits.

  - R&D should likewise be promoted. The government could lead a consortium of firms to develop new technologies, which would eventually be transferred to private firms. To sustain dynamic R&D processes, incentives must be provided and competition encouraged.

  - Links among SMEs and between SMEs and larger companies—both public and private—must also be encouraged, particularly since many SMEs can be important innovation incubators. The government must act as a catalyst to establish SME networks that serve as the foundation of an innovative value chain. The US networking solutions, which encourage connectivity between innovation stakeholders and the national innovation system, can provide a good model for Kazakhstan.

  - To promote competition and encourage R&D, inefficient state-owned enterprises (SOEs) ought to be privatized. Currently, SOEs are concentrated in resource-related industries and spend very little on innovation. This makes it difficult to upgrade Kazakhstan's comparative advantage in resource-related industries.

- **Industrial policy is not just for manufacturing**.

Industrial policy is relevant for promoting economic sectors other than manufacturing, including agriculture and services. Upgrading these sectors can create the jobs necessary to keep Kazakhstan's growing labor force employed.

- Agricultural upgrading could come in the form of links with global value chains that work directly with farmers.
- Services—such as finance, insurance, real estate, education, and business—offer opportunities for diversifying and for implementing indirect industrial policy.

- **Macro and financial stability is a prerequisite for successful industrial policy**.

Macroeconomic policy has a significant effect on buttressing the economy's resilience to external shocks, especially financial shocks. Maintaining sufficient foreign reserves and strengthening macroeconomic policies will help Kazakhstan maintain a stable exchange rate and avoid the so-called Dutch disease.

- **More investment in infrastructure is needed to support industrial policy.**

Kazakhstan must upgrade its transportation, logistics, and energy systems to facilitate industrial policy implementation. Modern infrastructure will not only help integrate domestic markets, but also provide a link to unexploited external markets. Indeed, an ADB study estimated that improving Kazakhstan's transport infrastructure could reduce road travel time between provincial capitals by 35%, rail line-haul time by 71%, and intermodal rail and road container shipment cost by 24% (ADB 2012).

Appendix

Table A1: **Countries to which Kazakhstan Exported at least $10 million in 2010**

Country	Exports ($ million)	Country	Exports ($ million)
People's Republic of China	10,240.08	Estonia	149.97
Germany	4,333.18	Iran	129.85
France	3,746.84	United Kingdom	121.94
Italy	2,820.03	India	110.36
Russian Federation	2,355.04	Denmark	109.98
Turkey	2,302.87	Saudi Arabia	103.5
Canada	1,969.18	Georgia	91.63
United States	1,764.03	Hungary	82.94
Romania	1,610.16	Sweden	78.81
Greece	1,177.49	Egypt	74.07
Netherlands, The	1,038.84	Lithuania	65.97
Austria	1,029.21	Latvia	49.16
Switzerland	973.04	Brazil	34.33
Portugal	747.83	Pakistan	33.14
Ukraine	700.73	Thailand	28.65
Japan	564.56	Indonesia	25.62
Poland	395.59	Slovakia	24.24
Spain	394.97	Slovenia	22.28
Belarus	380.28	Belgium–Luxembourg	21.4
Kyrgyz Republic	343.84	Lebanon	18.93
Czech Republic	339.35	Tunisia	16.29
Korea, Republic of	321.58	Argentina	16.28
Azerbaijan	265.79	Moldova	14.96
Finland	224.33	Australia	12.25
Afghanistan	177.92	Armenia	12.03

Source: Hausman et al. (2011).

Table A2: **Distribution of the 127 Products Exported with Comparative Advantage by Kazakhstan in 2010 by Complexity and Connectedness to Other Products**

