Cases from Developing Economies

Anwar Aridi and Natasha Kapil
INNOVATION AGENCIES

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## ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AITD</td>
<td>Angel Investors’ Tax Deduction</td>
</tr>
<tr>
<td>AVAS</td>
<td>Advisory and Value-Added Services</td>
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<tr>
<td>BICRO</td>
<td>Agency for Business Innovation (Croatia)</td>
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<tr>
<td>BIRAC</td>
<td>Biotech Industry Research Assistance Council (India)</td>
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<tr>
<td>DST</td>
<td>Department of Science and Technology</td>
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<tr>
<td>EIF</td>
<td>Enterprise Incubation Foundation (Armenia)</td>
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<tr>
<td>GCI</td>
<td>Grand Challenges India</td>
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<td>GII</td>
<td>Global Innovation Index</td>
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<tr>
<td>GITA</td>
<td>Georgia Innovation and Technology Agency (Georgia)</td>
</tr>
<tr>
<td>HAMAG-BICRO</td>
<td>Hrvatska Agencija za Malo Gospodarstvo, Inovacije i Investicije (Agency for SMEs, Innovations, and Investments) (Croatia)</td>
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<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
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<tr>
<td>ICTA</td>
<td>Information Communication Technology Agency (Sri Lanka)</td>
</tr>
<tr>
<td>IF</td>
<td>Innovation Fund (Serbia)</td>
</tr>
<tr>
<td>M&amp;E</td>
<td>Monitoring and Evaluation</td>
</tr>
<tr>
<td>MTDC</td>
<td>Malaysian Technology Development Corporation (Malaysia)</td>
</tr>
<tr>
<td>NCBR</td>
<td>Narodowe Centrum Badań i Rozwoju (National Centre for Research and Development) (Poland)</td>
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<tr>
<td>NIS</td>
<td>National Innovation System</td>
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<tr>
<td>PPP</td>
<td>Public-Private Partnership</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>RDB</td>
<td>Rwanda Development Board (Rwanda)</td>
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<tr>
<td>S&amp;HE</td>
<td>Science and Higher Education</td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium Enterprise</td>
</tr>
<tr>
<td>SPRING</td>
<td>Standards, Productivity, and Innovation Board (Singapore)</td>
</tr>
<tr>
<td>STI</td>
<td>Science, Technology, and Innovation</td>
</tr>
<tr>
<td>TEHCRO</td>
<td>Development of Technology and Innovation Infrastructure</td>
</tr>
<tr>
<td>TIA</td>
<td>Technology Innovation Agency (South Africa)</td>
</tr>
<tr>
<td>TTGV</td>
<td>Türkiye Teknoloji Geliştirme Vakfı (Technology Development Foundation of Turkey)</td>
</tr>
<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
</tr>
<tr>
<td>VC</td>
<td>Venture Capital</td>
</tr>
<tr>
<td>YTIP</td>
<td>Youth Technology Innovation Program</td>
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</table>
EXECUTIVE SUMMARY

Many high-income and developing countries have established agencies to promote innovation. This study examines the origin and evolution, organizational structure, policy interventions, delivery challenges, and evaluation mechanisms of 13 innovation agencies in developing countries and one case (SPRING in Singapore) for comparison purposes. The case studies were selected from a list of about 50 innovation agencies to maximize diversity relating to geography, scope and scale of operation, age, and resources. The analysis is based on an extensive review of scholarly and policy literature, in-depth interviews with agency staff and reviews of program materials.

This study does not assume that the only approach to improving innovation lies in a dedicated agency - each innovation system is governed differently and the same intervention may have very different results in different contexts. Rather, our goal is to capture how these agencies dealt with the major challenges that confront establishing an innovation agency in a developing country context, where innovation is often hampered by significant market, coordination, and institutional failures, investments in innovation tend to be limited, and the capabilities required for effective innovation are often lacking. The analysis is presented according to seven building blocks that emerged from the analysis of the cases' patterns and dynamics as pre-requisites for the success of innovation agencies, including a clear but adaptable mission, capable staff, effective governance and management structures, diagnostic-based interventions, robust monitoring and evaluation (M&E), sustainable funding, and strategic partnerships and networks.

The agency should have a clear strategy for remedying the market, coordination, and institutional failures in the National Innovation System (NIS). This provides direction for effective interventions and helps the agency establish a different purpose and clear lines of authority with respect to other institutions involved in innovation. The agency can be focused towards basic development outcomes or more specialized innovation targets, as dictated by the level of development of the NIS. Agencies also should have the flexibility to adapt their missions as the needs of the NIS evolve over time.

Capable staff and strong management practices are critical. While visionary individuals have established effective agencies, this experience cannot be replicated and nurturing organizational and staff capabilities is essential. Capable staff, particularly staff with private sector backgrounds and connections to business networks, help to establish trust among prospective beneficiaries and improve the agency’s effectiveness in working with entrepreneurs as well as national and international investors, corporations, partners, and donors. This places a premium on building human resource capabilities to enhance cooperation with external stakeholders.

Effective governance and management structures are necessary to balance competing demands. Agencies need autonomy and flexibility but must also operate with the oversight and accountability necessary for a public or quasi-public organization. Key issues include sources of funding, legal authority to accept funding from other agencies or international donors, and flexibility to respond to rapidly changing domestic and international market conditions. However, the primary goal of governance and management structures should be to support the ability of agency staff to make decisions based on their professional judgment. The case study agencies, in order of those with the strongest oversight to those with the most autonomy, include operating as a ministerial unit, government agency, government agency with high autonomy, and non-profit, public-private partnership (PPP).

A diagnosis of NIS gaps and global trends is required to design policy interventions. The effectiveness of interventions adopted depends on the quality of policy design process and hence their ability to address identified NIS gaps. Systematic diagnosis of market and institutional failures has helped agencies to design a diversified range of instruments to address different and evolving NIS needs. Interventions have included direct financial support (grants--some with matching requirements, equity finance, loans and vouchers), indirect financial support (tax deductions and loan guarantees) and non-financial support (public procurement, research and development [R&D]/technology infrastructure programs, early stage support, technology transfer office (TTO) programs, advisory services, standards, metrology and testing services, inducement prizes and recognition awards). Especially notable is the gradual development of non-financial interventions, particularly consulting and networking services, by innovation agencies to improve the effectiveness of their financial interventions.

1 Poland, a transition economy that recently graduated to high-income status, is included in this group.
Robust M&E systems are essential to guide decisions to continue, modify or sunset programs based on their progress, and to understand the overall impact of the agency. Experimentation through pilot programs can demonstrate the extent to which interventions are effective within specific contexts. Internal M&E capabilities enable evaluation efforts to be integrated into the development and implementation of new interventions, and can be used to improve operations in general. However, establishing M&E capabilities is resource intensive; only a few agencies in the study have established dedicated M&E units. Agencies also can commission well-respected organizations and external evaluators to conduct regular or one-off evaluations and audits, although these are limited in their ability to provide sustained program insights, compared to internal M&E capabilities.

Sustained and diversified funding is critical for effectiveness. Initially, reliable finance, usually from government sources, is required to hire and train staff, design policies and establish M&E protocols. Over time, proactive agencies cultivate multiple funding sources to enhance program offerings and diversify their portfolios. Diversifying sources is crucial to ensure the sustainability of financing. Alternative sources beyond the government have included supranational organizations such as the European Union, international donors such as United States Agency for International Development (USAID), international finance institutions such as the World Bank, and charitable organizations such as the Bill and Melinda Gates Foundation. Some agencies have earned income from equity investments in startup companies or by charging clients a nominal fee for innovation services. Agencies also can help establish and participate in PPPs, drawing upon industry partners as a potential source of funding and as an important partner to spur innovation.

Finally, strategic partnerships and networks enable innovation agencies to connect to financial resources as well as technical and other specialized capabilities. Domestically, partnerships can provide resources, capabilities, and political support for the agency, and also empower innovation agencies to demonstrate effectiveness and gain the trust of NIS stakeholders, especially that of private sector actors. Internationally, partnerships can provide financial resources and specialized technical expertise not available within their respective countries. In addition, international partnerships can potentially connect domestic companies to partners, skilled diaspora members, and markets abroad.
Innovation, a critical driver of national productivity and thus sustained economic growth and prosperity, is dependent on complementary institutions and factors governed on national and sectoral levels. While innovation can occur at the individual, firm, and institutional levels, its economic and social impact is especially dependent on national and sectoral-level factors, for example capital availability, entrepreneurial culture, a well-educated workforce and a well-functioning intellectual property regime. The efficacy of these factors greatly depends on their interconnectivity and capability to collectively promote innovation through systematic effort. As a whole, the components (including institutions) and relationships which interact in the production, diffusion and use of innovation form the national innovation system (NIS) of a country.  

While innovation is difficult to achieve in any context, developing countries face even greater challenges. These countries lack critical NIS components, which leads to significant market, coordination, and institutional failures. Further, most developing countries do not make substantial investments in innovation because they do not possess adequate capabilities to effectively diagnose problems, identify solutions, or implement policy interventions. This situation leads to what researchers term the innovation paradox: countries that stand to gain the most from productivity improvements generally invest the least. Conversely, significant improvements to the NIS can be achieved when countries have a good process in place for the design, implementation, and governance of innovation policy instruments that is appropriate to the specific context, in a way that emphasizes experimentation, evaluation, and adaptation.

Many countries have established innovation agencies to develop and implement policy interventions to address challenges within their NIS. A recent report by NESTA, for example, highlights the establishment and function of innovation agencies within ten developed countries, including Austria, Israel, Taiwan, and the United States, among others. Agencies highlighted in the NESTA study are “government-funded or managed institutions that provide financial and other support to catalyze or drive private sector innovation” (p. 6). However, each agency differs in purpose, structure, and array of policy interventions, reflecting each country’s unique NIS needs. In other words, a one-size-fits-all model for innovation agencies does not exist: innovation agencies must fit the specific needs and context of a particular country.

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Despite the proliferate of innovation agencies in developing countries, there is a lack of understanding of how they function. This study seeks to address this gap through an investigation of 13 innovation agencies located in developing countries and one comparison case (SPRING in Singapore). Case studies of these agencies examine their origin and evolution, organizational structure, policy interventions, delivery challenges, evaluation mechanisms and impact. The derivative findings presented in this report should not be seen as a one-size-fits-all solution but instead as seven building blocks for establishing and operating innovation agencies that will likely improve their innovation-related impact.

This study does not evaluate the performance of the agencies, prescribe a specific approach, or assume that the only approach to improving innovation lies in a dedicated agency. However, policy practitioners, if having decided that a dedicated innovation agency is needed in their NIS, can use the seven building blocks presented in this report to guide the establishment and operation of such an agency. Practitioners should interpret the country-specific approaches presented in the case studies with caution: a specific agency characteristic or intervention approach that yields results in one context may not do the same in another. The building blocks will be most useful as policy practitioners design, establish, and operate agencies and interventions that best fit the needs of their own respective contexts.

The study’s cases were selected to maximize diversity relating to geography, scope and scale of operation, age, and available resources. These criteria were applied to an initial list of about 50 innovation agencies to select 13 supplemented by the selection of SPRING, a well-respected, well-resourced agency, as a developed-country benchmark (for a total of 14). Table 1 provides characteristics of the innovation agencies selected for the study. An extensive review of scholarly and policy literature was conducted to understand the implementation and impact of innovation policies in the selected NISs. Agency-specific data were collected through in-depth interviews with agency staff and through reviews of program materials (e.g., annual reports, impact evaluations, budget briefs). These data were analyzed and used to compose 14 agency case studies with cross-case analyses conducted to understand common patterns across the cases.

The rest of the report unfolds as follows. Section 2 presents the seven building blocks which emerged from the comparative analysis of the agency case studies. Section 3 presents each developing-country case study and discusses their establishment, organizational structure, and impact, among other issues. Finally, the Appendix provides additional details relating to the case study methodology.

Figure 1. Innovation Agencies Selected for the Case Studies

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6 Poland, a transition economy that recently graduated to high-income status, is included in this group.
7 See Table 17 in appendix for a full list of Innovation Agencies
<table>
<thead>
<tr>
<th>Country</th>
<th>Agency</th>
<th>GII Rank 2017</th>
<th>Income Category</th>
<th>Year Founded</th>
<th>Staff</th>
<th>Annual Budget (US$ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rwanda</td>
<td>Rwanda Development Board-Information and Communication Technology Department (RDB-ICT)</td>
<td>99</td>
<td>Low-income</td>
<td>2008</td>
<td>20</td>
<td>N/A</td>
</tr>
<tr>
<td>India</td>
<td>Biotech Industry Research Assistance Council (BIRAC)</td>
<td>60</td>
<td>Lower-middle income</td>
<td>2012</td>
<td>60</td>
<td>18</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Information Communication Technology Agency (ICTA)</td>
<td>90</td>
<td>Lower-middle income</td>
<td>2003</td>
<td>150</td>
<td>4</td>
</tr>
<tr>
<td>Armenia</td>
<td>Enterprise Incubation Foundation (EIF)</td>
<td>59</td>
<td>Lower-middle income</td>
<td>2002</td>
<td>80</td>
<td>1</td>
</tr>
<tr>
<td>Georgia</td>
<td>Georgia Innovation and Technology Agency (GITA)</td>
<td>68</td>
<td>Lower-middle income</td>
<td>2014</td>
<td>32</td>
<td>0.7</td>
</tr>
<tr>
<td>Serbia</td>
<td>Innovation Fund (IF)</td>
<td>62</td>
<td>Upper-middle income</td>
<td>2011</td>
<td>17</td>
<td>1.98</td>
</tr>
<tr>
<td>South Africa</td>
<td>Technology Innovation Agency (TIA)</td>
<td>57</td>
<td>Upper-middle income</td>
<td>2009</td>
<td>165</td>
<td>30</td>
</tr>
<tr>
<td>Colombia</td>
<td>iNNpulsa</td>
<td>65</td>
<td>Upper-middle income</td>
<td>2012</td>
<td>70</td>
<td>26.1</td>
</tr>
<tr>
<td>Lebanon</td>
<td>Kafalat</td>
<td>81</td>
<td>Upper-middle income</td>
<td>1999</td>
<td>29</td>
<td>11</td>
</tr>
<tr>
<td>Turkey</td>
<td>Technology Development Foundation of Turkey (Türkiye Teknoloji Geliştirme Vakfı, TTGV)</td>
<td>43</td>
<td>Upper-middle income</td>
<td>1991</td>
<td>28</td>
<td>4</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Malaysian Technology Development Corporation (MTDC)</td>
<td>37</td>
<td>Upper-middle income</td>
<td>1992</td>
<td>134</td>
<td>45</td>
</tr>
<tr>
<td>Croatia</td>
<td>Agency for small and medium enterprises (SMEs), Innovations, and Investments (Hrvatska Agencija za Malo Gospodarstvo, Inovacije i Investicije, HAMAG-BICRO)</td>
<td>41</td>
<td>Upper-middle income</td>
<td>2014</td>
<td>47</td>
<td>12</td>
</tr>
<tr>
<td>Poland</td>
<td>National Centre for Research and Development (Narodowe Centrum Badań i Rozwoju, NCBR)</td>
<td>38</td>
<td>High-income</td>
<td>2007</td>
<td>360</td>
<td>1,140</td>
</tr>
<tr>
<td>Singapore</td>
<td>Standards, Productivity, and Innovation Board (SPRING)</td>
<td>7</td>
<td>High-income</td>
<td>1996</td>
<td>500</td>
<td>60-70</td>
</tr>
</tbody>
</table>

Source: Project team’s compilation.
Note: GII = Global Innovation Index.
This section presents the seven building blocks to position innovation agencies for success. These building blocks are derived from an analysis of the 14 agency case studies and are meant to provide policy practitioners with specific considerations for the establishment and operation of new agencies—or for repositioning existing ones—within a developing country context. Each innovation agency examined in the study is unique in terms of its establishment, structure, and policy interventions. Some agencies focus on improving innovation within specific sectors, while others focus on improving key aspects of a country’s overall innovation environment.

Despite these significant differences across agencies, the seven building blocks are common prerequisites shared by well-functioning agencies. These building blocks reflect important considerations as innovation agencies evolve, including: clear but adaptable mission, capable staff, effective governance and management structures, diagnostic-based interventions, robust monitoring and evaluation (M&E), sustainable funding, and strategic partnerships and networks. While the building blocks are presented sequentially, it is nonetheless important to note their interdependency (see Figure 2). While this report does not evaluate innovation agency performance, it is difficult to imagine an effective agency that has yet to embody all these important building blocks over the course of its development.

Most of these building blocks relate to the strategic as well as managerial capabilities of organizations. Strategic capabilities of agencies are those related to “big-picture” directions, such as the capabilities to define and adjust the agency’s mission within the NIS based on a robust M&E framework, as well as the ability to secure adequate and sustainable funding. Managerial capabilities of agencies are those related to internal operations of the organizations, which allow for staff and teams to grow, learn and establish conducive partnerships. Very importantly, both types of capabilities need to complement each other and constantly develop to address the evolving needs of the NIS. Equipped with both types of capabilities, innovation agencies are likely to bring together the seven building blocks and play a leadership role in the advancement of the NIS.

2.1. Clear but Adaptable Mission

The rationale for establishing an agency must be based on the identification of market, coordination, and institutional failures in the NIS, which may change over time as the needs of the NIS evolve. Agencies in
this study were typically established to address specific needs within the NIS of their respective countries. The establishment of an effective innovation agency is likely to depend on the capability of a country to understand the function and failures of its NIS, as well as a related national innovation strategy that seeks to remedy these failures. Within this context, a clear agency mission provides direction for operational action, especially the creation of specific policy interventions (discussed in section 2.4 below). Moreover, a clear mission enables the agency to possess a differentiated purpose from and clear lines of authority to other support organizations responsible for implementing innovation strategy.

