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Public Financial Support for Commercial Innovation in ECA Countries

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Key Messages[1]

- **Commercial innovation and R&D are key factors driving *self-sustained*, long-term economic growth. These factors are generated from within the economic system, responding to economic incentives.**
- **Translating research into economically productive commercial applications is a critical missing link in Europe and Central Asia (ECA) countries.**
- **Typically, the bulk of R&D spending in ECA, as much as two-thirds of the 0.9 percent of GDP, is financed by governments whereas only about one-third is financed by the private sector.**
- **The utilization of instruments such as matching grants and venture capital—with as much private sector participation in risk sharing and selection as possible—will be needed in ECA countries to ensure transparency and commercial viability and mitigate the risks of government failure.**

Growth and Innovation versus Technology Absorption

Key factors driving self-sustained, long-term economic growth are innovation and technology absorption; these factors are generated from within the economic system, responding to economic incentives. This conceptual framework molds our analysis: on the one hand, the view of the centrality of innovation and knowledge creation in the growth process and, on the other hand, the understanding that these are economic factors that may be shaped and influenced by properly designed economic policies.

For the purpose of this Knowledge Brief, *innovation* can be defined as the development and commercialization of new unproven technologies and untested processes and products, and *absorption* as the application of existing technologies, processes, and products. The ability of an economy to research and develop new technologies increases its ability to understand and apply existing technologies. Vice versa, the absorption of cutting-edge technology inspires new ideas and innovations.

However, the adoption of existing technology via trade, Foreign Direct Investment (FDI) or licensing is not guaranteed or cost free. Firms and countries need to invest in developing 'absorptive' or 'national learning' capacity, which in turn is a function of spending on research and development (R&D); domestic R&D has a role in developing a firm's ability to identify, assimilate, and exploit knowledge from the environment, that is, enhance the *absorptive capacity* of the economy.

Innovation in ECA

Scarcity of capital and the high cost of labor in ECA countries, relative to their Asian competitors, limit cost-based competitiveness. The crisis exposed the limits of growth fueled by external financing or natural resource exports. Revitalizing growth requires new strategies to raise competitiveness: export-led sectoral diversification; investments in skills and infrastructure; and innovation and absorption of technologies from the world.

The ECA region has a fairly high human capital stock and well-developed research institutions, with an average of nearly 2,000 R&D researchers per million; Russia has the highest ratio of researchers to its population—more than 3,400 per one million people. In Figure 1, the gross

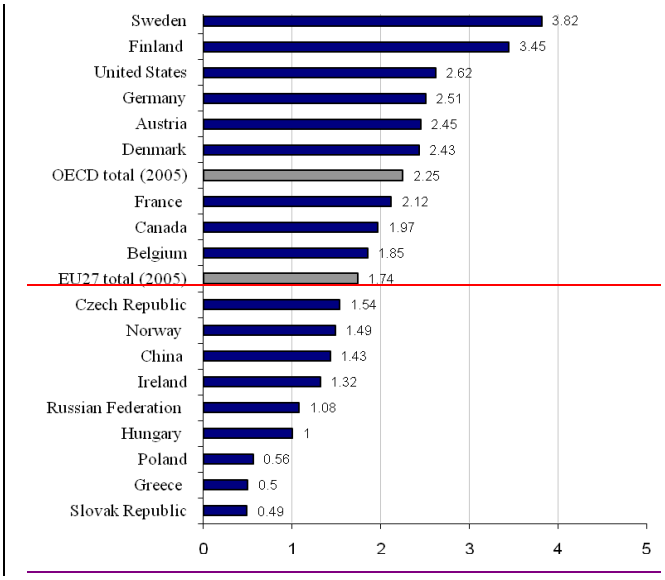
[1] This Knowledge Brief is based on a Knowledge Economy Study that is part of an ongoing Regional Working Paper Series sponsored by the Chief Economist's Office in Europe and Central Asia Region of the World Bank.

domestic expenditures on R&D (as a percentage of GDP) of some of the major ECA countries are compared with other developed nations. The average R&D-to-GDP ratio in ECA is 0.9 percent. Of the 28 ECA countries, only 6 countries have a ratio of 1 percent or more.

However, in most ECA countries, R&D is typically isolated from industry and effective structural reform would require bridging this gap between industry and research. To effectively integrate their R&D activities in line with private sector innovative efforts, two crucial problems of institutional design must be addressed: (i) aligning the R&D activities performed in institutes and academia to the technological demands of existing business enterprises, and (ii) facilitating two-way flows of information and knowledge at the public-private interface.