HS4 Product Code	Product Name
Products in the Bottom Tercile of Connectedness and Bottom Tercile of Complexity	
Animal and Animal Products	
303	Frozen fish, excluding fillets
304	Fish fillet or meat
305	Fish flours, meals and pellets for human consumption
507	Ivory, tortoise-shell, whalebone, and whalebone hair
Vegetable Products	
704	Cabbages, cauliflower, kohlrabi, kale, broccoli
707	Cucumbers
807	Melons
1101	Wheat or meslin flour
1204	Linseed
1206	Sunflower seeds
1301	Lac
1404	Vegetable products not elsewhere specified
1512	Sunflower-seed or safflower oil, crude
1517	Margarine, not liquid
Foodstuffs	
1704	Confectionery sugar
2202	Waters flavored or sweetened
2207	Ethyl alcohol
2302	Bran, sharps (middlings), and other residues
2306	Cotton seed oilcake
2401	Tobacco, raw
2402	Cigars
Mineral Products	
2503	Sulphur
2506	Quartz
2510	Natural calcium phosphates
2511	Natural barium sulphate
2514	Slate
2524	Asbestos
2529	Feldspar
2601	Iron ores and concentrates
2602	Manganese of 47 percent or more by weight
2603	Gold content
2607	Lead ores
2608	Zinc ores
2610	Chromium ore
2611	Tungsten ores
2612	Uranium or thorium ores
2617	Other ores and concentrates
2618	Granulated slag
2701	Coal; briquettes
2702	Lignite
2704	Coke of coal, lignite or peat, retort carbon
2708	Pitch and pitch coke
2709	Petroleum oils, crude
2710	Petroleum oils, refined
2824	Lead oxides
2844	Radioactive chemical elements and radioactive isotopes
Raw Hides, Skins, Leather, and Furs	
4102	Raw skins of sheep or lambs
4103	Other raw hides and skins
4104	Tanned hides and skins of bovine or equine animals
4105	Tanned skins of sheep or lambs
Textiles	
5101	Wool
5102	Animal hair
5201	Cotton raw
5202	Cotton waste
Stone and Glass	
7108	Gold
Metals	
7204	Ferrous waste and scrap
7206	Iron and nonalloy steel
7401	Copper mattes; cement copper
7402	Unrefined copper
7403	Refined copper and copper alloys
7404	Copper waste and scrap
7602	Waste or scrap, aluminum
Products in the Bottom Tercile of Connectedness and Middle Tercile of Complexity	
Vegetable Products	
1003	Barley
1205	Rape or colza seeds
Mineral Products	
2706	Tar distilled from coal
Chemical and Chemical Products	
2809	Diphosphorus pentaoxide; phosphoric acid
2846	Compounds, inorganic or organic, of rare-earth metals
Metals	
7405	Master alloys of copper
8107	Cadmium
Products in the Bottom Tercile of Connectedness and Top Tercile of Complexity	
Vegetable Products	
1109	Wheat gluten
Metals	
8103	Tantalum
8106	Bismuth
Products in the Middle Tercile of Connectedness and Bottom Tercile of Complexity	
Animal and Animal Products	
504	Guts of animals except fish
510	Ambergris, civet, musk for pharmaceutical use
511	Animal products not elsewhere specified
Vegetable Products	
703	Onions and shallots
1104	Worked cereal groats
1902	Pasta

continued on next page

Table A2 *continuation*

HS4 Product Code	Product Name
2711	Petroleum gases
Chemical Products	
2818	Artificial corundum
2713	Petroleum coke
Chemical Products	
2804	Hydrogen, rare gases, and other nonmetals
2833	Sulfates; alums; peroxosulfates (persulfates)
3102	Mineral or chemical fertilizers, nitrogenous
3105	Mineral or chemical fertilizers, mixed
Raw Hides, Skins, Leather and Furs	
4101	Raw hides and skins of bovine or equine animals
Textiles	
5208	Woven fabrics of cotton
5802	Terry toweling & similar fabrics
Stone and Glass	
7106	Silver
7112	Scrap of precious metal
Metals	
7202	Ferroalloys
7210	Flat rolled iron or non-alloy steel, coated with tin
7408	Copper wire
7601	Unwrought aluminum
7901	Unwrought zinc
Products in the Middle Tercile of Connectedness and Middle Tercile of Complexity	
Vegetable Products	
1001	Wheat and meslin
Mineral Products	
2621	Other slag and ash, including seaweed ash (kelp)
Chemical Products	
2817	Zinc oxide and peroxide
2841	Salts of oxometallic or peroxometallic acids
3202	Synthetic organic tanning substances
Stone and Glass	
6809	Plaster articles
Metals	
7208	Hot rolled iron or non-alloy steel, coil
7409	Copper plates, sheets and strip
8112	Other metals