The role and mission of the agency can be focused towards basic development outcomes, or more specialized innovation targets, as relevant for the level of development of the NIS. For example, India’s BIRAC was established with the clear mission of improving the research and innovation capabilities of Indian biotech companies. The mission was motivated not only by the desire to build a rapidly-growing, competitive biotechnology industry, but also by the goal of reducing the costs of biotechnology products to better meet India’s health-related needs. The Rwanda Development Board’s ICT Unit (RDB-ICT) similarly established a clear mission to provide leadership for the country’s ICT industry and to help meet related public needs. RDB-ICT has done this by focusing on developing a national fiber-optic backbone, improving rural broadband access through a national network of cybercafes, and overseeing the provision of laptops to thousands of children in collaboration with international partners. Sri Lanka’s ICTA was similarly established with a clear mission of providing policy leadership and interventions to develop that country’s ICT industry. The founding mission not only included the establishment and implementation of an industry development roadmap, but also prioritized the application of emerging ICT industry capabilities to public needs, such as the digitalization of government and hospital functions.

As markets and related challenges evolve, so too must innovation agencies adapt their missions to evolving NIS needs to enhance their relevance and impact. Poland’s NCBR, for example, adapted its mission from one focused on supporting academic research to a mission focused on supporting firm-level technology development, including through private-public partnerships (PPPs). Mission adaptation was inspired by program evaluations showing that NCBR’s focus on academic research
neglected other innovation-related needs in the NIS, and that technologies derived from university research and development (R&D) were often not disseminated or further developed. NCBR’s mission adaptation thus guided the design and implementation of its new policy interventions, which now engage universities not as research leads but as partners in firm-focused innovation projects.

2.2. Capable Staff

Capable staff are a critical building block for a successful innovation agency. In some of the cases, visionary, dedicated individuals were critical to the establishment of innovation agencies and their ongoing leadership remains critical to the agency’s effectiveness. However, the emergence and achievements of these leaders was context specific and difficult to replicate. Thus, this leadership-centric approach should not overshadow the importance of good management practices and nurturing overall organizational and staff capabilities.

Having capable staff with private sector experience is essential for the agency to establish trust among prospective beneficiaries. While a variety of staff in terms of career backgrounds is needed, experienced individuals with private sector background can be especially instrumental for innovation agencies due to two main reasons. Firstly, staff with a private sector background and access can facilitate trust building with beneficiaries, through existing knowledge of firms and entrepreneurs and connections to business networks and investors. Secondly, the private sector typically features a different culture and pace from that of public institutions and thus having leaders with private-sector management knowhow can improve the agency’s effectiveness in working with entrepreneurs as well as national and international investors, corporations, partners, and donors. To this end, while maintaining a balanced profile of administrators, innovation agencies should include in their ranks experienced professionals with a private-sector background and connections.

Innovation agencies must build organizational capabilities to recruit, hire, and cultivate capable staff. Agency performance depends on a capable staff who possess the relevant experience and skills to work with a variety of individuals, especially entrepreneurs, investors, industry officials, and technologists. Human resource capabilities thus provide the mechanism for recruiting these individuals and, once hired, their mentoring and training. For example, Colombia’s INNpulsa is known to hire highly qualified and effective staff, and its alumni later on take up influential positions in the broader economy. Similarly, South Africa’s TIA hires outside of the civil service to attract top talent, which not only provides opportunities for finding talented personnel, but also allows some flexibility to reduce the workforce if needed.

Besides proactively recruiting new talents, innovation agencies can benefit from external support to enhance the capabilities of its staff. For example, Serbia’s IF has benefited from close cooperation with donor partners and external experts in developing its in-house capabilities, and also in establishing mentoring relationships between staff and individuals on its investment committee as well as former innovation advisors from Israel, Poland, and the USA. Further, IF staff participate in periodic study visits to agencies and other innovation support organizations in countries such as Israel, Finland, and the United Kingdom. Leveraging the expertise and networks of skilled diaspora members and entrepreneurs is also key for agencies seeking to augment their internal capabilities and achieve international reach. Unfortunately, some agencies in the study have been unable to maintain a core staff of capable individuals. Georgia’s GITA, for example, has not been able to maintain a capable core staff to advance the mission of the agency due to irregular and insufficient funding (sustainable funding is discussed in Section 6 below).

2.3. Effective Governance and Management Structures

Effective governance and management structures bolster the performance and credibility of an innovation agency by balancing two competing goals - autonomy versus oversight. Innovation agencies should possess the organizational autonomy and flexibility needed to work with industry and adapt to a rapidly changing economy. At the same time, innovation agencies should also operate with guidelines and oversight to meet the accountability requirements that come with the status and funding of a public or quasi-public organization. Several factors should be considered in the design and operation of effective governance and management structures, including sources of funding, legal authority to accept funding from other agencies or international donors, and flexibility to respond to rapidly changing domestic and international market conditions. However, the primary goal of governance and management structures should be to support the ability of agency staff to make decisions based on their professional judgment and, given the strategic positioning of the agency within the NIS, to guarantee its autonomy.
There is no ideal model for the governance of innovation agencies; rather, there are different models that come with organizational and operational strengths and weaknesses related to the tradeoff between autonomy and oversight. Table 2 provides an overview of types of governance structures represented by innovation agencies considered in the study, including ministerial unit, government agency, government agency with high autonomy, and non-profit PPP. Several agencies have external bodies that play an important role in their governance and management. For example, Lebanon’s and Serbia’s IF established external investment committees of private-sector advisors (including diaspora members) to review and validate agency funding decisions and to reassure investment partners and donors.

### Table 2. Governance structures of innovation agencies

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
</table>
| Ministerial unit   | An office or department within a ministry (economy or industry, usually) that reports to the minister and receives allocations from the ministry’s budget.                                                                 | • Controlled and aligned with the ministry/government strategy.  
• Accountability may be easier, as activities will be subject to government budget scrutiny.                                                                 | • Hampered by bureaucracy.  
• Short-term political pressures.  
• Resource constrained.  
• Weak access to and know-how of firms’ and entrepreneurs’ needs |
| Example:          | An increasingly rare occurrence for management of innovation funding. This practice was prevalent in several post-transition economies where special ministerial cells/teams directly evaluated and provided funding for research/innovation. South Africa’s TIA was established through an Act of Parliament, and is governed by a board that reports to the Department of Science and Technology (DST). The board is appointed by the minister to serve for a period of five years. TIA is fully funded by government through an annual funding allocation from the national Treasury. Its strategy aligns with and is approved by the Ministry of Science & Technology. Before the recent influx of European structural funds for smart specialisation, Poland’s enterprise innovation funding (negligible at the time) was financed directly by the Ministry of Economy. Today given the influx of EU funds, Poland’s NIS includes several major national agencies (for science, research, innovation, and enterprise development). In Serbia, Sri Lanka, and Ukraine, this remains the practice for public research funding. |
| Government agency  | A formal governmental bureaucracy under direct political control.                                                                                                                                                                                                     | • Dedicated agent with clear remit.  
• Improve agency’s ability to plan for the long term.                                                                                                                                                                           | • Operational constraints.  
• Resources dependent on public budget.  
• Possibly more political pressures to pursue certain favored sectors without sufficient market input/discipline.  
• May have less flexibility in hiring and retaining the skills to make the agency relevant. |
<p>| Example:          | Poland’s NCBR is the country’s largest R&amp;D funding agency. Established as a government agency in 2007, it is supervised the Minister of Science and Higher Education (S&amp;HE). Since 2011, NCBR’s budget has been to a large extent financed from EU funds, necessitating two streams of reporting: to the Minister of S&amp;HE and to the Minister of Investment and Economic Development, who finally reports to the European Commission. |</p>
<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
</table>
| Government agency with high autonomy     | An agency owned by the government but with a degree of autonomy and flexibility to derive its funding from multiple sources (e.g. from donors or private sector). | • Quasi-flexible operating rules.  
• Freedom to hire competent staff.  
• Improve the agency’s ability to plan for the long term.  
• Governance can improve as external financiers may have vigorous standards for M&E and other accountability mechanisms. | • Effectiveness depends on the ability of politicians to let the market dictate rather than get too involved in day-to-day decision making.  
• The government may not need to commit with many resources if there is “free money” from other funders. |
| Nonprofit public-private partnership     | A separate legal entity, often a nonprofit organization or foundation.       | • Combines resources from public and private sources.  
• Led and managed by the private sector.  
• Involvement of the private sector is useful to establish credibility in the market and develop services that are relevant to firms. | • May drift from public sector priorities.  
• Needs to contentiously inform public sector management to ensure alignment.  
• Risk of straying from mission as activities are adapted to “follow the money.” |

Example: Colombia’s iNNpulsa is a government-owned agency. While the agency receives funding from Banco de Comercio de Exterior, both depend on and report to the Ministry of Trade, Industry and Tourism. iNNpulsa has autonomy to acquire funding from a variety of sources, primarily different parts of government, which it does on an annual basis. The Serbia IF was established using EU funds, administered by the World Bank. The Serbian government is to assume financial responsibility for its operational budget and core enterprise innovation programming post-pilot once vetted.

Example: Armenia’s EIF is a PPP whose board comprises various stakeholders, including leaders from the government, industry, and academia. This structure allows the EIF to accept funding and in-kind resources from governments and international organizations for its operations. Turkey’s TTGV is a not-for-profit PPP that has received some initial government funding but now relies on service and investment income. TTGV’s board includes both public and private sector members.

Source: World Bank
2.4. Diagnostic-based Interventions

Agencies must develop diagnostics to understand NIS gaps and global trends to inform evolving agency missions and to design and implement policy interventions. Essentially, programs and policy interventions are the mechanisms through which innovation agencies address market and systems failures and thus strengthen their respective country’s NIS. For example, Sri Lanka’s ICTA has deployed a periodic market survey to understand domestic and global trends in the ICT industry, including workforce growth and needs, industry size, foreign market penetration, and revenue growth. ICTA uses this analysis to guide the design of new programs and update existing technical assistance, workforce development, and entrepreneurship support programs. Poland’s NCBR similarly adjusted the design of its innovation programs over time to focus on firm and industry-level technology commercialization, based on ongoing diagnostics.

Across different contexts, innovation agencies have implemented a wide range of programs and policy interventions to address NIS gaps. Table 3 summarizes the range of policy instruments adopted by the studied agencies, with examples showcasing the concrete programs in different countries. The effectiveness of these interventions depends on their implementation, ability to address intended NIS gaps, and adaptation based on evolving NIS needs. Within this context, agency staff must also be willing to undertake experiments through pilot programs that can demonstrate the extent to which interventions are effective within specific contexts.

Especially notable is the gradual development of non-financial interventions by innovation agencies to improve the effectiveness of their respective financial interventions. To enhance the impacts of typical financial instruments (e.g. grants and loans), it is increasingly common to launch complementary technical assistance support, such as firm-focused consultancy and networking services. The range of services might cover business plan development, marketing, intellectual property, and technical problem-solving. Croatia’s HAMAG-BICRO, for example, developed its TEHCRO program to improve firm-level capabilities and networks through consultancy services, in addition to the establishment of incubators and R&D centers.

Table 3. The range of policy instruments adopted by the studied agencies

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<thead>
<tr>
<th>Instrument</th>
<th>Description</th>
<th>Examples</th>
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<tbody>
<tr>
<td>Direct Financial Support</td>
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<tr>
<td>Grants and matching grants for innovation and collaboration</td>
<td>Direct allocation of funding from public agencies to innovation actors to finance all or part of a (collaborative) innovation project. In the case of matching grants, public agencies match a percentage contribution of the project made by the applicant, to ensure applicant commitment to the activity.</td>
<td>• In Georgia, GITA’s microgrant (US$ 2,000) assists very early-stage companies to undertake prototyping and travel. • In Croatia, BICRO’s RAZUM grant program provides enterprises with funding to undertake applied research that may lead to new or improved products or services. • In Serbia, the IF’s collaborative R&amp;D grant scheme provides resources for partnerships between at least one Serbian company and at least one Serbian R&amp;D organizations; additional partners may be included.</td>
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<td>Equity finance</td>
<td>Investments in a particular enterprise in exchange for an ownership stake or agreement to share revenue.</td>
<td>In Poland, NCBR’s Bridge VC and Bridge Alfa programs use privately run and owned venture capital (VC) funds to source projects from academia, screen them, and invest public and private money.</td>
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<tr>
<td>Instrument</td>
<td>Description</td>
<td>Examples</td>
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<tr>
<td>Loans</td>
<td>Money provided to businesses that is often required to be repaid, typically at low interest rates.</td>
<td>In Lebanon, Kafalat offers entrepreneurs a suite of secured loans to be repaid within 5–15 years. Some loan programs target specific industries, such as energy and agriculture, while other loan programs are open to any high-growth industry.</td>
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<td>Vouchers</td>
<td>Certificates that entitle the holder to a certain amount of a particular benefit, typically entrepreneurship support services from accredited providers.</td>
<td>In South Africa, TIA’s Youth Technology Innovation Program (YTIP) enables youth to develop new technologies that can solve market and societal challenges, through vouchers to access mentorship and business support services, and ultimately to be prepared to access other TIA funds and programs.</td>
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<tr>
<td><strong>Indirect Financial Support</strong></td>
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<td>Tax deductions</td>
<td>Tax deductions offer investors the ability to reduce their reported income subject to taxes.</td>
<td>In Singapore, SPRING’s Angel Investors’ Tax Deduction (AITD) program is available to angel investors who are willing to invest at least US$100,000 in a qualifying start-up. Both Georgia and Rwanda provide tax exemptions for investments into the company.</td>
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<td>Loan guarantees</td>
<td>Arrangements to cover some portion of the potential losses experienced by lenders when firms default on loans.</td>
<td>In Lebanon, Kafalat’s core business is offering credit guarantees to SMEs. Kafalat helps the banking system assess risk and understand how to work with SMEs. This secures financing for SMEs in the short term, and boosts learning for the financial sector over the long term.</td>
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<tr>
<td><strong>Non-financial Support (and Other Mechanisms)</strong></td>
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<tr>
<td>Public procurement</td>
<td>Provision of access or preferential treatment enabling SMEs to bid on public procurement contracts.</td>
<td>Through procurement Rwanda has incorporated an ICT-enabled component in its public service delivery model. Examples include the use of Tracnet, a digital platform that has enabled healthcare workers to share HIV/AIDS patient information and monitor drug supplies, and iRembo, an online platform to access a broad range of government services through a 25-year PPP.</td>
</tr>
</tbody>
</table>
| R&D/technology infrastructure programs (e.g. university innovation centers) | Programs that build infrastructure to support research, entrepreneurship, and technology commercialization primarily within public research institutes. | • In Croatia, BICRO’s Development of Technology and Innovation Infrastructure (TEHCRO) program encourages the development of specialized research and incubation facilities within research institutes to encourage and support entrepreneurship in specific technical fields.  
• In Turkey, TTGV has provided financial support for the infrastructure to establish technoparks at Bilkent University (Bilkent Cyberpark) and Istanbul Technical University (Ariteknokent). |
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<tr>
<th>Instrument</th>
<th>Description</th>
<th>Examples</th>
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| Early-stage support (e.g. incubation and acceleration)          | Typically a place-based organization that seeks to encourage and support the establishment and growth of start-up companies.                                                                                                                                                                                                                                                                           | • In Armenia, EIF provides a variety of resources, services, and connections to other organizations in support of ICT start-ups.  
• Serbia’s IF deploys an in-house mentoring/training program for its beneficiary start-ups and SMEs.                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                             |
| Technology transfer office (TTO) programs                       | Programs designed to help universities and research institutes establish offices of technology transfer.                                                                                                                                                                                                                                                                                                   | • In Colombia, iNNpulsa provides competitively awarded grants that enable universities to establish TTOs to help scientists and entrepreneurs protect and manage intellectual property.  
• In Serbia, the IF developed a national Technology Transfer Facility.                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                             |
| Advisory services (e.g. on technology extension and/ or business operations) | Programs that help entrepreneurs improve a wide range of technical and operational functions for their company.                                                                                                                                                                                                                                                                                             | In Malaysia, MTDC’s Advisory and Value-Added Services (AVAS) division provides advisory services for recipients of MTDC funds. Constituent advisory capabilities include marketing, technical assistance, fundraising, technology development, accounting, and law.                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                             |
| Quality infrastructure, including standards, metrology and testing | Part of a country’s framework conditions for innovation that provide the basic facilities and services for quality assurance and standardization.                                                                                                                                                                                                                                                            | In Singapore, SPRING was established as a quality standards agency. While its mission has expanded, it still manages national schemes that certify enterprises based on their capability to meet quality-related performance standards.                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                             |
| Inducement prizes and recognition awards                        | Awards linked to an individual or organization that can successfully address a specific problem. Hosted events that create excitement and awareness of innovation and an agency’s support programs                                                                                                                                                                                                                                                                                                                                                                           | • In India, BIRAC, in partnership with NESTA, makes period awards to talented innovators who develop new, effective diagnostics for antimicrobial resistance.  
• iNNpulsa’s “Heroes Fest” is an entrepreneurship celebration in Colombia. The event convenes well-known entrepreneurs from Colombia and other countries to generate excitement among potential entrepreneurs.                                                                 |                                                                                                                                                                                                                                                                                                                                                                                             |

Source: World Bank

### 2.5. Robust Monitoring and Evaluation

**M&E provides the foundation for evidence-based policy making.** For innovation agencies, M&E provides the diagnostic capabilities that guide decisions to continue, modify, or sunset programs based on their progress or impact. M&E is not only limited, however, to understanding the effectiveness of specific programs and policies, but also to understanding the overall impact of the agency.