Spending in ECA on applied research that has higher commercial potential is low when compared with the world's most developed countries. There is also a mismatch between the research being undertaken and private sector needs. Typically, the bulk of R&D spending in ECA—as much as two-thirds of the 0.9 percent of GDP—is financed by governments; only about one-third is financed by the private sector. By contrast, in countries with high rates of R&D expenditure, such as Japan, the United States, Sweden, Finland, Ireland, and Germany, the share of industry-related R&D spending ranges from 65 percent to 70 percent, whereas government spending amounts to only 20 to 30 percent.

Figure 1: R&D intensity (Gross Domestic R&D expenditure as a percentage of GDP)**, 2006 or latest available year**



Source: OECD Science, Technology and Industry: Scoreboard 2007

In recent years, policy makers in the ECA region have increasingly directed their attention towards enhancing investments in R&D in their respective countries. The European Union's (EU) Lisbon Strategy has prompted the new member states and other ECA countries to consider implementing financial instruments to promote innovation, especially venture capital schemes. However, this is being done with little consideration for the necessary institutional requisites or appropriateness of the instruments. In a number of countries in the former Soviet Union (for example, Russia, Ukraine, Kazakhstan) and its satellites and in the former Yugoslavia (Serbia, Croatia), the legacy of research and human capital also provides an incentive to revive their research capacity. But absorptive capacity remains an issue in all ECA countries. Some of the countries are likely to have higher productivity returns from investments in building absorptive capacity than in commercial innovation.

Should Governments Support Innovation?

In a new book[2] on entrepreneurship and venture capital, Josh Lerner of the Harvard Business School writes: "When we look at the regions of the world that are, or are emerging as, the great hubs of entrepreneurial activity— places such as Silicon Valley, Singapore, Tel Aviv, Bangalore, and Guangdong and Zhejiang provinces—the stamp of the public sector is unmistakable. … While the public sector is important in stimulating these activities, I will note that far more often than not, public programs have been failures. Many of these failures could have been avoided, however, if leaders had taken some relatively simple steps in designing and implementing their efforts."

Any public intervention must be weighed against the actual and potential costs of intervention. This includes the well-known problems of capture and corruption. Market failures may justify government intervention to stimulate absorptive capacity in the private sector. However, policy design needs to account for potential risks of government failures, such as capture of policy makers by large companies and other vested interests and misaligned incentives of government officials who risk high penalties if their policies fail but expect little extra compensation if they succeed in risky policies.

The government plays a special role in promoting start ups because of the high risk that deters the entry of new ventures and their high failure rate once such ventures are established. It is the role of the government to encourage new ventures as a way to generate new activities and support sustainable job creation. This role derives from the

[2] Josh Lerner, *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed--and What to Do About It*, Princeton Press, 2009.

asymmetry of risk between the government and the start up: the failure of a startup is a total loss for the private investor but from the point of view of society, the intellectual property (IP) assets that a failed startup created and the skills imparted to its former employees can be used to start a new enterprise utilizing those assets. Therefore, for governments, the subsidization of failed startups, rather than being a total loss, contributes to innovation and developing future startups. In particular, it is important that governments support new ventures which are based on IP because it is support precisely for those firms which, by definition, are introducing new technologies and new products and which are developing new markets.

How Can Governments Support Innovation?

Governments can support innovation and technology absorption in three major ways:

- *Regulatory interventions:* to improve the policy environment for innovation and technology absorption via easier entry and exit, mobility, removal of barriers to FDI and non-tariff-barriers and an intellectual property rights (IPR) regime conducive to international R&D cooperation and the global openness of science.
- *Financial instruments:* to subsidize R&D and business development in start ups, enterprises and spinoffs (matching grants, loans, tax holidays, etc.).
- *Institutional instrument*s: incubators, technology parks, technology transfer offices, etc.

Government interventions need to be carefully designed to promote private risk-taking instead of rent seeking and to stimulate markets for private risk capital, so as not to crowd out private investment and other funding sources. The government should also not decide ex ante which technological sectors, firms or projects to support, but respond to the demands coming from the market. Especially in ECA countries, the institutional design should aim to immunize, as much as possible, the funding allocation from interference by political actors, corruption, and other state or specific interests capture.

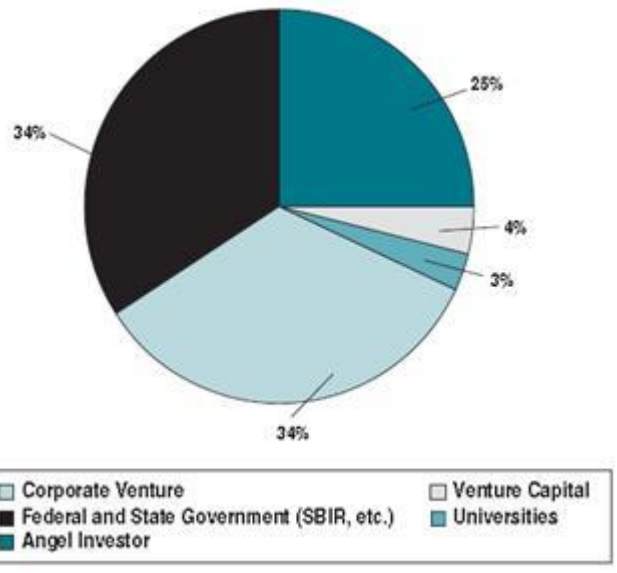
An active innovation policy government program in support of innovation should span the entire commercialization cycle. The three different stages of the innovation cycle require different policy instruments:

- **Early stage** building of a deal flow**:** incubators, angel investors or matching grants, as well as spinoffs and other spillovers from multinational companies (MNCs).
- **Growth stage**: government support for private venture capital (VC) via risk sharing.
- **Mature stage and exit:** international and local equity funds and strategic investors.

One of the major problems of the innovation system is in the sequencing of support for early stage vis-à-vis support for 'growth stage' innovation, mainly VC. Effective sequencing should aim at building a significant *deal flow* of early stage projects *before* supporting VC. The success of the growth stage of the commercialization cycle depends on a 'deal flow' of attractive companies coming out of the early stage. For example, in Israel, the VC boom in the 1990s would not have been possible without the projects which had been supported by matching grants for 20 years by the Office of the Chief Scientist Program.

The more traditional approach to R&D support for firms has been through tax incentives or subsidized loans. However, since the 1980s, there has been an increasing awareness among OECD countries of the benefits of matching grants in encouraging firms to share and manage risk. A number of historically successful grant programs, such as Australia's R&D Start Program and the U.S. SBIR Program, have an implicit matching component in that firms are expected to support a portion of the research budget. Figure 2 shows an estimated breakdown of actual funding sources for early stage technological development (ESTD) in the United States.

Figure 2: Funding For Early Stage Technological Development in the United States



Source: Auerswald and Branscomb 2003. "Valleys of Death and Darwinian Seas: Financing the Invention to Innovation Transition in the United States." *Journal of Technology Transfer* 28 (3–4): 227–39.

In countries such as Finland and Israel, more formal matching grant programs are helping to create a seedbed of commercialization activities out of which the most promising innovation can be generated for follow-on investment by private sector investors, such as VC firms.

A matching grants program works by encouraging risk sharing with firms, and it orients the selection process toward R&D programs that are most likely to generate innovations that can be commercialized. Qualifying firms, or consortia from academic institutions, will submit grant applications for specific R&D projects that are reviewed by an independent research committee. If approved, the applicants receive a grant from 50 percent to 70 percent of the stated R&D budget for the project. Successful projects (that is, those leading to sales) will be required to repay the grant, as a royalty from revenue, up to the dollar-linked amount of the grant. The royalty scheme also orients the selection process toward picking projects mainly to achieve sales and profitability targets[3].

In order to encourage private VC at the growth stage, the government could mitigate private investors' risks by investing as a founding and passive Limited Partner, with a minority stake. Venture capital-backed firms played a key role in driving innovative economic activity during the 1990s in the US, UK and several other markets.

The Path Ahead for ECA

In a globalized economy, local skills and indigenous technology are not enough to remain competitive and there is a need to actively connect to the rest of the world. Openness to trade and FDI, investments in skills and collaboration in the world of R&D, and strong internal competition in domestic markets, are critical for innovation and technology absorption in emerging markets. Encouraging innovation will first require improving the investment climate for innovative firms, including reinforcing the regulatory reform agenda, removing barriers to competition and fostering skills development. Policies to encourage trade, FDI and skills, and improve the investment climate should be supplemented by policies to spur participation in the world of R&D.

To address the apparent lack of collaboration between the science and business sectors mentioned above financial instruments like mini-grants, matching grants and venture capital would likely address the problem through the encouragement of private R&D in companies, by providing incentives for collaboration through the co-funding of "consortia" of firms and universities/research institutes to implement innovative projects.

There is also a need to adapt these instruments to the conditions prevalent in many countries in ECA (with regards to state capture, corruption, and weak courts, etc.). The utilization of instruments such as matching grants and venture capital -- with as much private sector participation in risk sharing and selection as possible -- will be needed in ECA countries to ensure transparency and commercial viability and mitigate the risks of government failure. In situations in which the government is actively involved in selection, such as early-stage grants, the selection process needs to be carefully designed to include outside expertise. Business support services are important complementary instruments to support financial instruments, such as grants and venture capital, but have a weak track record on a stand-alone basis.

[3] Theoretically, the importance of matching stems from the fact that its effect is to reduce the marginal cost of research to the firm. A firm facing a downward sloping marginal research returns schedule will always increase total expenditure when the marginal cost falls, precluding the dollar-for-dollar crowding-out.

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