HS4 Product Code	Product Name
Mineral Products	
2508	Clays
2521	Limestone
Products in the Middle Tercile of Connectedness and Top Tercile of Complexity	
Chemical Products	
2819	Chromium oxides and hydroxides
2849	Carbides
Stone and Glass	
6814	Mica articles
Metals	
8104	Magnesium
8108	Titanium
Products in the Top Tercile of Connectedness and Middle Tercile of Complexity	
Chemical Products	
2835	Phosphinates and phosphonates
3214	Glaziers' putty
Plastic and Rubbers	
4010	Conveyor or transmission belts of vulcanized rubber
Metals	
7209	Cold rolled iron or non-alloy steel, coil
7304	Tubes, pipes and hollow profiles, seamless of iron or steel
7324	Sanitary ware and parts of iron or steel
7325	Other cast articles of iron or steel
7904	Zinc bars, rods, profiles, and wire
8301	Padlocks of base metal
Products in the Top Tercile of Connectedness and Top Tercile of Complexity	
Wood and Wood Products	
4906	Architectural, engineering, industrial plans, and drawings
Stone and Glass	
6806	Slag wool, rock wool and similar mineral wools
Metals	
7322	Radiators for central heating of iron or steel
Machinery and Electrical	
8482	Ball or roller bearings

HS4 = harmonized system at four digits.
Source: Authors.

Table A3: **Distribution of the 127 Products Exported with Comparative Advantage by Kazakhstan in 2010 vs. 1995**

Products exported with comparative advantage in 2010 but not in 1995 (new ones): 82 products

HS4 Code	Product Name
Animal and Animal Products	
303	Frozen fish, excluding fillets
304	Fish fillet or meat
305	Fish flours, meals and pellets for human consumption
504	Guts of animals except fish
510	Ambergris, civet, musk for pharmaceutical use
511	Animal products not elsewhere specified
Vegetable Products	
703	Onions and shallots
704	Cabbages, cauliflower, kohlrabi, kale, broccoli
707	Cucumbers
807	Melons
1001	Wheat and meslin
1101	Wheat or meslin flour
1104	Worked cereal groats
1109	Wheat gluten
1204	Linseed
1206	Sunflower seeds
1301	Lac
1512	Sunflower-seed or safflower oil, crude
1517	Margarine, not liquid
Foodstuffs	
1704	Confectionery sugar
1902	Pasta
2202	Waters flavored or sweetened
2207	Ethyl alcohol > 80% by volume
2302	Bran, sharps (middlings) and other residues
2306	Cotton seed oilcake
2401	Tobacco, raw
2402	Cigars
Mineral Products	
2503	Sulphur
2506	Quartz
2508	Clays
2510	Natural calcium phosphates
2511	Natural barium sulphate
2514	Slate
2521	Limestone
2529	Feldspar
2601	Iron ores and concentrates
2603	Gold content
2607	Lead ores
2608	Zinc ores
2612	Uranium or thorium ores
2618	Granulated slag
2621	Other slag and ash, including seaweed ash (kelp)
2704	Coke of coal, lignite or peat, retort carbon

continued on next page

Table A3 *continuation*

HS4 Code	Product Name
2706	Tar distilled from coal
2708	Pitch and pitch coke
2709	Petroleum oils, crude
2711	Petroleum gases
2713	Petroleum coke
Chemical Products	
2809	Diphosphorus pentaoxide; phosphoric acid; polyphosphoric acid
2817	Zinc oxide and peroxide
2818	Artificial corundum
2835	Phosphinates and phosphonates
2849	Carbides
3102	Mineral or chemical fertilizers, nitrogenous
3214	Glaziers' putty
3603	Safety or detonating fuses
Plastics and Rubbers	
4010	Conveyor or transmission belts of vulcanized rubber
Raw Hides, Skins, Leather, and Furs	
4103	Other raw hides and skins
4104	Tanned hides and skins of bovine or equine animals
4105	Tanned skins of sheep or lambs
4906	Plans and drawings for architectural, engineering, industria
Textiles	
5208	Woven fabrics of cotton
5802	Terry toweling and similar fabrics
Stone and Glass	
6806	Slag wool, rock wool and similar mineral wools
6809	Plaster articles
Stone and Glass	
7108	Gold
7112	Scrap of precious metal
Metals	
7206	Iron and non-alloy steel
7304	Tubes, pipes and hollow profiles, seamless, of iron or steel
7322	Radiators for central heating of iron or steel
7324	Sanitary ware and parts of iron or steel
7325	Other cast articles of iron or steel
7401	Copper mattes; cement copper
7402	Unrefined copper
7408	Copper wire
7409	Copper plates, sheets and strip
7601	Unwrought aluminum
7802	Lead waste or scrap
8104	Magnesium
8106	Bismuth
8301	Padlocks of base metal
Machinery and Electrical	
8482	Ball or roller bearings