This understanding of overall agency impact provides an important input for adapting agency missions and demonstrates agency effectiveness to stakeholders, and thus serves as an important basis for obtaining financial and political support.

**Incorporation of M&E mechanisms in the policy design process is essential for the effectiveness of the interventions, its sustained impact, and should not be an afterthought.** The Public Expenditure Review for Science, Technology, and Innovation (PER...
STI) methodological approach\(^6\) can be a useful tool for policymakers to assess the functionality and efficiency of their institutional and program design and implementation. For example, the World Bank has worked with iNNPulsa (Colombia) to carry out a functional and efficiency analysis, which helped identify deficiencies in the policy design and implementation process. Such activities could assist program managers in defining the logical framework for assessing progress and evaluating the effectiveness of their interventions. Ex-post evaluations, which focus on identifying the impact of policy interventions, can take place after the implementation of the policy intervention and only if the proper collection systems were established at the onset and maintained during program implementation. Impact evaluations have become increasingly important as policy makers seek to understand the additionality of public funding, and to justify the renewal, adjustment, or termination of a policy intervention. While only few of the cases studied in this report has undergone rigorous impact evaluations to their programs, their importance can’t be emphasized enough.

Innovation agencies should ideally develop their own internal M&E capabilities so that evaluation efforts can be integrated into the development and implementation of new interventions. Establishing M&E capabilities is a resource intensive endeavor; only a few agencies in the study, including Armenia’s EIF, Sri Lanka’s ICTA, Malaysia’s MTDC, and Singapore’s SPRING, have established dedicated M&E units. Though it doesn’t have a dedicated M&E unit, India’s BIRAC built these capabilities by establishing a standing external evaluation committee which is comprised of two to three technical experts and one financial analyst to monitor and guide funded projects.

When internal M&E capabilities are not available or deemed inappropriate, innovation agencies may draw upon other interim M&E approaches, such as commissioning well-respected organizations and consultants to conduct regular evaluations and audits. Serbia’s IF, for example, retained an independent consultant who conducts annual financial audits, has undertaken ad-hoc program evaluations, and has established data collection protocols. Colombia’s iNNPulsa and Croatia’s HAMAG-BICRO commissioned outside organizations to evaluate specific programs in 2014 and 2011, respectively, while Turkey’s TTGV benefitted from a World Bank evaluation of its programs in 2006. While one-off evaluations constitute an important first step, they are limited in their ability to provide sustained program insights, compared to internal M&E capabilities.

Finally, while M&E should guide agency interventions, they can also be used to improve specific agency functions and overall agency operations. South Africa’s TIA, for example, has institutionalized a periodic customer satisfaction survey to understand challenges faced by clients. Based on survey results, the agency has already re-engineered its application processes, improving the speed of application review, decision approval, and award disbursement. The annual survey also resulted in the establishment of an independent process for resolving disputes and decision appeals.

2.6. Sustainable Funding

Given that the returns to innovation investments are often uncertain, sustained funding is an especially important building block to enable the effective functioning of innovation agencies. During the initial years of establishment, sustainable funding is extremely critical to enable the hiring and training of a capable staff, the design and implementation of policies, and the establishment of M&E protocols. A sustained commitment from governments is particularly valuable during the early years of an agency. However, overreliance on government funding may mean significant fluctuations in funding, thus jeopardizing program continuity and effectiveness, if not agency existence. The budget of Colombia’s iNNPulsa, for example, relies primarily upon government funding, and its budget has fluctuated from $3.8 million in 2012, to as high as $21.4 million in 2013, and then to $1.4 million in 2016, which created substantial operational and programmatic challenges. Georgia’s GITA has had similar challenges maintaining a sustainable funding source affecting the agency’s ability to maintain a capable staff.

Proactive agencies cultivate multiple funding sources to enhance program offerings and diversify their portfolios. As shown in Table 4, in addition to government sources, innovation agencies can obtain funding from super-national organizations such as the European Union (Poland’s NCBR and Serbia’s IF), international donors such as United States Agency for International Development (USAID), international finance institutions such as the World Bank (Armenia’s EIF), and charitable organizations such as the Bill and Melinda Gates Foundation (India’s BIRAC). Innovation agencies can serve as a platform through which other government agencies can utilize the agency’s resources to conduct innovation-related projects.

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as is in the case of Malaysia’s MTDC. Agencies can also cultivate their own income sources by earning income off previous equity investments in startup companies (e.g., Turkey’s TTGV) or by charging clients a nominal fee for its innovation services (e.g., Sri Lanka’s ICTA). Finally, innovation agencies can help establish and participate in PPPs, drawing upon industry partners not only as a potential source of funding but also an important partner to spur innovation.

Table 4. Different sources of financial support for innovation agencies

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<th>Source</th>
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<th>Examples</th>
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<tr>
<td>Central government</td>
<td>Innovation agencies may spring out of broad national initiatives—such as economic transformation visions, poverty reduction strategies, or national digitization efforts—and secure funding through these efforts.</td>
<td>Rwanda's RDB receives its mandate from the central government, and its activities are closely aligned with the SMART strategy, which supports poverty reduction through many aspects of the economy and affects numerous agencies and organizations across the board. In Sri Lanka, ICTA was mandated to lead the country's digitization efforts.</td>
</tr>
<tr>
<td>Domestic ministries/government agencies</td>
<td>Other mission-oriented agencies within the country can provide funding and technical assistance important to the success of the innovation agency.</td>
<td>Malaysia’s MTDC supports its individual programs using funding from a variety of Malaysian government sources. MTDC possesses expertise and infrastructure important to advancing innovation, but within the context of other agency missions. For example, the MTDC Bumiputra Expansion Fund is funded by the Bumiputra Expansion Fund to encourage and support entrepreneurship among native Malaysian populations.</td>
</tr>
<tr>
<td>International partners</td>
<td>Many agencies from developed countries offer resources and technical assistance designed to support economic and social development within the developing world.</td>
<td>In India, BIRAC’s partnerships with the World Bank and development agencies in France, Australia, and the United States provide funding and technical assistance important for fulfilling its mission of developing innovation to address relevant socially-oriented product development needs (such as the development of Rotavirus vaccine).</td>
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<tr>
<td>Multinational or international organizations</td>
<td>Increasingly, multinational and international organizations are including entrepreneurship and innovation programs as part of their overall economic development programming.</td>
<td>The EU and World Bank were involved in the establishment of Serbia’s Innovation Fund (IF). The EU provided valuable pre-accession funds, while the World Bank supported the establishment of the IF’s operations and governance structures, and the launch of its flagship pilot programs for early-stage tech entrepreneurship, SME innovation, tech transfer, and collaborative research.</td>
</tr>
<tr>
<td>Charitable foundations</td>
<td>Large, charitable foundations play an increasingly important role in funding the advancement of innovation in areas that also contribute to social goals within developing countries, such as addressing health, climate change, and food security.</td>
<td>In India, BIRAC works with several charitable foundations, including the Bill and Melinda Gates Foundation and the Wellcome Trust, to obtain financial resources and access to expertise to address critical technical problems important to the economic and social development of India.</td>
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2.7. Strategic Partnerships and Networks

The final building block, strategic partnerships and networks, enables innovation agencies to connect to financial resources as well as technical and other specialized capabilities important to the operation and impact of the agency. Domestically, partnerships can on the one hand provide resources, capabilities, and political support for the agency, and on the other hand, empower innovation agencies to demonstrate effectiveness and gain the trust of NIS stakeholders, especially that of private sector actors. Internationally, partnerships can provide innovation agencies with access to resources and specialized technical expertise not available within their respective countries. Connections with diaspora professional networks and successful entrepreneurs can provide access to knowhow, expertise, and markets. In addition, international partnerships can potentially connect domestic companies to partners and markets abroad, offering opportunities for export growth.

Lebanon’s Kafalat owes its existence to a unique partnership of financial institutions, including the National Institute for the Guarantee of Deposits and several commercial banks. Several of Kafalat’s programs are also supported through strategic partnerships with international organizations. The agency’s partnership with the European Union and Lebanese Ministry of Agriculture, for example, provides the Kafalat Agriculture program with both financial support and technical expertise to improve outcomes from agency funding and loan guarantee programs.

India’s BIRAC has developed strong networking capabilities and benefitted from strategic partnerships with a variety of international organizations that not only supplement the budget of the agency (by as much as 10-15%), but also help to build critical biotechnology capabilities within India and advance the country’s social and economic development goals. For example, BIRAC partnered with the Bill and Melinda Gates Foundation to establish the Grand Challenges India (GCI) program. The program funds scientific and technological research to advance health outcomes in India as well as in other developing countries. Similarly, BIRAC and Australian government have established a partnership (Horticulture Innovation Australia) to develop sustainable and productive horticultural products through the development and deployment of modern plant biotechnology. BIRAC’s partners also include the Wellcome Trust, UK’s NESTA, and USAID, among many others.

Armenia’s EIF has established a PPP model that focuses on building long-term relationships with international ICT companies, including Microsoft, Cisco Systems, Sun Microsystems, Hewlett-Packard, and Intel. EIF provides these companies with facilities and connects them with Armenian educational institutions, while the companies provide exposure to the latest ICT technologies as well as ICT curricula and standards. In addition, the international companies can help Armenian entrepreneurs connect with individuals and organizations outside of Armenia. These partnerships thus build technical and entrepreneurial capabilities among Armenians while providing partner companies with an understanding of and rapid entry into local markets.

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<th>Source</th>
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<tr>
<td>Fee-based services</td>
<td>Once an innovation agency has demonstrated its value to the NIS, it may charge fees for services.</td>
<td>Sri Lanka’s ICTA has shifted towards a revenue-based business model to bolster its operating sustainability.</td>
</tr>
<tr>
<td>Investment income</td>
<td>An agency may be able to earn income from direct equity investments in its portfolio of companies.</td>
<td>Turkey’s TTGV is currently pivoting towards a business model whereby it makes its own investments within what it considers as high potential sectors. TTGV is a limited partner in VC and private equity funds.</td>
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CASE STUDIES

This section presents individual case studies of selected innovation agencies. Each case follows a standard structure, addressing key dimensions of the innovation agency; from basic facts (size, timeline of establishment and evolution), its overall positioning in the respective innovation system (strategic roles and complementary agencies), technical aspects such as the agency’s policy design capacity and business models, and finally, a summary of M&E evidence available that indicates the effectiveness and impacts of the agency activities. The cases are descriptive by nature and intended to share insights with policy makers and practitioners interested in designing and/or reforming innovation agencies, as well as researchers who are interested in further developing the knowledge base in this field. A more detailed discussion of the methodology is included in the Appendix.
3.1. Biotech Industry Research Assistance Council (BIRAC) in India

Overview

Biotechnology Industry Research Assistance Council (BIRAC) is a not-for-profit Section 8, public sector enterprise set up by the Department of Biotechnology (DBT) as an interface agency to stimulate, foster, and enhance the strategic research and innovation capabilities of the Indian biotech industry, particularly start-ups and small and medium-sized enterprises (SMEs). Its aim is to strengthen and empower emerging biotech enterprises to undertake strategic research and innovation, addressing nationally relevant product development needs.

Key Takeaways

BIRAC is the first public sector organization to be set up to promote industry partnership and innovation research for affordable product development in India.

Biotechnology is a key component of India’s growth story, especially as it has the potential to further catalyze the growth of the Indian economy in several areas such as health care, agriculture, green energy, and environmental sustainability. India therefore established BIRAC in 2012, especially to facilitate the role of world-class research and development (R&D) by start-ups and SMEs in building high-quality biotechnology products.

BIRAC is a key contributor to the present government’s ‘Make in India’ and ‘Start-up India Mission’ initiatives, which have detailed action plans to promote and nurture the innovation research ecosystem in India with special focus on start-ups and SMEs. The strategic initiatives open up numerous opportunities for investments across various sectors, especially high-value manufacturing in biological pharmaceuticals (biopharma: vaccines and biosimilars) and medical technologies.

BIRAC’s national and global partnerships between academia and industry support translational research.

Role in the Country’s National Innovation System

The core function of the agency is to provide support for discovery technologies, product development/translation, and technology diffusion across different sectors, such as public health, agriculture, green technology, and industrial processes. BIRAC aims to positively impact the biotechnology industry sector by providing access to risk capital for early and late-stage innovation research for affordable product development, facilitating product innovation and commercialization through incubation, technology transfer, acceleration, and grand challenges, and by aiding the support system for building enterprises.

BIRAC works with multiple parts of the biotechnology value chain, from nurturing talent and entrepreneurship development, to supporting commercialization from start-ups and other firms, helping with technology adoption, industry-research partnerships, and support to social enterprises.
Country Indicators

GDP, PPP: US$ 9.5 trillion (2017)

GDP per capita: US$ 1,942 (2017)

Gross Expenditures on R&D (GERD): 0.6% of GDP (UNESCO, 2015)

World Economic Forum (WEF) competitiveness rank: 40/178 (2017)

Complementary Agencies

The Ministry of Science and Technology, which oversees innovation policy activities, including human and institutional capacity-building, community engagement, and science, technology and innovation (STI) policy support, includes three departments: the Department of Biotechnology (DBT); the Department of Science and Technology (DST) which plays a pivotal role in promoting science and technology; and the Department of Scientific and Industrial Research (DSIR) which supports industrial R&D and technology transfer activities. While BIRAC funding is crucial for start-ups and SMEs, other similar agencies under DST and DSIR provide funding and policy for capacity building, technology transfer, and commercialization. Of these, the National Science and Technology Entrepreneurship Development Board (founded in 1982) promotes knowledge-driven and technology-intensive enterprises, while the National Research Development Corporation has promoted the commercialization of the technologies since 1953. The Technology Information, Forecasting and Assessment Council, set up in 1988, operates under the DST to look ahead in the technology domain, assess technology trajectories, and support innovation by networked actions in areas of national importance. The Biotech Consortium India Limited, established in 1990, is a public limited company promoted by the DBT to assist in technology transfer, project consultancy, fund syndication, information dissemination, training, and placement related to biotechnology. All India Financial Institutions, a group of development finance institutions, provides the necessary linkages among stakeholders and business support to facilitate accelerated commercialization of biotechnology. The Council of Scientific and Industrial Research, an autonomous body under the Ministry of Science and Technology, is an R&D organization that brings together commercial innovations from public and private R&D labs as well as academic institutions.

Private initiatives include the Global Innovation & Technology Alliance, a non-profit public-private partnership that supports and enables technology-driven enterprises; and the Millennium Alliance, an inclusive platform to leverage Indian creativity, expertise, and resources to identify and scale innovative solutions being developed and tested in India to benefit developing populations across the world.

Roles, Capabilities, and Organization

Origins and Evolution

Mandate

BIRAC is a nodal funding agency for the biotechnology industry, evolving from the DBT’s Biotechnology Industry Research Assistance Programme (BIRAP), which transformed into a not-for-profit Sector 25 company in 2012. Now, as a Sector 8 company under the aegis of the DBT, BIRAC’s mandate is to catalyze the transformation of the rapidly growing biotechnology sector in India to global excellence and usher in an impactful biotech economy.

To implement its vision, BIRAC’s strategy has been to first identify gaps in the biotech innovation ecosystem and then design solutions that address these gaps. BIRAC’s funding mechanism encompasses the full range of the product development pipeline from ideation to proof of concept, and to later stages, including validation, scaling-up, and commercialization.

BIRAC has a number of partnership models, both national and international. They include collaborations with innovation and development agencies such as the Gates Foundation, USAID, Tekes, Ministry of Electronics, and India Council of Medical Research. These partnerships have provided access to co-funding, access to international markets, skill development and mentorship, and access to research facilities.

Sectoral Focus

BIRAC’s mandate extends across all domains of bio- and medical technology, such as biopharma, bio services, bio industrial, bio agriculture, and bio information technology (IT). It aims to:

• Trigger, transform, and tend to biotech start-ups to convert innovative research in the public and private
sectors into viable and competitive products and enterprises;

- Conceptualize and support the development of affordable, novel, deployable products and technologies used for manufacturing in the health care, agriculture, environment, bio-energy, and other industrial sectors, through public-private partnerships;

- Support and strengthen SMEs through gap-filling interventions that facilitate high-risk research, innovation, and product development. This includes financial, infrastructural, institutional, and mentoring support to reduce barriers to entry for SME entrepreneurs.

- Encourage knowledge-sharing and networking among biotech entrepreneurs at national and international levels to maintain scientific and technological advantages;

- Offer policy and institutional support for all stakeholders involved in converting biotechnological innovations into enterprises.

**Business Model Evolution**

BIRAC’s evolution has largely occurred through experience from programming and observations about the ecosystem through interactions with the industry and scientific communities. Some specific observations include the need to address particular challenges or bottlenecks to collaboration and innovation. For example, BIRAC has described the mindset of stakeholders as a persistent hurdle to collaboration between academia and industry. Communication of impact has also been seen as a weak point in India’s innovation economy, spurring a more focused communication strategy within BIRAC. In addition, harnessing talent from universities effectively has proven difficult, as has helping the academic sector align itself towards commercial activities. These observations guide BIRAC’s evolving strategy.

BIRAC’s management has now realized the need to consolidate its programs and focus on its three core vertical programs:

- Investment, which addresses funding from the idea stage to proof of concept;

- Entrepreneurship Development, which provides infrastructure, mentoring, and other business start-up assistance; and

- Strategic Partnerships, which leverages resources and expertise in both domestic and international networks.