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Table A3 *continuation*

Products exported with comparative advantage in 1995 but not in 2010 (losses): 23 products

HS4 Code	Product Name
Vegetable Products	
1002	Rye
1402	Kapok
Foodstuffs	
1604	Prepared or preserved fish
Mineral Products	
2620	Slag, ash, and residues
Chemical Products	
2805	Alkali or alkaline-earth metals; rare-earth metals, scandium
2826	Fluorides; fluorosilicates, fluoroaluminates
2845	Isotopes not elsewhere specified
2851	Inorganic compounds, liquid or compressed air
3103	Mineral or chemical fertilizers
3501	Casein
Plastics and Rubbers	
3915	Plastic waste, parings and scrap
Textiles	
5001	Silkworm cocoons
5003	Silk waste
5103	Waste of wool or animal hair
5206	Cotton yarn
5515	Other woven fabrics of synthetic staple fibers
Metals	
7413	Stranded wire, cables and similar articles of copper
7414	Endless bands of copper wire for machinery
7608	Aluminum tubes and pipes
7905	Zinc plates, sheets, strip and foil
8004	Tin plates, sheets and strips, thickness
Transportation	
8608	Railway or tramway track fixtures and fittings; safety equip
Miscellaneous	
9704	Postage or revenue stamps

Products exported with comparative advantage in both 1995 and 2010 (remain): 45 products

HS4 Code	Product Name
Animal and Animal Products	
507	Ivory, tortoise-shell, whalebone and whalebone hair, horns,
Vegetable Products	
1003	Barley
1205	Rape or colza seeds
1404	Vegetable products not elsewhere specified
Mineral Products	
2524	Asbestos
2602	Manganese of 47% or more by weight
2610	Chromium ore

continued on next page

Table A3 *continuation*

HS4 Code	Product Name
2611	Tungsten ores
2617	Other ores and concentrates
2701	Coal; briquettes
2702	Lignite
2710	Petroleum oils, refined
Chemical Products	
2804	Hydrogen, rare gases, and other nonmetals
2819	Chromium oxides and hydroxides
2824	Lead oxides
2833	Sulfates; alums; peroxosulfates (persulfates)
2841	Salts of oxometallic or peroxometallic acids
2844	Radioactive chemical elements and radioactive isotopes
2846	Compounds, inorganic or organic, of rare-earth metals
3105	Mineral or chemical fertilizers, mixed
3202	Synthetic organic tanning substances
Raw Hides, Skins, Leather, and Furs	
4101	Raw hides and skins of bovine or equine animals
4102	Raw skins of sheep or lambs
Textiles	
5101	Wool
5102	Animal hair
5201	Cotton raw
5202	Cotton waste
Stone and Glass	
6814	Mica articles
7106	Silver
Metals	
7202	Ferroalloys
7204	Ferrous waste and scrap
7208	Hot rolled iron or non-alloy steel, coil
7209	Cold rolled iron or non-alloy steel, coil
7210	Flat rolled iron or non-alloy steel, coated with tin
7403	Refined copper and copper alloys
7404	Copper waste and scrap
7405	Master alloys of copper
7602	Waste or scrap, aluminum
7801	Lead refined unwrought
7901	Unwrought zinc
7904	Zinc bars, rods, profiles, and wire
8103	Tantalum
8107	Cadmium
8108	Titanium
8112	Other metals

HS4 = harmonized system at four digits.
Source: Authors.

Table A4: **Other DMC Exporters of Natural Resources**

Country	Natural Resource Intensity (%)	Diversification	Non-natural Resource Diversification
Azerbaijan	94.42	73	65
India	32.49	169	161
Indonesia	36.18	317	300
Kazakhstan	82.86	127	98
Myanmar	46.09	40	35
Uzbekistan	34.12	67	59

DMC = developing member country.
Source: Authors.