**Organizational Structure**

**Organizational and Reporting Structure**

BIRAC is a public sector not-for-profit company under the DBT within the Ministry of Science & Technology. BIRAC’s overarching mandate, mission, and vision are outlined in its inception document and the articles of association. Its key strategies are developed within this framework and in consultation with stakeholders and revisited every two years.

BIRAC’s board of directors is empowered to design and approve its strategy and program. The board comprises seven directors: an executive chairman, an executive managing director, four independent directors, and a government-nominated director. The board’s members are primarily from academia, with backgrounds in the not-for-profit sector, the sciences, and government. Most have substantial international experience.

In addition to the board, BIRAC is guided by an apex board and technical expert committees for each program. These committees include senior experts, scientists, industry leaders, and international experts.

**Budget Sources and Allocations**

BIRAC’s core budget for operations comes from the government of India; the budget for its programs is divided, with about 90% from the government and 10% from international partners. BIRAC receives funding support primarily from the DBT, but also actively partners with other departments, such as the Department of Electronics and Information technology (DeitY). It also receives funding from international agencies, such as the Gates Foundation and the Wellcome Trust. Such agency funding has gradually increased by about 10-15% annually.

In 2016, BIRAC received grants for program execution of Rs 910,428,612 (approximately US$ 14 million) complemented by other income of Rs 28,145,121 (approximately US$ 400,000). This was an increase from Rs 748,345,941 (approximately US$ 12 million) in grant allocations and Rs 11,624,247 (approximately US$ 200,000) in the previous year. The program expenditure in 2016 was Rs 801,354,655 (approximately US$ 12 million)—about 88% of total expenditure. BIRAC provided Rs 154 million (approximately US$ 2 million) to start-ups and entrepreneurs, Rs 723 million (approximately US$ 11 million) to SMEs and other companies, and Rs 212 million (approximately US$ 3 million) to incubation centers.
In the budget, funds have been earmarked through special purpose vehicles, which have been approved by the Department of Economic Affairs (DEA) and the World Bank. These include BIRAC, with Rs 10 billion (US$ 150 million) for bio-manufacturing; Rs 7.5 billion (US$ 115 million) for scaling up Indian biotech SMEs and start-ups; and Rs 15 billion (US$ 230 million) for launching vaccines, biopharmas, R&D for biomedical devices, product development, and facilities.

BIRAC has supported 384 companies through its programs. The total funding received by these companies is Rs 15.74 billion (US$ 230 million), of which BIRAC’s contribution is Rs 7.49 billion (US$ 110 million), while the industry has committed Rs 8.25 billion (US$ 120 million). This leveraged co-financing from the industry suggests that, despite the overall nascentness of the industry in India, given the right funding tools, its appetite for R&D is increasing.

Human Resources and Skills

The compensation structure for BIRAC’s 60 employees is designed to ensure that performance is rewarded and to create healthy competition. Experts are also contracted for specific time periods based on project need, and paid a lump sum for their contributions. Employee performance is measured by factors such as their knowledge of the job, the quality and quantity of output, initiative, leadership abilities, supervision, dependability, co-operation, judgment, and versatility. Individual action plans are set up for training and development needs, to ensure career growth and continued relevance of skills. BIRAC also attempts to increase gender diversity, provide greater amenities, and foster a cross-functional environment.
Table 5. Operational expenditures

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td></td>
<td>US$ (millions)</td>
<td>Rs (millions)</td>
</tr>
<tr>
<td>Biotechnology Industry Partnership Programme (BIPP)</td>
<td>2.45</td>
<td>159</td>
</tr>
<tr>
<td>Small Business Innovation Research Initiative (SBIRI)</td>
<td>0.94</td>
<td>61</td>
</tr>
<tr>
<td>Bio Incubators Support Scheme</td>
<td>2.77</td>
<td>180</td>
</tr>
<tr>
<td>BIG</td>
<td>3.08</td>
<td>200</td>
</tr>
<tr>
<td>University Innovation Cluster</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Early Translational Accelerator</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Contract Research Scheme (CRS)</td>
<td>1.02</td>
<td>66</td>
</tr>
<tr>
<td><strong>Total grants disbursed</strong></td>
<td><strong>10.25</strong></td>
<td><strong>666</strong></td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>US$ (millions)</td>
<td>Rs (millions)</td>
</tr>
<tr>
<td>Partnership program</td>
<td>0.75</td>
<td>49</td>
</tr>
<tr>
<td>Capacity building</td>
<td>0.06</td>
<td>4</td>
</tr>
<tr>
<td>Technology transfer and acquisition</td>
<td>0.40</td>
<td>26</td>
</tr>
<tr>
<td>Intellectual property services</td>
<td>0.03</td>
<td>2</td>
</tr>
<tr>
<td>Entrepreneurial development/Regional center</td>
<td>0.18</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total activities</strong></td>
<td><strong>1.43</strong></td>
<td><strong>93</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROGRAMME EXPENDITURE</th>
<th>April 2015–March 2016</th>
<th>April 2014–March 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>US$ (millions)</td>
<td>Rs (millions)</td>
</tr>
<tr>
<td>Operational expenditure on advertisement, meetings and project monitoring committee (PMC)</td>
<td>0.65</td>
<td>42</td>
</tr>
<tr>
<td><strong>Total program expenditure</strong></td>
<td><strong>0.65</strong></td>
<td><strong>42</strong></td>
</tr>
<tr>
<td><strong>Total BIRAC expenditure</strong></td>
<td><strong>12.32</strong></td>
<td><strong>801</strong></td>
</tr>
</tbody>
</table>

*Source: BIRAC 2016 Annual Report*
Timeline

Major Internal Events

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>BioNEST launched</td>
</tr>
<tr>
<td></td>
<td>Continued SBIRI (2005) and BIPP (established 2008)</td>
</tr>
<tr>
<td>2012</td>
<td>BIRAC established</td>
</tr>
<tr>
<td></td>
<td>BIG launched</td>
</tr>
<tr>
<td></td>
<td>CRS started</td>
</tr>
<tr>
<td></td>
<td>Began IGNITE in partnership with Judge Business School, Cambridge, U.K.</td>
</tr>
<tr>
<td>2013</td>
<td>Patent Assistance Funding Scheme launched</td>
</tr>
<tr>
<td></td>
<td>SPARSH launched</td>
</tr>
<tr>
<td></td>
<td>BIRAC Regional Innovation Centre (BRIC) in partnership with IKP Knowledge Park, Hyderabad, established</td>
</tr>
<tr>
<td>2014</td>
<td>Industry Innovation Programme on Medical Electronics (IIPME) Scheme launched</td>
</tr>
<tr>
<td>2015</td>
<td>Early Translation Accelerator launched</td>
</tr>
<tr>
<td></td>
<td>SEED Fund established</td>
</tr>
<tr>
<td>2016</td>
<td>ACE Fund launched</td>
</tr>
</tbody>
</table>

Major External Events

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>Liberalization of the Indian economy</td>
</tr>
<tr>
<td>2013</td>
<td>Science, Technology and Innovation Policy adopted by the Ministry of Science and Technology to further the “2010-2020 decade of innovation” campaign and synergize science, technology, and innovation</td>
</tr>
<tr>
<td>2014</td>
<td>“Make in India” initiative launched</td>
</tr>
<tr>
<td>2015</td>
<td>National Biotechnology Development Strategy 2015-2020 launched to establish India as a world-class bio-manufacturing hub</td>
</tr>
<tr>
<td>2016</td>
<td>“Start-up India” launched to build an ecosystem for nurturing innovation and start-ups in the country</td>
</tr>
</tbody>
</table>

Implementation, Capacity, and Programs

About BIRAC programs

BIRAC operates in three verticals: investments, enabling services, and partnerships. Financing applies at every stage: idea, proof of concept, early- and late-stage validation, and product development. Funds are generally provided as grants, with royalty granted for projects in late-stage development, which increases investor confidence and mitigates risk.

Nurturing Innovation Funding

Student Innovations for Advancement of Research Explorations (SITARE) was launched in collaboration with SRISTI, a voluntary organization, to support innovations and creativity among students at IIM Ahmedabad, including individual innovators.

Encouraging Youth for Undertaking Innovative Research through Vibrant Acceleration (eYUVA) supports pre-incubation innovation hubs in five universities to foster the culture of innovation and technological entrepreneurship among university students.

Social Innovation Immersion Fellowship (SIIP) focuses on building the next generation of social entrepreneurs by helping them to interface with communities and identify gaps that can be bridged through an innovative product or service offering developed through this fellowship.

Discovery, Early and Late-stage Funding

Biotechnology Ignition Grant (BIG), BIRAC’s start-up funding program, has played a key role in the emergence of a biotech start-up culture in India. BIG is implemented through its five partners—IKP Knowledge Park (IKP), Center for Cellular and Molecular Platforms (C-CAMP), Foundation for Innovation and Technology Transfer (FITI), Venture Center (Entrepreneurship Development Center, Pune) and KIIT Technology Business Incubator (KIIT-TBI).

From 2013 to 2017, 192 projects for biotech start-ups and entrepreneurs have been approved and grants of up to Rs 5 million (US$ 75,000) given.

Social Innovation Programme for Products Affordable & Relevant to Societal Health (SPARSH) combines social innovation and biotechnology by identifying and supporting innovations towards affordable product development with potentially significant social impact.
Small Business Innovation Research Initiative (SBIRI) is an innovation-focused PPP initiative in biotechnology which aims to fund high-risk innovative R&D beyond the proof-of-concept stage.

Biotechnology Industry Partnership Programme (BIPP) offers support for high-risk, accelerated technology development, especially in futuristic technologies having major economic potential. It is focused on Intellectual Property (IP) creation.

Contract Research Scheme (CRS) supports validation of academic research with potential for commercialization by industry. BIRAC facilitates Freedom to Operate (FTO) searches to identify patent barriers to operating, along with IP management, and preparation of material transfer agreement (MTA) memorandum of understanding (MOU), non-disclosure, and IP protection contracts and licensing agreements, as well as technology transfers for academia.

Collaborative Funding

Indo-French Centre for the Promotion of Advanced Research (CEFIPRA) supports high-quality bilateral research, encourages and enables Indo-French collaboration between public and private research groups, industry, clinicians, and end-users in the domain of red biotechnology, which makes use of organisms for the improvement of health care and medical processes.

Wellcome Trust is a U.K.-based organization that supports innovations in translational medicine in the domain of diagnostics for infectious diseases.

Grand Challenges India (GCI) is a collaboration between DBT and the Gates Foundation on scientific and technological research to alleviate critical global health and development issues through a series of approved schematic calls or definite initiatives, to be jointly funded by USAID and IKP collaborate to support new diagnostic tools for tuberculosis through grants totaling Rs 50 million (US$ 750,000).

Horticulture Innovation Australia (HIA) collaborates with BIRAC on a jointly funded program supporting innovative technologies and solutions for sustainable and productive horticulture, focused on developing and deploying modern plant biotechnology to improve crop productivity. They have a grant size of up to US$ 4.58 million over the duration of the collaboration.

A charity in the United Kingdom, NESTA offers the Longitude Prize to innovators helping solve the problem of global antibiotic resistance. BIRAC has committed funding for Discovery Awards supporting teams working in the antimicrobial resistance domain. This could eventually lead to participation in the Longitude Prize. The grants are up to US$ 134,000.

Industry Innovation Programme on Medical Electronics (IIPME) was launched by BIRAC in partnership with DeitY to support innovations in the medical electronics and devices sector.

Equity Funding (to be operationalized)

Sustaining Enterprise and Entrepreneurship Development (SEED) Fund offers financial equity-based support to start-ups and enterprises through bio-incubators for scaling enterprises. It is to provide grant-in-aid assistance to 5 selected incubators, to begin with. It offers funding up to Rs 20 million (US$ 300,000) per incubator.

The Accelerating Enterprises (AcE) Fund is a fund of funds to scale up R&D and innovation in biotechnology among sectors such as health care, pharmaceuticals, medical devices, agriculture, and sanitation.

Infrastructure and business incubation support

BIRAC has supported 20 bioincubators, placed either within academic/research clusters or stand-alones (privately or state government-funded), at various stages of operationalization, with a cumulative area of 200,000 sq. ft. with the Nurturing Entrepreneurs for Scaling-up Technology (BIRAC-BioNEST). They provide incubation space, mentor networks, instrumentation facilities, IP, and technology management support.

Selection of Projects

Each project is evaluated and monitored through its life cycle (from Request for Proposal to project closure). The products are evaluated according to technology readiness level, ranging from ideation to pre-commercialization.

The evaluation comprises several steps to ensure that the most relevant projects are supported: proposals undergo peer review by a panel of area-specific experts; then are overseen by a technical expert committee (TEC), with a possible site visit, before expert review, when required, and a final review by the TEC. Each program has integrated systems. Each project within a program is reviewed at least twice by the TEC. This committee consists of experts from industry, academia, and government. Scrutiny and final decisions are made by the Apex Committee comprising senior technical experts and members from various ministries and departments. Financial and legal
Figure 4. Programs Administered by BIRAC

<table>
<thead>
<tr>
<th>Direct Financial Support</th>
<th>Non-financial Support</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equity finance</strong></td>
<td><strong>Prizes and awards</strong></td>
</tr>
<tr>
<td>- SEED Fund</td>
<td>- Discovery award with Nesta, U.K.</td>
</tr>
<tr>
<td>- AcE Fund</td>
<td>- BIRAC-SRISTI GYTI Awards,</td>
</tr>
<tr>
<td></td>
<td>- National Technology Day Award</td>
</tr>
<tr>
<td><strong>Grants</strong></td>
<td><strong>Infrastructure</strong></td>
</tr>
<tr>
<td>- Grants: BIG, CRS, SIIP (Social</td>
<td>- University innovation clusters (5)</td>
</tr>
<tr>
<td>Innovation Immersion Fellowship)</td>
<td>- Bio incubators (20)</td>
</tr>
<tr>
<td>- Matching Grants: BIPP (Biotechnology</td>
<td>**Advisory, extension, and training</td>
</tr>
<tr>
<td>Industry Partnership Programme), SBIRI,</td>
<td>services**</td>
</tr>
<tr>
<td>IIPME</td>
<td>- IGNITE for entrepreneurship</td>
</tr>
<tr>
<td>- Collaborative Funding: GCI (Grand</td>
<td>development</td>
</tr>
<tr>
<td>Challenges India)</td>
<td>- Workshops and hands-on training</td>
</tr>
<tr>
<td></td>
<td>provided through BIG and SIIP</td>
</tr>
<tr>
<td></td>
<td>Partners to entrepreneurs and</td>
</tr>
<tr>
<td></td>
<td>start-ups for IP and grant writing</td>
</tr>
</tbody>
</table>

**Collaborative networks and policies**
- National partnerships include GCI
- International partnerships include NESTA, Wellcome Trust, USAID, IKP Knowledge Park, and Horticulture Innovation Australia

**Information and advocacy**
- BIRAC Regional Innovation Centre (BRIC) at IKP Knowledge Park Hyderabad

Due diligence is conducted and then the final approval is given. BIRAC’s procedures feature a grievance redressal panel, follow right-to-information policies, and a well-defined conflict of interest policy.

**Delivery Challenges**

**Institutional Reforms**

While the institutional setup has not changed since inception, BIRAC has evolved with the view of supporting innovation, innovators, start-ups, and SMEs, from discovery to product development. Transparent and efficient decision-making is a valued asset of BIRAC, since all the programs, information, and processes are online. It follows continuous feedback mechanisms to assess critical gaps and maintain pace with a globally evolving ecosystem.

**Budgetary, Capacity, and Political Issues**

The biotechnology industry faces several unique challenges, chiefly, the requirement for high capital and advanced, quality infrastructure from the start-up stage, a long gestation phase (5–10 years) for products to reach the market from the ideation stage, and intense regulatory scrutiny, as products impact human and animal health. BIRAC has been cognizant of these issues and has been focused on de-risking all aspects of the novel product development chain.

Over the last four years BIRAC has received support from the government as well as non-governmental organizations. The government aims to establish a dynamic and vibrant biotech ecosystem, making India the leading destination in biotechnology innovation and R&D, as well as encouraging new products to be designed and manufactured in India. Its goal is for India to be a US$ 100 billion bio-economy by 2025. The government’s continuing commitment towards the biotechnology sector is illustrated by major
Figure 5. General Operational Mechanics for BIRAC Programs

Call for Proposals

- Healthcare
- Biomedical implants & devices
- Energy and Environment
- Industrial products and processes
- Agriculture
- Other areas

Submission of Project (online only)

Eligibility check

Area Panel reviews by Senior Experts

Technical Expert Committee chaired by Eminent Scientist

Projects qualifying evaluation process - shortlisted for presentation

Due diligence site visit of technically sound projects

Evaluation by Technical Expert Committee based on site visit report, detailed IP search, etc

Apex committee for final decision

Project evaluated for:
- Technical strength of PoC
- Clarity of strategy
- Potential of creating a technology or product
- National/social relevance
- Commercial potential or translational capacity
- Investigators credentials and/or collaborative team's complementation
- Integrated expertise

Recommend

Financial concurrence, legal contracts and other formalities

Project approval and fund disbursement
initiatives, such as Make in India (2014) and Start-up India (2016), focusing on biotechnology. As the nodal centre for implementing these programs, BIRAC and the DBT are assured of regular funding for the next decade, for example through committed funds to the BioNest program.

Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations

The projects are monitored and mentored regularly by an expert committee constituted by BIRAC for each project. Site visits are conducted by the expert committees, comprising two to three technical experts and one financial expert. Each project monitoring committee (PMC) is responsible for:

(a) Monitoring the progress of the project in conformity with the outputs, milestones, targets, and objectives agreed upon.