Table A5: **Australian Industrial Policy Instruments**

Instrument	Description	Outcome
Fiscal Incentives	Output bounties on products such as books, shipbuilding, textiles, computers, machine tools, textile yarns, and steel mill products Export incentives on passenger motor vehicles and textiles, clothing, and footwear Export Market Development grants R&D incentives such as best-practices programs for SMEs Emergency relief for certain sectors when deemed (politically) necessary	Overall, Australian (heavy) industry is not globally competitive. Higher value-added manufactured goods (elaborately transformed), particularly electronics, have become internationally competitive. Meanwhile, agriculture in Australia is highly competitive and has low levels of protection.
Investment Attraction Programs	Tax relief to companies in the form of accelerated depreciation for plant and equipment Extensive support for training and wage subsidies Export assistance from federal government (market research) Reductions in corporate tax rates Reduced land, utility prices, and taxes offered by state governments	Mixed results suggest that government interventions can attract investment (foreign and domestic), but at the same time lead to market distortions.
Training Policies	Extensive apprenticeship schemes dominated by public service agencies	The apprenticeship program has become a major source of skilled trade labor in Australia, though public support has been scaled back since the 1980s.
Infrastructure Support	Rail infrastructure Road infrastructure Snowy Mountain Scheme Two Airline Agreement	Successful Successful Successful Failed Ongoing shift underway toward use of PPPs rather than retaining construction capacity within the private sector.

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Table A5 *continuation*

Instrument	Description	Outcome
Trade Measures	Barrier protection for manufacturing industries, dominated first by import quotas and then Tariffs; 40% for motor vehicles and textiles, clothing, and footwear Anti-dumping measures Bounties on intermediate products Local content plans, particularly in the motor vehicle industry	Barrier protection methods based on the infant-industry argument defined industrial Policy from the 19th century until the late 1970s. Rent-sharing between firms and workers became the norm and productivity improvements lagged behind world standards. Import penetration increased in the 1960 despite rising protection. The use of import quotas hid the deteriorating competitive position of local industry. The 1970s oil crisis threatened domestic motor vehicle firms. The problem was exacerbated by the market entry of Nissan and Toyota.
Public Procurement	Commonly used, particularly in the Defense Forces	No evidence available.
Financial Mechanisms (loans, risk-sharing)	PPPs for major road, hospital, and school infrastructure The Australian Industry Development Corporation (AIDC), a federal government bank, provides funding assistance to small firms unable to access capital markets. The Rural Industries Research and Development Corporation was established to work with industry to invest in R&D for a more dynamic rural sector.	PPPs have generally not been successful. Several have collapsed with the state having to accept full responsibility for ongoing operations and project completion. AIDC was effective but its development role has more recently been downplayed with increased financial deregulation and ideological antagonism to such nonmarket assistance. The Rural Industries Research and Development Corporation continues to play an effective role in rural development.
Industrial Restructuring Schemes	A new approach to industry policy began in the 1980s, replacing protection from competition with productivity enhancement. Targeted industries included motor vehicles, textiles, clothing and footwear, shipbuilding, and iron and steel. The federal government provided financial assistance to encourage plant modernization and export market development. Button Car Industry Plan (late 1980s): the government introduced phased tariff reductions (2.5% per year) and minimum annual production requirements (reduce number of models, achieve efficient production scale), and encouraged joint ventures across firms; export credits schemes, and plant rationalization assistance.	Staged reductions in protection began in 1984, plants were closed and the number of models reduced. Export penetration increased as did the quality of output. However, the automobile industry remained uncompetitive in the face of international competition. Today, public support to the industry is limited to assistance in making the shift to renewable energy.

PPP = public–private partnerships, R&D = research and development.
Source: Mitchell (2013).

Table A6: **EU Industrial Policy Instruments**

Instrument	Description	Outcome
Fiscal Incentives	*United Kingdom (UK)* Process of gradual reduction of corporate tax rates, from 24% in 2012, to 23% in 2013, and 22% in 2014 SMEs eligible for a 200% tax relief on allowable R&D costs (increased to 225% in April 2012); Large companies eligible for 130% relief if R&D costs are at least of £10,000 per year Reform of taxation for controlled foreign corporations (CFC) by taxing profits from UK activity, rather than worldwide income of a group to the UK "Patent Box" scheme involves tax relief of 225% for every British pound invested in patents and a favorable corporate tax rate of 10% on all profits coming from the patent Sector-specific tax for green (Enhanced Capital Allowance Scheme) and creative industries (animation, high-end television, and video games) *Netherlands, The* Corporate tax rate is 20% for the first €200,000 and 25% thereafter The Patent Royalty Box is a fiscal tool to incentivize IP by offering more favorable tax rates for profits originating from IP. Launched in 2007, the Netherlands is one of the pioneers of such tools. Initially 10%, reduced to 5% in 2010. Losses are deductible at the general rate of 25%, R&D costs are deducted upfront. Firms are eligible for an R&D deduction of 42% of the first €100,000 in R&D wage costs and 14% for the remaining amount. Start-up companies are allowed a 60% deduction of the first €100,000. Foreign companies have the option of agreeing in advance on tax treatment on future investments in the Netherlands (advance tax ruling).	Impact of corporate tax reform and SME tax relief yet to be determined. CFC tax reform, designed in consultation with the private sector, seeks to tax artificially diverted UK profits, while not taxing profits (genuinely) originating from activities conducted abroad. Patent Box scheme launched in April 2013 to adapt to the new trends whereby intellectual property (IP) is often the result of cooperation between actors from different countries. Many firms currently register their intellectual property in other EU countries with more favorable conditions Details on Enhanced Capital Allowance Scheme available at http://etl.decc.gov.uk/ The Dutch tax regime makes the Netherlands an attractive location for businesses with global operations. Lokshin and Mohnen (2007) studied the effect of the R&D deduction on Dutch firms in 1996–2004 and found this policy tool was effective in lowering the costs of R&D and stimulating investment. The standardized process of advance tax ruling ensures clarity and certainty for future transactions.
Investment Attraction Programs	*Germany* The Investment Allowance is a special incentive program created in 2008 to promote investment in former East Germany through a tax-free cash payment or tax credit automatically given to firms. The Joint Task Program for the Promotion of Industry and Trade offers non-repayable grants for investment costs throughout Germany, with the amount depending on the investment costs, or the estimated wage costs of the future business, and on the localization of the investment. The regions of Eastern Germany provide the highest incentives: from 50% of the investments in small firms, 40% in medium-sized firms, and 30% in large firms.	According to Ernst and Young's European Attractiveness Survey in 2012, Germany has recently increased its appeal as an FDI destination. Investors identified quality of infrastructure, economic stability, industrial and exporting power, local expertise, and better economic outlook as primary strengths.

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Table A6 *continuation*

Instrument	Description	Outcome
	Ireland A favorable corporate tax regime is a cornerstone of the Irish industrial policy. FDI attraction is also achieved also through investment in education and the training of local workers.	According to Deloitte (2012), the low corporate tax rate; generous exemptions from dividend, royalty, and interest withholding taxes; the absence of CFC legislation; the existence of incentive packages that maximize EU financial assistance; and the efficient use of EU funds make Ireland an extremely attractive business location in Europe. A total of 148 FDI-related projects were approved in 2011, 28% of which were outside the most developed cities (Dublin and Cork). More than 50% of the investing companies came from the US, generating employment in international and financial services (accounting for almost half of the jobs created), with medical and dental supplies and instruments and pharmaceuticals accounting for much of the remainder.
Infrastructure Support	*Structural Funds* Many infrastructure projects are financed under the EU's Structural Funds. About €82 billion will be spent on transport at the EU, national, and regional levels in 2007–2013, an increase of 65% over 2000–2006. TENT-T is an initiative for an EU-wide transport network launched in 2006, with a budget of more than €1.5 trillion for 2010–2030.	Details on EU infrastructure projects are available at http://ec.europa.eu/transport/themes/infrastructure/index_en.htm
Trade Measures	The 27 EU countries implement a community customs code that implies that they act as one when it comes to trade policy. These rules not only regulate common tariffs but all aspects of trade policy, such as non-tariff instruments, preferential trade, health and environmental controls, agricultural and fisheries policies, and external relations policy measures. The EU maintains a public database with tariff rates and other protective measures. Apart from ad valorem duties, several non-ad valorem duties are applied, mostly on agricultural products. According to WTO data (WTO 2011), in 2011 the average tariff rate for agricultural products was 15.2% against 4.1% for non-agricultural products. Tariffs for industrial products are among the lowest in the world (3.9%). Export credit insurance systems and other export finance schemes are managed by Member States. The EU tries to reduce competitive distortions between EU companies by providing Member states common principles and rules about coverage and transparency.	Article 23 of the European Community (EC) Treaty stipulates free circulation for Community goods throughout the EC. This principle applies to goods made in the EC and imported goods that have been released for free circulation after payment of the import duties. Quantitative quotas exist for the following products: steel, textile, footwear, and potassium chloride. Even though protection has decreased since 2008, support to agriculture is still considerable, according to the WTO. Apart from import tariffs, the EU offers export subsidies in agriculture totaling more than €100,000 billion per year according to an OECD estimate.
Public Procurement	Within the framework of EU directives, countries define the details of their respective public procurement procedures. Rules dictate harmonized and transparent conditions in selecting contractors. Member states can divide contracts into separate lots, offer business consultancy to SMEs, and give guidelines on how to manage contracts. Public procurement accounts for 16% of EU's GDP.	Details on public procurement in the EU are available at http://ec.europa.eu/internal/_market/public procurement/index_en.htm