(b) Assessing and recommending:
   - the release or partial release of the next installment of funds,
   - the revision of project timelines,
   - closing, dropping, or modifying components of the project, within the overall approved objectives, budget, and time-frame,
   - inclusion of additional industrial or institutional partner(s), if the applicant requests it,
   - mentoring to overcome technological problems faced in project implementation, and
   - the revision of financial assistance

(c) Advising on issues related to securing IP rights; and

(d) Advising on any other matter as referred to it by BIRAC, or if otherwise reasonably necessary for effective discharge of its duties and the achievement of the project’s aims and objectives.

Parties Responsible for Monitoring and Evaluation

Monitoring is done by the PMC and technical experts. Project evaluation is done by the board of directors or a committee constituted by them. All project funding is milestone based, so projects are monitored as soon as they complete their first milestone.

Impact Evaluations

Evidence of Results

Biotech industry support: BIRAC has approximately 830 beneficiaries in total.

Funding support to stimulate R&D among SMEs: BIRAC has supported 384 SMEs through programs such as SBIRI, BIPP, and CRS. The total funding received by these companies is Rs 15.74 billion (US$ 230,000) wherein BIRAC's contribution is Rs 7.49 billion (US$ 110,000) while industry has committed Rs 8.25 billion (US$ 120,000).

Kickstarting biotech start-ups: The biotech start-up scenario in India was transformed by BIG, one of BIRAC’s flagship schemes. BIG has supported 192 entrepreneurial ideas between 2013 to 2017, in comparison with the 240 entrepreneurs and start-ups BIRAC has supported and scaled up.

Access to high-end infrastructure: BIRAC BioNEST has supported 20 bioincubation centers across the nation and has created 200,000 sq. ft of incubation space.

Products and technologies: Through its various funding mechanisms, BIRAC has created 34 products/affordable technologies and 31 early-stage technologies. These products and technologies are from biopharma, industrial biotech, medical devices, and agri-biotechnology. Some examples are: Rotavac, a vaccine to immunize children against rotaviral diseases; Maxio to help in tumor ablation (which has received USFDA clearance); a low-cost cancer treatment; a malaria detection kit; and other diagnostic and treatment technologies, including several other vaccines. Two BIRAC supported companies have been granted USFDA approval and many others have foreign collaborations.

Industry-academia interface: BIRAC has supported 104 academic institutes, anchoring 583 projects. It has created five research facilities in separate universities. It has facilitated filing for IP rights for 105 properties, of which 24 have been filed internationally.
3.2. Enterprise Incubation Foundation (EIF) in Armenia

Overview

The Enterprise Incubator Foundation (EIF) is one of the largest technology business incubators and information technology (IT) development agencies in the region, comprising South Caucasus, Central Asia and parts of Eastern Europe. EIF was established by the government of Armenia within the framework of the World Bank’s ‘Enterprise Incubator’ project to support the development of the ICT sector in Armenia.

Key Takeaways

In the context of a small post-transition economy with a small internal market size and low market access, the EIF’s support to the ICT sector has helped to make it one of the fastest growing sectors in the economy, thereby placing Armenia as a regional technological hub on the world map.

Through its activities and projects, the EIF takes up a key role in the ICT sector, from ensuring infrastructural development to attracting further resources for skill development and start-up ecosystem development.

The EIF has designed and implemented various PPP projects, as a result of which several multinational companies, including Microsoft, IBM, Intel, and National Instruments, have come to Armenia, bringing their knowledge and expertise. The EIF has leveraged local and international knowledge to develop an innovation ecosystem for start-up creation, skill development and investment attraction, including physical infrastructure and financial mechanisms such as grants and equity investments. The EIF cooperates closely with technological universities in Armenia and abroad to ensure up-to-date curricula are available for professionals in the industry.

Role in the Country’s National Innovation System

Since its establishment in 2002, the EIF has contributed to the development of the National ICT Development Strategy, representing the sector at the government level and contributed to and facilitated reforms for the ICT sector. As a “one stop shop” for the ICT sector, the EIF promotes legal, business, and educational reform; undertakes investment promotion; provides start-up funding, advisory services, and access to facilities and communication infrastructure, and develops the workforce. Its main beneficiaries are local start-ups and other ICT companies which are helped through a number of programs and funding systems, most of which are implemented on behalf of international partners. While the ICT sector remains the primary target of interventions, programs are also open to other innovative and high-tech companies. The EIF has supported the implementation of the Concept Paper on the Initial Strategy for Formation of the Innovation Economy (ISFIE, 2011), thereby contributing to public policy on innovation.

Headquarters: Yerevan, Armenia

Founded: 2002

Staff: 80 employees

Budget: US$ 1,000,000 per year (operational)

Agency model: Public-private partnership (PPP) with board representation by public and private sectors, and academia.

Clients served: 600 companies supported, including private companies, start-ups, universities, investors, public agencies, and international organizations.

Domestic market size: 2.9 million people (2017)

Mission statement: Fostering economic growth of Armenia and its technology sector via targeted assistance to Armenian information and high technology enterprises and stimulation of entrepreneurial activity, skill development, and start-up formation in the country.

Noteworthy results: The EIF has accelerated innovation in Armenia by providing enterprises with funding and services critical to the commercialization of new technologies.
Country Indicators

**GDP, PPP:** US$ 28.27 billion (2017)

**GDP per capita:** US$ 3,937 (2017)

**Gross Expenditures on R&D (GERD):** 0.2% of GDP (UNESCO, 2017)

**Public R&D spending:** 91.41% of GERD (UNESCO, 2017)

**World Economic Forum (WEF) competitiveness rank:** 73/137 (2017-18)

The EIF is a visible player in Armenia’s innovation and industrial policy landscape. The government’s stake in the EIF is managed by the Ministry of Economic Development and Trade, which is the leading public body in charge of innovation policy. Together, the EIF and the Ministry of Economic Development and Trade promote commercialization of research and development (R&D), distinct from the State Committee of Science which focuses on science and basic R&D. There is some institutional disconnect between private and public R&D in the country; the former suffers from quite a low demand for innovation.

The EIF is the only quasi-public agent supporting innovation and commercialization from the private sector in Armenia. It is unique given that competitive funding programs and the involvement of business enterprises are relatively new within Armenia’s financial landscape. In addition, the EIF has designed and established the first venture capital fund in Armenia, as well as the first technology and innovation centers in Armenia. It serves as the secretariat for the IT Development Support Council chaired by the Prime Minister of Armenia.

Roles, Capabilities, and Organization

Origins and Evolution

**Mandate**

Recognizing the important role that the ICT sector has in technological development and research commercialization in the wider economy, the Armenian authorities established the EIF in 2002. It was created within the framework of the World Bank’s Enterprise Incubator project to support the development of the ICT sector. The goal was to build a conducive environment for innovation and technological advancement in Armenia. The EIF’s mandate has grown since inception and it is now the largest initiative for ICT development in Armenia. Its activities cover every aspect of sector development and it acts as a cross-point for all entities in the sector. While most of its initiatives are driven by donors or international organizations, the EIF contributes to the shared goal of ICT excellence by bringing together public and private institutions, international organizations, government agencies, major multinationals, and small start-ups.

While there are potential benefits to expanding innovation policy and replicating the EIF’s approaches beyond ICT, policy attention and support has remained largely focused on the ICT sector. In 2011, the government adopted the recommendations of the ISFIE, which focuses on attracting high-tech multinationals and promoting high-tech Armenian firms abroad.

Complementary Agencies

The Armenian innovation system is characterized by a wide range of intermediary and policy-making institutions run by public and semi-public authorities. The Small and Medium Entrepreneurship Development National Center of Armenia (SME DNC) trains entrepreneurs and facilitates access to technology and markets. SME DNC fosters entrepreneurship in Armenia, provides consulting and various forms of financial support (for example, loan guarantees for start-ups and for upgrading SMEs) as well as support for micro-franchises. The National Center of Innovation and Entrepreneurship (NCIE) is set up to contribute to innovation policy design and provide various innovation support services. The Intellectual Property Agency is the national body responsible for the legal protection of intellectual property in Armenia. The National Competitiveness Foundation is a PPP that engages the Armenian diaspora to attract FDI and promote international competitiveness.

A few private technoparks and innovation centers have also been launched—for example, Technology Transfer Association, Viasphere Technopark, and IT Park in Yerevan—that provide infrastructure, working space, incubation, R&D and training, as well as cooperation with local universities, funding through equity and funds, management and consultancy, and marketing services. Several organizations and associations are also involved in development of the IT sector, such as the industry associations Union of Information Technology Enterprises (UITE) and Union of Employers of ICT Companies (UEICT).
Sectoral Focus

The EIF has a sectoral focus on ICT, but is open to all high-tech and innovative companies. The main beneficiaries of the EIF’s services are innovative domestic and international technology companies, as well as start-ups.

Business Model Evolution

Originally set up as an incubator, the EIF has evolved to become the main ICT development agency of the country and currently extends its activities to the high-tech sector. The EIF’s activities are broad, covering all aspects of the ICT value chain. As an autonomous and flexibly managed PPP, the EIF is able to mobilize resources for Armenia’s innovation support programs from the government, other official donors, and private sources. At a national level, the EIF promotes policy reform to benefit the ICT sector and develop Armenia toward becoming an e-society. The EIF’s mandate was recently extended to include general support for innovation and high-tech sectors.

The EIF has evolved to become an implementer of various projects in partnership with international companies like Microsoft, Cisco Systems, Sun Microsystems, Hewlett Packard, and Intel. Foreign ICT companies assist in piloting programs such as technoparks and innovation centers offering training, resources, infrastructure, and access to a worldwide expert community. One prominent example is the Microsoft Innovation Center. The Science & Technology Entrepreneurship Program (STEP) develops entrepreneurial abilities in ICT professionals, helping them to innovate, create new ventures, and connect to established companies. The EIF also organizes several business plan competitions and workshops and has matching grants and mini-grants (co-financing plan), and an early-stage venture fund (public-private financing).

The initiatives developed under the PPP model were valued by EIF’s partners, especially new entrants to the Armenian market, as they have gained experience with the local private and public innovation stakeholders. Multinationals allocate their resources as part of their corporate social responsibility or public relations initiative, and the PPP model enabled them to test and enter the market quickly. Building on pilots and new initiatives undertaken within the PPP framework, most of the EIF’s partners have gone on to initiate second-phase cooperation agreements. For example, Microsoft has been the private partner in three PPPs for innovation centers; IBM is currently involved a similar PPP with Yerevan State University of Armenia, the Ministry of Economic Development and Trade, and United States Agency for International Development (USAID); and a new PPP with the Ministry of Labor and Social Affairs is being designed.

Organizational Structure

Organizational and Reporting Structure

The EIF is registered as a foundation, which is governed by a board of trustees consisting of 11 members with representation from the Ministries of Transport, Communication and IT, Finance, Economic Development and Trade, and Foreign Affairs; two universities (rotating); two IT industry associations; and three private companies. The chairperson of the board of trustees comes from the Ministry of Transport, Communication and IT.

Internally, the EIF is led by a director who oversees five functional departments: Business Development; Skills Development; Strategic Projects; Operations; and Legal, Accounting, and Human Resources.

The EIF conducts its operations according to the charter, organizational chart, and staffing plan that have been approved by the board. The board also approves the annual budget, activity plan, and annual report. During its operations, the EIF has established several internal regulations, including performance reporting, evaluations, procurement, and accounting procedures. When the EIF works with donor organizations such as USAID and the World Bank, the corresponding procurement and accounting procedures are employed. Although accounting is outsourced, all other job responsibilities are clearly defined for each employee of the EIF in the job descriptions.
Budget Sources and Allocations

The EIF's funding comes from three main sources. As an implementer of projects in Armenia's technology sector, it receives funds from donors such as the World Bank, the European Union (EU), and USAID to carry out specific projects. In addition, some funding comes from the Armenian government for the EIF's role in supporting the development of the national technology sector and providing policy advice to the government. Private companies that pay fees for the EIF's services make up the third funding source for programs. Funding from the private sector comes in two forms: implementation of large projects, such as the Innovation Centers (funded by Microsoft and IBM); and fees for customized consulting services, whereby the EIF's experts provide business advice to technology companies that wish to enter or grow in the Armenian market. Table 6 shows the largest multi-year programs managed by EIF on behalf of donors and partners.

The EIF’s operating budget is made up of program funding from a range of partners, most notably through the programs above. Specific allocations are made for overhead expenses; in principle, this is 20–30% of overall project costs. The EIF has made a conscious decision to maintain its operational budget at around US$ 1 million per year so that it has the capacity to execute its mandate effectively and keep the scope of operations to a reasonable size. More than half of the EIF’s operational budget is dedicated to staffing, covering both direct employees of the EIF and the many staff working directly in the foundation’s innovation centers.

Human Resources and Skills

The EIF has 80 employees including management staff, administrative staff, business and skills development managers, and support staff. A majority of technical staff work as business development managers, supporting the EIF’s business clients in planning, strategy, and technology. The foundation has five main divisions: Skills Development, Acceleration/Incubation, Strategic Projects, Operations, and Legal and Finance. The staff that work within business functions such as legal and finance support the EIF’s clients in those functions as well as the EIF itself. In addition to the core staff, about 40 consultants work for the EIF as technical experts and advisors for projects at any given time.

Timeline

Major Internal Events

2002 | The EIF established
2006 | Armenia’s Science and Technology Entrepreneurship Program (STEP) launched
2010 | Memoranda of partnership signed by the Ministry of Economic Development and Trade, Ministry of Education and Science, Intel, Hewlett-Packard, the EIF, and Unicomp CJSC, for the implementation of Teachers PC and Classmate PC pilot projects in Armenia
Armenian-Indian Center for Excellence in ICT established in Armenia
Microsoft Innovation Center Armenia established
Armenian National Engineering Laboratories established
Granatus Ventures, the first Armenian venture capital fund, established
Gyumri Technology Center opened
Matching Grants Competition launched
The government of Armenia and Microsoft sign a memorandum and cooperation agreement to contribute to the development and implementation of prospective new programs.
Vanadzor Technology Center established

Major External Events

2000
Government declares IT a priority for Armenian economic development

2001
ICT Master Strategy and ICT Development Implementation Plan launched
Information Technologies Development Support Council of Armenia (ITDSC) established by decree of the President of Armenia

2008
The government adopts a new 10-year industry development strategy to improve the quality of IT graduates, create new IT infrastructure, and foster start-ups
First year of ArmTech, the Annual Armenian global high-tech congress, intended to promote the Armenian high-tech industry

2010
Government of Armenia approves the Development Concept Paper for Armenian E-society

2011
Armenia passes laws allowing Free Economic Zones to promote production and export of high-tech and innovative products in diverse industries

2012
Armenian IT/High-Tech Representative Office officially launched

2013
Memorandum of understanding signed between the government of Armenia and IBM to cooperate on education and R&D and establish the Innovative Solutions and Technologies Center

Implementation, Capacity, and Programs

Direct Financial Support

Several financial instruments have been introduced to support tech entrepreneurship. Idea (STEP) grants support entrepreneurs in developing business ideas for innovative technologies, science and technology convergence, and commercialization. These US$ 15,000 grants are awarded to teams and start-ups to take their ideas to market, and are accompanied by opportunities for learning and mentorship. So far, 50 grants have been awarded, with five grants in 2017. The EIF has also awarded five additional Idea grants of US$ 6,000 each.

Innovation matching grants are aimed at supporting relatively mature ideas, start-ups, and businesses. Funding of up to US$ 50,000 is awarded to tech start-ups to increase the customer base, develop prototypes, implement sales, and/or expand the business. Co-funding of 50% is required from start-ups in Yerevan, but only 15% is required for businesses in provinces outside of the capital city. To date, 33 such grants have been awarded.

The EIF designed and established the first Armenian venture capital firm, with capital investment from both the government and the private sector. In three years, the fund has made 11 investments in companies operating in the telecommunications (mobile), education, communication, e-commerce, and digital media sectors.

Non-financial Support

National Instruments, a prototyping, measurement, and testing company, has participated in a PPP for the design and implementation of the Armenian National Engineering Laboratories. This partnership has built a strong research infrastructure and resulted in the graduation of 3,000 top-quality engineers yearly from the National Polytechnic University of Armenia (SEUA). All of these initiatives have laid the groundwork for the next partnership: an Engineering City in Bagrevand. The Engineering City will build favorable infrastructure for the growth of engineering companies and will promote the growth of an Armenian
engineering cluster. The consortium is led by National Instruments and involves 16 private companies and three public companies.

The EIF has used several instruments including the establishment of technology and innovation centers with diverse partners; these include the Armenian-Indian Center of Excellence in Information, Communication and Technology (ICT), Microsoft Innovation Center, IBM Innovative Solutions and Technologies Center, Armenian National Engineering Laboratories, mLab, Gyumri Technology Center, and Vanadzor Technology Center.

**Delivery Challenges**

A major challenge to achieving ICT sector growth lies in the cultural "digital divide". Much of Armenia’s population and many of its institutions are unprepared to thrive in the digital age. The Armenian education system and government are also finding it difficult to stay up to date with accelerating digital demands. The EIF’s role of bridging the gap between the local ecosystem and rapidly changing technology requires its staff to remain dynamic while maintaining good relations to stakeholders on both sides of this divide. In many cases, the EIF acts as an interpreter of the new digital age for local institutions, a constantly evolving role.

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### Figure 6. Programs Administered by EIF

**Direct Financial Support**

<table>
<thead>
<tr>
<th>Equity finance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• EIF equity investments</td>
</tr>
<tr>
<td>• Granatus Ventures venture capital fund</td>
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</table>

**Grants**

<p>| |</p>
<table>
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<tr>
<th></th>
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<tbody>
<tr>
<td>• Science and Technology Entrepreneurship Grants</td>
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<tr>
<td>• Innovation Matching Grants</td>
</tr>
<tr>
<td>• Idea Grants</td>
</tr>
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</table>

**Indirect Financial Support**

<table>
<thead>
<tr>
<th>Tax incentives</th>
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<tbody>
<tr>
<td>The EIF participates in the committee certifying companies as qualified for tax holidays as required under the Republic of Armenia law ‘On state support to IT sector’</td>
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</table>

**Non-financial Support**

<table>
<thead>
<tr>
<th>Prizes and awards</th>
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<tbody>
<tr>
<td>• Prizes and awards to students and entrepreneurs during contests and competitions</td>
</tr>
<tr>
<td>• Annual Business Partnership Grant Competition and Venture Conference (five winning teams in 2013 received grants of either US$ 7,500 or US$ 15,000 for their projects in the respective competitions)</td>
</tr>
<tr>
<td>• Technology Entrepreneurship Workshops with awards for promising business ideas</td>
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</table>

**Infrastructure**

<p>| |</p>
<table>
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<tbody>
<tr>
<td>• Microsoft Innovation Center in Armenia</td>
</tr>
<tr>
<td>• IBM Innovative Solutions and Technologies Center</td>
</tr>
<tr>
<td>• Gyumri and Vanadzor Technology Centers (Facilities and infrastructure for start-ups and existing companies)</td>
</tr>
<tr>
<td>• Armenian National Engineering Laboratories</td>
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</table>

**Advisory, extension, and training services**

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<tbody>
<tr>
<td>• Armenian-Indian Center for Excellence in ICT</td>
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<td>• Microsoft Innovation Center in Armenia</td>
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<tr>
<td>• mLab</td>
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<tr>
<td>• IBM Innovative Solutions and Technologies Center</td>
</tr>
<tr>
<td>• Gyumri and Vanadzor Technology Centers</td>
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<tr>
<td>• Armenian National Engineering Laboratories</td>
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**Regulation and standards for innovation**

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<tbody>
<tr>
<td>The EIF is a committee member of the National Institute of Standards</td>
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</table>

**Collaborative networks and policies**

Joint projects with multinational organizations

**Information and advocacy**

<p>| |</p>
<table>
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<tbody>
<tr>
<td>• Representation offices in Canada, Austria, and the United States</td>
</tr>
<tr>
<td>• IT sector ‘State of Industry’ analysis</td>
</tr>
<tr>
<td>• Guide to Armenian IT companies</td>
</tr>
<tr>
<td>• Forums</td>
</tr>
<tr>
<td>• Exhibitions</td>
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</tbody>
</table>
Moreover, while competition for a share in the international high-tech market is global, Armenia’s resource endowments are local. As a small developing country, Armenia has limited human, financial, and natural resources. This makes it challenging for the country to compete in the global digital economy. However, its small size does help Armenia attract companies, due to the relative ease of navigating regulations, customs, and politics, and of coordinating with key stakeholders. In addition, an active and committed diaspora has helped bring investments and know-how to Armenia, while promoting Armenian companies and products abroad.

Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations

The programs implemented by the EIF are evaluated based on pre-defined indicators, which vary depending on the client. EIF carries out M&E for programs supported by the World Bank and USAID. In addition, the EIF has its own organizational key performance indicators (KPIs) to evaluate the impact of its activities on the ecosystem. The key success metrics for the EIF include the annual percentage growth in the ICT sector; growth in start-ups; change in legislative environment; and growth in firm revenues. An annual audit is conducted for the organization and a separate audit is conducted for all projects funded by international donor organizations.

Evaluation Methodologies

For program-specific evaluations, project components and sub-components are measured by project outcome indicators and intermediate output indicators, respectively. As implementer, the EIF is responsible for designing and implementing surveys and assessments among key stakeholders and beneficiaries, which involves data collection from possible and pre-targeted sources, qualitative and quantitative research, and analysis of the program outputs and results. The results and outcomes are reflected in monthly, quarterly, and annual reports by the EIF. Information gathered from project teams is aggregated into report documents. Data for all indicators are collected annually.

Parties Responsible for Monitoring and Evaluation

As an implementing agency for a number of donor-funded and other programs, the EIF has Monitoring and Evaluation (M&E) specialists who monitor and evaluate programs under the EIF’s management. An independent and external consulting firm provides audits and additional monitoring and evaluation as well. Each project has unique development objectives and progress indicators, and the M&E process is tailored to each program individually.

Impact Evaluations

Evidence of Results

During its lifetime, the EIF has supported over 600 companies of various sizes, representing an annual turnover of US$ 500 million. The EIF has contributed to 5% of Armenia’s economic output (that is, to its annual GDP), and benefited more than 15,000 employees, 60 universities, and 9,000 students.

The EIF has been instrumental to the development of the ICT sector in Armenia due to its reach, scope, and reputation. An industry report published in 2015 by the Information Technologies Development Support Council of Armenia demonstrates the growth in the ICT industry in recent years. Between 2010 and 2015, the following developments are a result of the EIF’s contributions to the innovation and ICT ecosystem in Armenia: 130% growth in local firms in the ICT sector; 26% increase in productivity of technical employees (excluding internet service providers); 276% increase in the turnover of the software and internet services industry; and 156% increase in employment in the ICT industry in Armenia.
3.3. Georgia’s Innovation and Technology Agency (GITA)

Overview

By providing financial support, technology centers, and a variety of value-added services to small and medium sized enterprises, Georgia’s Innovation & Technology Agency (GITA) represents one of the building blocks in a newly developing ecosystem. GITA is tasked with expanding broadband access outside cities; upgrading skills in the workforce; supporting innovation among new and established technology firms; and informing innovation and entrepreneurship policy.

Key Takeaways

GITA was created to address the need for long-term economic growth prospects in Georgia despite the country’s lack of natural resources. GITA was created to promote growth in the IT sector through skill upgrades.

Established in 2014, GITA started as a grassroots agency to identify and address bottlenecks to innovation. From its inception, GITA’s mandate was to coordinate the formation and development of an innovation ecosystem in Georgia; which included key functions such as supporting commercialization of innovations and knowledge and stimulating the use of innovations and technologies. Additionally, GITA has responded to the changing needs in physical infrastructure, technology programs, and business incubation services, identifying new programs to grow innovation within the technology sector as well as the traditional sectors.

Role in the Country’s National Innovation System

Since the early 2000s, Georgia has been implementing far-reaching reforms to improve the business environment, spur investment, and shake off the lingering rigidities of a centrally planned economy. These reforms have helped to kick start GDP growth, but the economy has still not fully returned to its pre-transition size and unemployment remains a significant public policy concern. Prospects for resurgence in productivity growth and exports are constrained by low levels of innovation, human capital development, and entrepreneurship. While the Georgian government had little previous investment in either innovation or technology, the government established a goal of training 40,000 information technology (IT) professionals within Georgia by 2020, along with establishing GITA. As a central part of this original economic growth agenda, GITA was one of the first members of Georgia’s emerging innovation ecosystem.

The country is now witnessing the first generation of students graduating from universities into a free labor market. The timing of GITA’s establishment enables a new generation of students to benefit from this new innovation-focused economic development model. Through early programs, such as hackathons, trainings, and conferences, GITA solicited inputs from the business community to inform its interventions. Its early efforts to promote the technology and innovation sector is demonstrated by the creation of the first Tech Park in Georgia’s capital of Tbilisi. In addition, GITA is actively engaged in a number of programs and companies for the development of IT professionals. For example, GITA recruited 130 technology...
professionals from Ukraine to train Georgian technology instructors. Consequently, more than 1,500 students have received technical training in the following years.

To adapt to the evolving needs of the growing innovation ecosystem, GITA’s package of infrastructure support, capacity development programs, and policy facilitation is designed to be flexible and strategic. Government funding has been used for entrepreneurship grants, incubation, and fabrication laboratories (FabLabs) to support individuals in building local companies.

GITA has partnered with international agencies and organizations to share ideas and successes in the development of the ecosystem. Often when GITA implements a new program, it is based on a similar strategy recommended and performed by another agency abroad. GITA plans to continue establishing partnerships as long as the innovation and technology field continues to grow within the country.

Complementary Agencies

GITA is currently the sole agency supporting the Georgian technology and innovation ecosystem, but it receives support from other sections of the government. Where GITA focuses on the education of individuals looking to gain specific knowledge within the industry, it partners with the Ministry of Education and universities around the country to provide FabLabs, so students can develop their skills while attending school. For example, Georgia’s Partnership Fund created Startup Georgia to encourage entrepreneurs with ideas to submit business proposals for funding. GITA oversees the innovation and technology projects that come to Startup Georgia.

Roles, Capabilities, and Organization

Origins and Evolution

Mandate

GITA was established in 2014 as part of the new government’s Social Economic Development Strategy 2020 plan to create a more knowledge-based economy. The overwhelming goal of the agency at the time was to promote innovation-based economic growth but in order to achieve this, specific issues needed attention. Consequently, GITA had three main goals: educating the workforce, supporting the innovation of newly created and already established businesses, and informing policy. While private company growth is its primary focus, GITA also works with the Minister of Economy, Minister of Education, and other government officials to help shape policies and programs to support innovation and entrepreneurship within Georgia.

Although GITA does not have a direct voice in policy making within Georgia, the Minister of Economy’s Office gives a path for GITA to influence policy. GITA makes recommendations on policy change and provides diagnostic inputs to the ecosystem through publications such as Innovation Strategy 2025 (a report produced by the government and partners, including the World Bank).

Sectoral Focus

Originally, GITA’s focus included little outside of the technology industry; however, recently the scope has broadened and GITA has implemented two new initiatives. The Tech Transfer Initiative seeks to use technology and trained individuals in building up and improving other industries. The program also aims to reduce the gap between businesses and scientists. Similarly, the Innovation Agents program intends to place three agents into traditional industries to evaluate and implement positive change. This program was specifically implemented after reviewing the success of a similar project managed by the Danish Institute of Technology.

Business Model Evolution

Since its establishment, GITA has significantly evolved to better develop Georgia’s Innovation ecosystem. In its first year, GITA primarily focused on assessment and diagnosis of the current environment. A major focus was spreading
the word about the new agency within the community. This was primarily done by hosting conferences, tech trainings and supporting hackathons to gauge popularity and establish community needs. In addition, GITA launched a small grant program (up to GEL 50,000 for each project) for technology innovation open to individuals, NGOs, research organizations and universities.

GITA’s early findings showed that start-ups in the technology sector required physical space, as there was nowhere for entrepreneurs to generate a prototype, find funding, or learn the business skills required to support their idea. GITA was able to build Tech Park Georgia, with the government’s financial support, just outside Tbilisi. The facility offers computer equipment, meeting and co-working spaces, conference facilities, a FabLab, and offices for the GITA team headquarters. The government viewed the US$ 1.1 million project as an investment in creating Georgia’s own Silicon Valley-like infrastructure, while GITA viewed it as essential to its success in developing entrepreneurs into successful business owners who then mentor the next generation. Now the institution is able to conduct nearly all its programs in one location.

Funding start-ups is still an evolving part of GITA’s programming. The types of funding and amounts in which applicants can apply for have changed over the past three years. In addition to Mini Grants designed to provide capital to entrepreneurs (valued at US$ 20,000) GITA began offering Micro Grants of up to US$ 2,000 in 2015, which help entrepreneurs to fund prototypes or travel required to develop their business. Prototype funding was channeled into a business incubator program to help entrepreneurs with more advanced business ideas. GITA is also responsible for approving technology and innovation applications to StartUp Georgia, which gives entrepreneurs loans of up to US$ 38,000 for business operational costs, alongside business development assistance such as mentoring. GITA continues to re-evaluate and improve the structure of these loans.

GITA and its partners are funding two innovation financing programs with the GENIE Project, a US$ 40 million loan from the World Bank. The first is a low-rate matching grant to help with prototyping and initial costs, and the other is a high-rate matching grant to fund the growth of established companies through development and business planning.

The current discussion on structuring the next round of funding is focused on two different strategies. The first would provide approved applicants up to US$ 30,000 to cover expenses such as proof of concept, business development and prototyping, in exchange of a 10% matching contribution of the project amount. The second strategy would use GENIE Project funding to provide up to US$ 250,000 and require a 30% matching contribution from the business owner. This would be used by applicants trying to develop a production and business model for their company. Quarterly financial reports would be required for the first two years, and submitted to the World Bank, who finances the GENIE Project, for review.

GITA’s primary goal since its inception has been to train people in information technology. With a lack of qualified IT trainers, apart from university professors in Georgia, the agency sought out foreign trainers to travel to Georgia for four months to teach selected applicants how to train others within nine technology fields. Consequently, nearly 200 trainers and 2500 people were trained; over 1,500 students received training in these fields and GITA projects. By the end of 2021, 15,000 more Georgian instructors will receive training from this initiative.

Through its International Relations and Donors department, GITA has partnered with Enterprise Europe Network, Horizon 2020, Danish Institute of Technology, Ukraine, and others. Utilizing both established partnerships and new ones will be key to the future of GITA and the Georgian innovation ecosystem as a whole.

Organizational Structure

Organizational and Reporting Structure

GITA is owned by the Georgian government and monitored by the Office of the Minister of Economy and Sustainable Development (MOESD). There is no official GITA board, but major decisions are handled by the Chairman of GITA, who manages day-to-day operations and reports to the Deputy MOE. The GENIE Project within GITA however, does have an advisory board to oversee the project, comprising World Bank professionals and international experts in the field.

GITA does not possess great diversity within its leadership, since its management consists solely of government employees. The MOE funds nearly all grants and programs with the exception of StartUp Georgia, which is funded by the Georgian Partnership Fund. This fund is managed by the government to consolidate the ownership of the largest state-owned enterprises. New programs and infrastructure under the umbrella of the GENIE Project will be funded by loans from World Bank. With the exception of this, the success of the ecosystem lies in the hands of the ruling government which could increase or decrease funding at any time.

GITA is internally organized into four divisions (see Figure 7 below):

- Deputy Chairman’s group: In addition to the Chairman and Deputy Chairman’s primary organizational
leadership responsibilities, this division oversees administrative assignments such as legal, accounting, and procurement.

- International Relations: This department provides support to fundraising efforts, international partnerships, and start-up internalization. It is also responsible for many of GITA's events and expositions and maintaining international network partnerships.

- Innovation and Commercialization: This unit administers and manages GITA's funding programs from start to finish, coordinating from application stage all the way through to funding payments.

- Strategic Development: This department manages the implementation of GITA's programs, as well as infrastructure development. In addition, the department reports to the MOESD.

Human Resources and Skills

Currently, 32 people are employed by GITA. The team has undergone significant restructuring since its inception, when it consisted only of a chairperson and a small (five to 10 people) group of young students. With time, GITA's roster grew to respond to new challenges. While the focus of staff in GITA's early days was primarily on the marketing of the agency, current staff fulfill a wider array of functional roles. This growth involved hiring project managers, marketing staff, and creating specialty roles such as for accountants and lawyers. Through programs such as FabLabs, successful students had the opportunity to be trained to run the program as a contracted employee.

Timeline

Major Internal Events

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>2014</td>
<td>GITA established</td>
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<tr>
<td></td>
<td>Matching grants and FabLab University partnership launched</td>
</tr>
<tr>
<td></td>
<td>1 FabLab and 3 iLabs opened</td>
</tr>
<tr>
<td>2015</td>
<td>4 additional FabLabs opened in partnership with city municipalities</td>
</tr>
<tr>
<td>2016</td>
<td>Tech Park Georgia opened in Tbilisi and Zugdidi</td>
</tr>
<tr>
<td></td>
<td>GENIE Loan Agreement with World Bank</td>
</tr>
</tbody>
</table>

Budget Sources and Allocations

Funding allocations are set each year during the planning phase of the government’s budget. They are adjusted each year to account both for donors, and for loans given to their respective agencies within the government. Funding levels are determined by the current project needs of each agency and prioritized based on the government’s agenda.

GITA’s 2016 budget increased to Lari 8.3 million (Approximately US$ 3 million), from Lari 6.1 million (Approximately US$ 2.3 million) in 2015 and Lari 6 million (US$ 2.3 million) in 2014.
### Implementation, Capacity, and Programs

**About GITA programs**

Business Incubator: This was originally designed to assist entrepreneurs in getting business ideas to the market within a year. It provided the resources required for market incorporation, but no resources to run the businesses. The time frame has subsequently shortened to six months. Since 2014 it has provided over 52 individuals and 19 teams with grants of Lari 5,000, for a total of Lari 400,000 (approximately US$ 150,000).

Business Accelerator: This program provided a business evaluation service for university students with ideas, with the goal of creating a pipeline into the Business Incubator program. Unfortunately, the program did not see great success and has since been halted.

Mini Grant: Established in 2014 as the first of GITA’s funding efforts, this provided early-stage start-up companies with tools for business development and grants of US$ 20,000.