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Table A6 *continuation*

Instrument	Description	Outcome
Financial Mechanisms (loans, risk-sharing)	*EU Structural Funds* Only the poorest member states are eligible for structural funds. In 2007–2013, "cohesion policy" will account for over one-third of the total EC budget. Out of a total of €347 billion, €86 billion was allocated to innovation, including infrastructure, entrepreneurship, ICT development, and human capital. The Competitiveness and Innovation Framework Program (CIP) increases SME access to finance and business support services. The Risk-Sharing Finance Facility is a joint program of the EC and European Investment Bank (EIB) that supports high-risk/high-reward ventures through loans, guarantees, and equity investment. *France* Oseo is a public institution that finances innovative SMEs through loan guarantees, subsidies, and grants, accounting for 22% of total public funding to private sector R&D in 2010.	Structural Funds seek to reduce disparities across regions, with the ultimate goal of convergence.
Industrial Restructuring Schemes	*Germany* The government funds biotech research in universities and government laboratories based on multi-annual thematic programs. The biotech program includes contests to identify young scientists and researchers, support for commercialization of innovation through the formation of new firms, promotion of clusters, and the financing of start-ups through government venture capital programs. *France* Under the *Poles de Compétitivité* initiative, 71 clusters have received public funding, with seven ICT clusters receiving more than one-third of total funding. Companies, research centers and education institutions in the clusters receive direct aid (subsidies for research projects, infrastructure), tax incentives (deductions from corporate and social taxes), marketing and networking support, and access to funding under privileged conditions (guarantees).	Details on *Poles de Compétitivité* are available at http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/fr/supportmeasure/support_mig_0022

FDI = foreign direct investment, GDP = gross domestic product, ICT = information and communication technology, OECD = Organisation for Economic Co-operation and Development, R&D = research and development, SME = small and medium-sized enterprise, US = United States.
Source: Farla, Guadagno, and Verspagen (2013).

Table A7: **US Industrial Policy Instruments**

Instrument	Description	Outcome
Fiscal Incentives	Tax credits and incentives for various types of activities such as R&D. These are offered at the federal level, as well as through a patchwork of incentives at the state and local levels. At the federal level, this category also includes patent protection laws.	Because state and local incentives are organized in a largely uncoordinated (often competitive) and decentralized fashion, some have succeeded and others have failed. At the federal level, there is ongoing debate about the impact and appropriate size and scope of programs like federal R&D credits. Patent laws are also a subject of vigorous debate as policymakers attempt to balance the accrual of private profits for innovative ideas with the potential to stifle innovation by limiting access to knowledge that could be used to push forward innovative horizons. Numerous federal programs have gradually developed mechanisms to protect intellectual property in collaborative ventures and to mediate different stakeholder interests in federally-funded or coordinated research programs.
Investment Attraction Programs	These diverse and decentralized programs, handled primarily at the state and local levels, include efforts to generate regional or local industrial or technological clusters.	These programs have a mixed record of success, but generally, since the 1980s state and local governments have had relatively constrained resources for developmental projects. Examples of successful use of such strategies, through both fiscal incentives and investment attraction programs, include the biotechnology cluster in San Diego and the cluster of green energy firms in central New Mexico.
Training Policies	The Manufacturing Extension Program (MEP) has established field offices that provide various forms of advice and consultation to small manufacturers. These programs are conceptually similar to agricultural extension offices. Specific programs, such as Small Business Innovation Research (SBIR), provide organizational training and "matchmaking" services (e.g., sponsoring sessions or conferences linking small firms with larger contractors or financiers). Many agencies have implemented programs designed to improve the capacities of partners and/or generate network synergies among actual or potential collaborators. In some instances the US government provides support for training programs in targeted fields such as the American Recovery and Reinvestment Act of 2009 (ARRA), which provided funds to community colleges for training programs in targeted areas.	With so many disparate programs at the federal, state and local levels, the results are mixed.
Infrastructure Support	Federal, state, and local governments regularly provide investments in infrastructure projects.	Typical concerns in recent years have emphasized that the US has not invested enough in its infrastructure to keep pace with foreign competitors. These concerns range from aging physical infrastructure (e.g., roads, bridges, railways) to infrastructure for the adoption and use of advanced technologies (e.g., the availability of high-speed internet has lagged far behind other developed nations).