### Table 7. Programs and funding

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Funding Level by Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2017 (projected)</strong></td>
<td><strong>2016</strong></td>
</tr>
<tr>
<td><strong>Tech Parks</strong></td>
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<tr>
<td>Lari 363,000 (Tech Park Telavi)</td>
<td>Lari 1,069,000 (Tech Park Zugdidi)</td>
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<tr>
<td><strong>Innovation Centers (IC)</strong></td>
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<tr>
<td>Lari 80,500 per IC (Kareli, Mestia, Rukhi and Akhmeta) Total: Lari 322,00</td>
<td>Lari 45,500 (Choporti); Lari 45,500 (Bagdadi) Total: Lari 91,000</td>
</tr>
<tr>
<td><strong>FabLabs</strong></td>
<td></td>
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<tr>
<td>Lari 137,000 (Art Academy)</td>
<td>Lari 324,000</td>
</tr>
<tr>
<td><strong>Innovation Laboratories (iLabs)</strong></td>
<td>Lari 54,000</td>
</tr>
<tr>
<td><strong>Total per year</strong></td>
<td></td>
</tr>
<tr>
<td>Lari 876,000 (Approximately US$ 333,000)</td>
<td>Lari 1,500,000 (Approximately US$ 580,000)</td>
</tr>
</tbody>
</table>

**Total** LARI 8.4 million (Approximately US$ 3.2 million)

### Major External Events

2017

- Business Incubator Program begun
- Regional Innovation Centers opened
- Regional Innovation Hubs and Community Innovation Centers to be constructed in regions across Georgia

2012

- Technology Transfer Center of Georgia (TTCG), established with the support of the Patent Office Sakpatenti and GiZ

2014

- EU signs trade deal with Georgia

2016

- Georgia becomes an associated country of EU’s Horizon 2020, EU’s framework program for Research and Innovation

2017

- Georgia adopts Estonian-style tax system, increasing tax incentives for start-ups to reinvest in their growth
No investment was required from the entrepreneur to receive the grant. A council of both public and private sector experts chose the winners. Over the course of a year, 150 applicants applied, 30 were shortlisted and 17 ultimately received the grants for a total of Lari 750,000 (Approximately US$ 290,000). To avoid public sector influence and increase entrepreneur investment, the grant is no longer issued.

Micro Grant: This program was established in 2015 to target the needs of very early-stage start-up companies for prototyping and travel. A US$ 2,000 grant was awarded by a panel of GITA professionals and invited experts in the relevant field. No investment was required from the entrepreneur to receive the grant. Over 170 individuals benefited from this grant from a budget of Lari 522,000 (approximately US$ 200,000).

Startup Georgia: Run by the government-owned Georgian Partnership Fund, this is designed to encourage Georgian entrepreneurs to apply for government funding to start their own business in both traditional and technology fields. GITA controls the application process and implementation for all technology and innovation start-up ideas. An applicant can apply for a loan up to Lari 100,000 (approximately US$ 40,000). GITA takes a 5% stake in the business and, at the end of the loan period, Startup Georgia receives either the total loan amount, or 5% of the company value, whichever is greater. Since its launch in 2016, 20 business ideas have been funded under the technology and innovation for a total of Lari 1.5 million (Approximately US$ 580,000).

FabLabs: Designed to provide entrepreneurs and engineers with infrastructure to build models and prototypes, these labs also create a networking environment for entrepreneurs to meet engineers who can help build their idea into a product.

Training of Trainers (TOT): This skill-development program started by GITA brings technology teachers from outside the country to instruct local trainers. More than 130...
Ukrainian technology professionals trained Georgians in the four-month program, which was carried out in two phases. The program was free for participants, who agreed to train a minimum of 20 people after participating in TOT. Over 1,500 registered students have received training from Georgian instructors. The cost of TOT amounted to Lari 720,000 (Approximately US$ 280,000) for both sessions of training.

Tech Park Georgia: This flagship project provides the infrastructure and environment for innovation and technology to thrive in Georgia by providing office and co-working space, a FabLab, and more. Many young start-ups occupy the offices, with GITA close by to support their businesses and programs. This Lari 2.8 million (Approximately US$ 1.1 million) project has provided a solid base for many years to come.

iLabs: Developed early at GITA, these now act as partners in innovation and technology. Three of these iLabs: Geo Lab (for mobile applications), CG Lab (for computer graphics), and Game Lab (for video game design), each received a grant for Lari 60,000 (Approximately US$ 23,000) as well as an agreement for GITA to fund administrative costs for three years—100% in the first year, 70% in the second, and 50% in the final year.

Regional Hubs and Innovation Centers: As a part of the GENIE project, Regional Hubs will be constructed within Georgia’s 10 regions, and over 50 Innovation Centers will be built across the country. These are to act as the centers for technology in each area and provide space for education and programs. Two Regional Hubs are currently in place in Tbilisi and Zugdidi, as well as three piloted Innovation Centers.

Broadband for Development (BfD): This economic development program aims to provide internet access and training to Georgians. Bringing internet to remote villages is the most challenging task for BfD but with a budget of Lari 21.6 million (approximately US$ 8.3 million) over the life of the project, internet access for all is within reach.

Entrepreneur Workshops: This is a new program run by GITA that aims to encourage and teach people to run their own businesses rather than be employed by the state or a large corporation. It will be carried out at all Regional Hubs. Discussions indicate that grants of Lari 20,000 (Approximately US$ 8,000) may be issued.

Innovation Competitions: These were some of the first programs implemented at GITA. During the marketing and buzz-creation phase, GITA hosted hackathons, make-a-thons and create-a-thons. Some of these competitions would have over 500 students and young adults in attendance. In 2016, Lari 53,000 (approximately US$ 20,000) was spent to support these programs.

Selection of Projects

Applications for funding go through a review process based on the amount requested. For original mini grants valued at US$ 20,000, the process involved two phases: (1) an international review committee and (2) a grant council comprising private and public professionals were used.

Micro Grants valued at US$ 2,000 are subject to (1) a review by GITA’s in-house and external experts and (2) an in-person idea pitched to both GITA and an invited expert.

For the growth funding through the GENIE Project, the evaluation was done in four phases: (1) eligibility review, (2) pre-evaluation review, (3) on-site visit and (4) final review.

Delivery Challenges

Institutional Reforms

One of the most recent challenges faced by GITA has been to identify a funding mechanism that provides opportunities for private investment. In recent years, private investment has been hard to attain as entrepreneurs would much rather receive a grant from the government rather than give up equity in their business to an investor. While grant programs can serve an important purpose in the ecosystem, leveraging private sector investments is currently among the top priorities for future GITA funding structures. More broadly, it is necessary to establish a robust monitoring and evaluation framework to account for results and encourage a public-private dialogue that informs policy advocacy on innovative entrepreneurship.

Budgetary, Capacity, Political Issues

Since its establishment in 2014, GITA has had consistent political and financial support from the government. However, prior to receiving the loan from the World Bank in 2016, GITA was entirely dependent on government funding. This lack of diversity in its budget sources has made the agency vulnerable to political changes. In addition, Georgia is yet to finalize on an innovation strategy which would serve to provide direction for long-term planning of the agency.
Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations

The key performance indicators, such as number of jobs and start-ups created, are developed and monitored by GITA. These performance indicators are reported to the MOESD on a quarterly basis and supplemented by a document summarizing events and attendance. Nevertheless, GITA does not have an established and comprehensive framework for monitoring the performance of the agency. Results monitoring is not a task assigned to any of the three departments within the agency. GITA does monitor its micro-grants scheme, but only undertakes financial rather than performance monitoring.

New funding programs through the GENIE Project are expected to help GITA monitor the funds that companies receive more diligently than in the past. With the assistance of the World Bank, GITA should be able to monitor its program spending by having quarterly financial reports. Over the last year, GITA has been leveraging the expertise of a financial expert to help improve the monitoring and collection of expenditure and outcome data.

Impact Evaluations

Evidence of Results

Since its start in 2014, one of GITA’s visible contributions to the Georgian innovation ecosystem has been the physical infrastructure investments, from university FabLabs to the newly built Tech Center Georgia. So far, 175 start-ups have been supported by Startup Georgia, Fablabs, and the Business Accelerator. Ilia State University has seen applications for Science, Technology, Engineering, and Math programs triple since the introduction of FabLab. This space has provided a hands-on learning experience that engages young audiences. Practical application development learning through the TOT program has provided opportunities for students to gain knowledge not provided elsewhere in Georgia. So far, 1,500 specialists have been trained by GITA-certified trainers. The number of mentoring relationships between business leaders and young business owners has increased. The culture around self-starting a business has shifted towards the technology sector.

Through initiatives such as the small grants program, GITA has contributed to bridging the financing gap experienced by Georgian businesses. GITA has positioned itself as a provider of seed stage financing and ancillary services, reaching more than 350 entrepreneurs with various ideation, prototyping, and start-up funding products (primarily grants) since 2014. In the case of GITA’s Mini Grants, the agency has realized the need for private co-investment or matching by the entrepreneur to improve impact, and decided to eliminate this program. GITA is still growing and adapting in transition towards being full-fledged innovation agency.
3.4. Agency for SMEs, Innovations, and Investments (HAMAG-BICRO) in Croatia

Overview
HAMAG-BICRO, a Croatian agency for small and medium enterprises (SMEs), innovations, and investments, was founded to support the development of SMEs, improve the innovation process, and encourage investments. It is the result of a merger between two agencies.

Key Takeaways
HAMAG-BICRO has more than 15 years of experience in developing programs for innovation support and 20 years of experience in supporting SMEs through guarantees, grants, and equity investments.

HAMAG-BICRO is the result of a number of organizational mergers in response to a dynamic national innovation ecosystem and an evolving understanding of its strengths and weaknesses.

Role in the Country’s National Innovation System
HAMAG-BICRO acts as the single entry point for SME support. The result of a merger between HAMAG, an SME support and investment agency, and BICRO, an R&D promotion and innovation policy agency, HAMAG-BICRO is a cornerstone of Croatia’s innovation ecosystem. The agency develops and coordinates national innovation policy and offers financial incentive plans and business advisory services through a network of certified consultants.

As implementer of a number of dedicated innovation support programs, HAMAG-BICRO has evaluated more than 1,000 innovative companies and projects and supported more than 200 projects with total funds in excess of US$ 40 million (2008–2013). It has invested more than US$ 20 million into incubators, technology parks, technology transfer offices, and centers of competence. The agency acts as a hub for innovative activity, facilitating access to over 100 experts in the finance, business development, and technology audit fields. As one of the founders of the Croatian Business Angels Network (CRANE), it maintains close contact with investors.

Complementary Agencies
The Ministry of Science, Education, and Sports (MSES) is the central governmental body responsible for implementing, coordinating, and monitoring science, innovation, and technology activities. It oversees the allocation of budgetary funds for R&D activities in public institutes and higher education institutions, as well as for technology programs and related activities including science-industry cooperation and commercialization of research results.

Issues pertaining to innovation and technology transfer are currently under the governance of the Directorate for Science, whose head also chairs the National Innovation System Council (VNIS) of MSES, an expert body (composed

**Headquarters:** Zagreb, Croatia  
**Founded:** 2014  
**Staff:** 112 employees  
**Budget:** Kn 400 million (approximately US$ 60 million) for five years (2016–2020); an average of Kn 80 million (US$ 12 million) per year.  
**Agency model:** Government-funded agency  
**Clients served:** SMEs, scientists, research and development (R&D) consortia, and foreign investors  
**Domestic market size:** 4.1 million people (2017)  
**Mission statement:** Successful and efficient support to technological innovation for industry and public research institutions with the goal of initiating economic growth through technological development, strengthening competitiveness, and social values.  
**Noteworthy results:** The agency has contributed to the development of the innovation ecosystem in Croatia. The agency is accredited with more than 500 new jobs and the attraction of Kn 150 million (approximately US$ 25 million) in private sector investments.
Country Indicators

GDP, PPP: US$ 108.5 billion (2017)
GDP per capita: US$ 13,382 (2017)
Gross Expenditures on R&D (GERD): 0.8% of GDP (UNESCO, 2016)
Public R&D spending: 36.36% of GERD (UNESCO, 2015)
Business R&D spending: 46.64% of GERD (UNESCO, 2015)
World Economic Forum (WEF) competitiveness rank: 74/137 (2017–18)

mainly of scholars) that monitors and facilitates the implementation of the Action Plan 2007–2010. VNIS may involve researchers active in innovation policy analysis to strengthen its competencies.

Policy formulation and implementation is conducted by the National Council for Science and the National Council for Higher Education, the highest advisory bodies in their respective fields. The Agency for Science and Higher Education is responsible for setting up a national network for quality assurance in science and higher education. The Strategic Council for Science and Technology (SVEZNATE) and VNIS were established in 2009 to coordinate research and innovation policy, but they are not functional.

The main support institutions of the Croatian science and innovation system are the MSES, the Ministry of Economy, the Ministry of Entrepreneurship and Crafts, and the Ministry of Regional Development and European Funds. HAMAG-BICRO, the Croatian Science Foundation, and the Unity through Knowledge Fund are specialized intermediary institutions providing competition-based grants for research and innovation.

The contribution of other ministries to innovation activities is rather modest. The Ministry of Agriculture, Forestry, and Water Management is the only ministry to provide grants, which it offers for applied agricultural research. The Ministry of Health is expected to take a more significant role in innovation development, particularly in the biosciences and medicine, after the ongoing health care reform is implemented. The modernization of health care institutions in Croatia should facilitate innovation development in this sector.

Other non-governmental organizations also support innovation in Croatia. The State Intellectual Property (IP) Office of the Republic of Croatia is responsible for the protection of IP rights. It carries out procedures for granting industrial property rights and offers the accompanying professional and legislative services. The Croatian Chamber of Economy and Croatian Employers Association are two leading organizations representing employers. The former is more traditional, with a compulsory membership and stronger links to the government, whereas the latter is voluntary, smaller, and more flexible. Both have an important role in the entrepreneurial policy arena but are arguably not sufficiently active in promoting innovation. The National Competitiveness Council is an advisory body uniting representatives from the government, business, academia, and trade unions, with significant influence on public policy development.

In recent years, there has been a push toward closer cooperation between government bodies in planning and implementing science and technology policies. The need for better inter-ministry coordination in science and technology development has been recognized as a crucial factor in overall strategic development, resulting in the establishment of SVEZNATE and VNIS in 2008. However, the two institutions have not appeared as active stakeholders in science and innovation policies as yet.

Roles, Capabilities, and Organization

Origins and Evolution

Mandate

HAMAG-BICRO is an independent institution under the Ministry of Entrepreneurship and Crafts. It is charged with coordinating innovation policy, fostering SME growth, and motivating R&D investments in the public and private sectors. The agency administers public guarantee funds and guarantees loans given by commercial banks and other creditors, financing fixed assets and working capital. It also implements several policy support measures in Croatia, providing loans and grants for innovative companies, strengthening science-industry cooperation, developing technology and innovation infrastructure, and facilitating equity financing. In addition, HAMAG-BICRO facilitates access to international development programs such as Eureka, which finances several market-oriented projects in various technological fields. One example is Eurostars which enables SMEs to access international cooperation arrangements, sharing expertise and knowledge across borders.
Objectives of HAMAG-BICRO:

- To motivate private sector R&D investment through financial instruments and other measures;
- To encourage and strengthen research and technology activities in academia and connect these to the private sector;
- To strengthen the absorption ability of structural funds from the European Union (EU) in R&D in Croatia, especially in the private sector;
- To develop education, consulting, and networking systems linking the private and public R&D sectors, especially those related to attracting investment and the successful commercialization of innovation; and
- To develop adequate technology infrastructure.

Sectoral Focus

HAMAG-BICRO supports SMEs in all sectors with financial and advisory services. In addition, it offers certain products targeted toward specific sectors. The Agriculture loan guarantee is offered to eligible SMEs that invest in agriculture and fishing and increase the productivity of agricultural production in order to achieve European Union (EU) standards. In addition, under the Entrepreneurial Impulse 2014 Support Program for entrepreneurship and crafts, HAMAG-BICRO gives grants to SMEs with at least 10 employees. SMEs must be in the manufacturing industry, environmental protection, the IT sector, or be considered innovative SME projects.

Business Model Evolution

Today’s HAMAG-BICRO is the result of several mergers prompted by the continuous consolidation and refining of innovation policy and programs in Croatia during the last decade. BICRO was originally the result of a 2010 merger between the former Croatian Institute of Technology (HIT), which funded pre-commercial research activities, and BICRO, a public company developing financial incentives for innovation and technology support. BICRO’s programs were modeled on international best practices and developed with the support of international experts and the World Bank. The merger became the key public institution in charge of catalyzing innovation processes. BICRO develops and coordinates national innovation policy and related financial instruments to motivate the private and public sectors to increase investment in R&D.

The Croatian Small Business Agency (HAMAG, renamed HAMAG INVEST—the Croatian Agency for SMEs and Investments) implemented measures from the 2004–2008 Development Program for Small Enterprises, focusing on financial incentive plans and business advisory services through a network of certified consultants. Established in 1994 as the Croatian Guarantee Agency, HAMAG traditionally implemented only credit guarantee systems, while the former Ministry of Economy, Labor, and Entrepreneurship (MELE) dealt with measures of a nonfinancial nature. From 2007, HAMAG took over a number of MELE programs: improvement of business support infrastructure (business centers, regional development agencies), entrepreneurship support in target groups (youth, start-ups, disabled persons), and support for student cooperatives and student enterprises.

To increase investment in innovation and derive more spillover benefits from BICRO, the existing best-practice program, HAMAG INVEST and BICRO were merged into a single agency for SME support in 2014. This forced two ministries to collaborate in defining and executing innovation policy while simultaneously boosting preparation for the receipt of structural funds from the EU. After the merger, HAMAG-BICRO became the foremost agency in the Croatian National Innovation System.

HAMAG-BICRO is considered to be the single entry point for SME support and development, and operates across Croatia’s innovation ecosystem. To increase the productivity of research and innovation in Croatia, the merged agency conducts activities to attract more applications to its SME support programs. HAMAG-BICRO encourages small business creation, growth, and investments; provides loans; issues guarantees for small business loans; and provides financial support for loan cost reduction. In addition, HAMAG-BICRO supports high-growth export-oriented businesses; subsidizes firm participation in international fairs and exhibitions; provides marketing, certification and Intellectual Property (IP) protection; encourages introduction of new technologies; and works on developing women’s and youth entrepreneurship, among other programs. HAMAG-BICRO has also developed an accreditation system for trainers and has started implementing a project for the accreditation of business consultants, which is based on the regular participation of Croatian consultants in tailored training programs for business service providers.