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Table A7 *continuation*

Instrument	Description	Outcome
Trade Measures	Under the framework of the WTO and other international trade agreements including the North American Free Trade Agreement (NAFTA).	Details on the impact of NAFTA are available at www.naftanow.org
Public Procurement	The Department of Defense, in particular, has used its substantial procurement powers to nurture industries both historically and recently. Earlier examples include airplanes and mainframe computers and semiconductors. More recently, the Department of Defense has taken tentative steps to "green" its fleets, though the scope and effects of such policies are not yet clear.	Many economic analyses suggest that procurement as an industrial strategy leads to underperformance, while others suggest it has been critical to industrial development within particular fields or sectors. Government procurement has played a major role in industrial development in the US in key sectors and has been usefully deployed in some cases as a mechanism for trade policy (Weiss and Thurbon 2006).
Financial Mechanisms (loans, risk-sharing)	Under the 1603 tax credit program managed by the Department of the Treasury, qualified firms could receive cash grants in lieu of tax credits. The 1703 and 1705 loan programs (passed, but not funded under the G.W. Bush Administration) were funded under ARRA and provided loans for alternative energy projects. Longer-running programs, such as SBIR program, provide seed funding for early-stage technology firms in areas of agency-determined targeted need. In addition, the Small Business Administration (SBA) and other agencies provide grant assistance and loans.	Many of the alternative energy programs supported by ARRA have technology horizons that are probably a decade or more away; these are difficult to evaluate in the short-run. Long-term programs, such as SBIR and the SBA, have been subject to official and third-party academic analyses. Conclusions differ widely.
Industrial Restructuring Schemes	After the financial crisis of 2008/9, the federal government took a stake in several major automakers and financial institutions in return for infusions of cash. These were short-term, emergency measures. Government stakes were later (or soon will be) sold on the market.	These particular decisions will likely be debated for decades. In the short-term, it seems inarguable that they saved many thousands of jobs at the firms in question and their domestic suppliers.

R&D = research and development.
Source: Keller and Block (2013).

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Report to the Government of Kazakhstan
Policies for Industrial and Service Diversification in Asia in the 21st Century

The economy of Kazakhstan has performed remarkably well since gaining independence in 1991, with per capita income approaching $13,000. This excellent performance has been the result of both sound macroeconomic policies and a favorable investment climate. However, Kazakhstan's economy remains heavily dependent on oil, and this dependence is increasing. While in 2000, petroleum accounted for 50% of total exports, by 2010 it represented 61%. Moving forward, Kazakhstan's strategic development objective is long-term sustainability, which requires diversifying the economy and upgrading the human capital base. Starting in 2010, the Government of Kazakhstan has put in place new programs to increase economic diversification. This report analyzes the degree of diversification of Kazakhstan's economy during the last 15 years. Using export data, the report documents that, surprisingly, in 2010 Kazakhstan exported fewer products with comparative advantage (the measure of diversification used in this report) than it did one decade ago. Second, the report summarizes the experiences and lessons of Australia, the People's Republic of China, the European Union, the Republic of Korea, Malaysia, and the United States, in modernizing industrial policy tools. And third, the report emphasizes that given that industrial policy should be stage-of-development dependent, Kazakhstan should implement a modern indirect industrial policy program and a risk-management framework, through the financial markets.

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