Organizational Structure

Organizational and Reporting Structure

HAMAG-BICRO operates under the Ministry of Entrepreneurship and Crafts, which is tasked with raising the competitiveness of the Croatian economy through SME and entrepreneurship support. Their purview includes fostering SME competitiveness, applications of innovation and new technologies, developing business infrastructure for SMEs.
Budget Sources and Allocations

The government has invested more than US$ 77 million in innovation programs, leveraging an additional US$ 50 million from private sector sources in the last 18 years. Unfortunately, there is still a lack of commitment for future program allocations, as most funds are committed for three-year periods only. Structural funds will make it possible to plan further ahead, but still will not guarantee continuity. HAMAG’s grant capital is valued at US$ 78 million. Grants are available to different types of SMEs and under different conditions based on the territory in which they operate.

Human Resources and Skills

HAMAG-BICRO has grown from 10 employees in 2014 to 112. However, increasing demand for the organization’s services and the need to respond to new demands is likely to require an expansion of its staff’s technical expertise. Currently, HAMAG-BICRO is developing its competencies in designing programs and financial evaluations, but obtains business and technological evaluations from external sources.
Table 8. Budget Sources and Allocations

<table>
<thead>
<tr>
<th>Year</th>
<th>Program/Fund</th>
<th>Funding Level (US$, millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial inception phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998–2004</td>
<td>RAZUM (loan)</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>20.0</strong></td>
</tr>
<tr>
<td><strong>First transformation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005–2012</td>
<td>RAZUM (conditional grant)</td>
<td>17.0</td>
</tr>
<tr>
<td></td>
<td>TEHCRO (matching grant for infrastructure)</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td>IRCRO (matching grant for R&amp;D)</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>KONCRO (matching grant for services and vouchers)</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>Proof of Concept (PoC) (grant for early-stage development)</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>EUREKA (matching grant for R&amp;D)</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>TEST (grant for R&amp;D)</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>41.3</strong></td>
</tr>
<tr>
<td><strong>Second transformation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013–2016</td>
<td>RAZUM (conditional grant)</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>IRCRO (matching grant for R&amp;D)</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>Seed co-investment fund (equity investment)</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Innovation in entrepreneurship B1 (grant)</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>PoC (grant for early stage development)</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>EUREKA (matching grant for R&amp;D)</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>16.3</strong></td>
</tr>
<tr>
<td><strong>Total funds managed</strong></td>
<td></td>
<td><strong>77.6</strong></td>
</tr>
</tbody>
</table>

Timeline

**Major Internal Events**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>Croatian Guarantee Agency established</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>BICRO public limited liability company established</td>
<td>2007</td>
</tr>
<tr>
<td>2002</td>
<td>RAZUM program begins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Croatian Guarantee Agency becomes the Croatian Agency for SMEs–HAMAG</td>
<td>2004</td>
</tr>
<tr>
<td></td>
<td>Existing programs are changed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A US$ 38 million contract with the World Bank for restructuring BICRO programs and R&amp;D activities in two major public institutes in Croatia signed</td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td>Public call issued for all BICRO programs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HAMAG begins to take over a number of MELE programs</td>
<td>2007</td>
</tr>
</tbody>
</table>
HAMAG supports business centers, regional development agencies, entrepreneurship of target groups, and support of student cooperatives and student enterprises.

**2008-2014**

Due to financial crisis and budgetary cuts, BICRO closes programs that rely on company spending and private investors.

**2009**

BICRO closes call for KONCRO and VENCRO programs.

**2010**

BICRO begins a POC program.

**2012**

BICRO changes status from a public company to a public agency.

HAMAG changes its name to HAMAG INVEST.

**2014**

BICRO merges with HAMAG INVEST; the merger renamed HAMAG-BICRO.

### Implementation, Capacity, and Programs

**HAMAG-BICRO’s activities**

HAMAG-BICRO’s activities can be grouped into four main categories based on their overall goals:

- **(a)** Support for innovative companies (RAZUM, PoC)
- **(f)** Strengthening science-industry cooperation (TEST, ICRÖ, EUREKA)
- **(g)** Development of technology and innovation infrastructure (TEHCRO)
- **(h)** Development of equity financing

#### (a) Support for Innovative Companies

RAZUM provides support for the commercialization of products and services, with market value primarily based on R&D, and which are, or have the potential to be, internationally competitive. It finances start-ups or established SMEs which conduct research leading to new or improved products and services. Subsidies are only available for projects at the pre-commercial stage. Projects that include investments in manufacturing or service facilities are evaluated by RAZUM but can only be financed by the Croatian Bank for Reconstruction and Development.

RAZUM primarily finances two types of innovative companies:

- **Pre-commercial projects** are financed through conditional loans, with 70% of the total value up to US$ 1.8 million provided by RAZUM, and the rest matched by the company. The loan must be repaid once the project reaches commercialization.
- **Commercial projects** are discovered before the stage of investment in production or service capacities, accompanied by a positive decision from BICRO, and are financed through the Croatian Bank for Reconstruction and Development from the program for financing innovation.
The PoC program was created to ensure pre-commercial capital for the technical and commercial testing of innovative concepts, in cooperation with recognized centers (technological infrastructure) offering support to private and public sector R&D. The goal of the program is to finance innovation in its earliest phase and provide grant support to scientists and entrepreneurs, allowing them to test if their current research results, newly devised processes, or technologies are feasible and have potential for commercial use. The PoC Grant Fund operates within the framework of the Croatian Science and Technology Project, in cooperation with the MSES and the World Bank.

The program has achieved results in terms of the number of applications and quality of projects since its introduction in 2010. It disperses grants of US$ 5,200–52,000 to cover external expenses incurred during the commercialization of new products and processes. Eligible activities include IP protection, demonstration of technical viability, and the development of a functional prototype, as well as market analysis, business planning, concept development or strategies for the development and commercialization of products, and business support in establishing market viability. The program is implemented with the help of 11 recognized centers that provide support in the preparation of project applications, which are then evaluated by HAMAG-BICRO.

The KONCRO program subsidizes consultancy services for SMEs in areas of technology and management competences, products and process development, improvement in productivity and product quality, and environmental protection. Projects may involve product design and development, IP rights protection, marketing activities, restructuring, process improvements and standardization, environmental protection, and so on. Applicants must demonstrate that the project will enhance their competitiveness and are obliged to only hire consultants pre-approved by HAMAG-BICRO. Due to the financial crisis, many companies reduced consultancy services, significantly influencing the quality of the project pipeline. Consequently, in 2009, KONCRO was postponed until further notice.

(b) Strengthening Science-Industry Cooperation

TEST is one of the oldest R&D programs implemented in Croatia. The program co-finances applied research initiated by Croatian scientists, with an emphasis on high technology. Applications are compiled through a general public call, although calls for specific R&D activities can be published as well. Project duration is 12–36 months and most projects receive US$ 45,000–450,000.

IRCRO aims to create science–industry links by stimulating demand for the services of public research institutions and encouraging SMEs to invest in R&D activities. Projects involve cooperation between an industrial firm and a research institution and are jointly funded by the IRCRO program up to US$ 120,000 and the industrial company through a 50/50 matching grant.

EUREKA is a European initiative for financing market-oriented projects in various technological fields. Croatia has been a full member of the program since 2000. In 2010, an agreement with the MSES designated BICRO as the program's implementing body. The program supports SMEs that develop new products, services, and processes through 50/50 matching grants up to US$ 170,000. Applicants may include scientific and research institutions as additional partners to benefit from technology and knowledge transfer. Partners must come from at least two different country members of the initiative.

(c) Development of Technology and Innovation Infrastructure

TEHCRO is a program focused on the development of technology infrastructure in Croatia. It is based on three principles: investing in infrastructure (networking), education, and training. The program develops infrastructure in three categories: technology business centers, technology incubators, and R&D centers. About 26% or US$ 2.22 million of all contracted TEHCRO funds are earmarked for the construction and reconstruction of infrastructure. TEHCRO combines investment funds from the state and local levels and is backed by the government through the MSES and the World Bank through the Croatian Science and Technology Project. The program is strategically coordinated jointly by the MSES and HAMAG-BICRO and managed by HAMAG-BICRO.

Objectives:

- To ensure adequate service infrastructure within the scientific community for encouraging technology transfer;
- To encourage the development of specialized scientific and incubation centers (particularly in the field of information and communication technology and bio- and nanotechnology), which stimulate growth and development in innovative companies; and
- To assist in the development of competitive R&D centers as well as provide training for students and researchers in R&D projects associated with Croatian industry.
Figure 10. Programs Administered by HAMAG–BICRO

**Direct Financial Support**
- **Equity finance**
  - Seed co-investment fund

**Loan guarantees and reduced interest rates**
- Loan guarantee program supports investments in all sectors, working capital, and innovations
- Microfinancing supports interest rates as low as 0.99%

**Vouchers**
Supports outsourcing business and technological needs (KONCRO)

**Grants**
A variety of grants and matching grants, depending on the goal (development of products/services, building prototypes, IP rights protection, collaboration): PoC, RAZUM, IRCRO, EUREKA

**Non-financial Support**

**Infrastructure**
- Technology Development Program (TEHCRO)

**Advisory, extension, and training services**
- Advisory services provided by technology infrastructure projects (marketing, financial, business development, and technical advisory)
- Training programs for TTOs

**Collaborative networks and policies**
- Business Science Club
- European Enterprise Network (EEN)

**Information and advocacy**
- Industry-university networking programs
- Mentorship programs for technology infrastructure
- Start-up competitions
- Hackathons

**Indirect Financial Support**

**Tax incentives**
- R&D tax credits for investments (R&D program)

Figure 11. Roles of Front and Back Offices

**Front Office**

<table>
<thead>
<tr>
<th>Department for Preparation</th>
<th>Ex Ante Evaluation</th>
<th>Back Offices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation Programs</td>
<td>Evaluation</td>
<td>Monitoring and Controlling Department</td>
</tr>
<tr>
<td>Units</td>
<td></td>
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</tr>
<tr>
<td>RAZUM</td>
<td>Units</td>
<td>RAZUM</td>
</tr>
<tr>
<td>EUREKA</td>
<td></td>
<td>EUREKA</td>
</tr>
<tr>
<td>IRCRO</td>
<td>RAZUM</td>
<td>IRCRO</td>
</tr>
<tr>
<td>POC</td>
<td>EUREKA</td>
<td>POC</td>
</tr>
</tbody>
</table>

Procedure:
- Front Office → Ex Ante Evaluation → Back Offices
- Back Offices → Monitoring → Front Office
(d) Development of Equity Financing

VENCRO is a BICRO-run program for the development of private venture capital. Currently, it is not fully operational. In 2015, the seed co-Investment fund was introduced. It doubles investors’ capital in new innovative ventures, up to US$ 340,000.

Selection of Projects

Client applications go through three evaluative stages. First, HAMAG-BICRO employees perform an administrative evaluation, checking submitted documentation with tendered propositions. Then, the application is sent to pre-approved external experts, who examine the technological and business potential of the investment proposal. Following their analysis, the documentation returns to HAMAG-BICRO, which tests it for financial soundness. Once all three stages have been completed, the department approves or rejects the project for funding.

HAMAG-BICRO divides duties between the front and back offices, as seen in Figure 11. Clearly defined duties allow the organization to direct more active support to SMEs.

Delivery Challenges

Institutional Reforms

HAMAG-BICRO has survived a few institutional reforms over its history. The first was initiated in 2004, when the RAZUM program was completely redesigned, and other programs were introduced. The transition was supported by the World Bank’s network of global consultants and best practices. As a result of the reform, BICRO refocused from investment in capital equipment (assets) to human capital and creation of innovative products and services (working capital). It also adopted a more risk-prone attitude toward such investments, as reflected in its switch from distributing collateralized loans to conditional grants. It also began requesting additional financing from entrepreneurs in all programs. Lastly, accountability became the most important value at all stages of all programs.

The second institutional change—altering BICRO’s legal status from a public company to a public agency—was executed in late 2012. Its aim was to reduce personnel costs. During this change, a younger sister agency, the Croatian Institute of Technology, was merged with BICRO, as a result of public pressure to reduce the number of agencies.

Following continued pressure to downsize the number of agencies, a third reform, initiated in 2013 and executed in 2014, merged BICRO and HAMAG INVEST. The restructuring created a single entry point for SME development. In addition, the management and supervision of innovation programs was shifted from the MSES to the Ministry of Entrepreneurship and Crafts, which is better equipped to ensure long-term steady governmental support for the program. As the restructuring took longer than expected, it resulted in a loss of qualified employees and a loss of trust from client SMEs.

Budgetary, Capacity, and Political Issues

Since the programs were set up during the 2009 financial crisis, there has been a lack of budgetary commitment. Due to the lack of funding, and with the help of a World Bank loan, BICRO developed the PoC program, which brought relatively low-investment innovations forward. Today, after having successfully supported the national innovation system through lean years, HAMAG-BICRO has a unique opportunity to transfer competencies and knowledge learned from those years, with the help of EU structural funds, into state-of-the-art programs for SMEs.

Poor timing and dramatically unstable market conditions also played a role in BICRO’s 2007 attempt to set up a venture capital fund. Today, Croatia’s innovation ecosystem is more ready, in terms of a sufficient number of accelerators, incubators, technology parks, mentors, start-ups, and investment in pre-seed and seed phases, to foster a space for private capital.

Since the RAZUM program finances R&D activities up to prototype development, companies have to implement commercialization activities by themselves. Around 50% expect difficult commercialization, and around 85% are likely to need additional financing for commercialization activities. Most companies plan to acquire the necessary financial resources internally or through strategic partnerships, and only a small percentage turn to venture capital funds and banks. A potential danger is inability to acquire financial resources for commercialization activities.
**Measurement, Learning, and Results**

**Organizational Monitoring and Evaluation**

**Program Evaluations**

The terms of reference developed to guide evaluations are comprehensive. They focus on the three fundamentals of policy intervention: (a) rationale, (b) implementation, and (c) achievements. Evaluators follow a comprehensive list of generic and specific questions developed with these fundamentals in mind.

The RAZUM and IRCRO programs were officially evaluated for the first time in 2011 by the Institute of Economics. The evaluation results, published in May 2012, consist of two main parts: analysis of existing projects along with conclusions and recommendations to improve the program. Data on the performance of TEHCRO are stored and analyzed by BICRO’s Department for Infrastructure.

**Parties Responsible for Monitoring and Evaluation**

M&E at the agency is performed by two different external expert groups: (a) Technopolis Group Austria, led by Fritz Ohler, provides perspective on how the agency compares to counterparts in other EU states, and (b) the Institute of Economics from Zagreb, led by Sonja Radas, monitors domestic problems and developments.

**Impact Evaluations**

**Evidence of Results**

The 2011 evaluation of RAZUM showed that science and research capacities significantly improved for beneficiary companies, mostly due to the employment of new experts and knowledge transfer, and that participation in the program had a positive spillover effect on other projects, mostly through the creation of ideas and access to new knowledge. The most important benefit of participating in the RAZUM program expected by companies is improved international competitiveness, as shown in the fact that 95% of the products under development are aimed at international markets.

For about half the companies, the expected project result is a patent, indicating that the innovation level of RAZUM projects is very high. The respondents’ evaluations show that around 30% of companies would not have begun their projects in the planned scope without the RAZUM program. While some could have started the project without RAZUM support, project development would have lasted significantly longer, planned activities would have been reduced, and the increase in science and research capacity would probably not have been achieved. Evaluators concluded that the RAZUM program had a significant impact on innovation development and the improvement of research and innovation capacity in its beneficiaries.

The program evaluation concluded that:

- The RAZUM program achieved its specified short-term goals and its implementation should continue in the future;
- Its medium-term goals cannot be evaluated yet, since the program has only been implemented for a short period (since 2006); and
- Participating companies have a high level of satisfaction with the program, with financial contributions being evaluated as very significant.
The main recommendations to improve the program were:

- To design new programs aimed at supporting companies during commercialization of the results achieved with RAZUM funding, through financial assistance and transfer of marketing and other necessary knowledge;
- To improve program visibility, to ensure that all potential participants are aware of the program;
- To shorten the time between the application and the decision on financing; and
- To improve project planning and evaluation to avoid situations where planned financial resources prove to be insufficient for project completion.

The Institute of Economics analyzed 18 of the 20 projects in the IRCRO program. Most of the enterprises surveyed had not cooperated with science and research institutions before entering the program. IRCRO’s financing for the analyzed projects amounted to Kn 10.5 million (approximately US$ 1.6 million), while the enterprises contributed Kn 12.5 million (approximately US$ 1.9 million). The evaluation found that the contracted financial resources were sufficient to complete the project in just nine of the 18 instances. Although only five companies have completed the R&D phase, 11 projects have already started some form of commercialization activity.

The main benefits for the participating companies have been access to favorable financing for R&D projects and a more competitive position in domestic and international markets. Based on the evaluations of the analyzed companies, their R&D activities would otherwise have been on a significantly smaller scale, indicating that IRCRO projects have helped increase R&D among SMEs. In addition, without the IRCRO financing, the project implementation period would have been significantly longer, indicating that IRCRO contributed to shortening time cycles. Likewise, the evaluators concluded that the program enabled cooperation between science and research institutions and contributed to strengthening the links between business and science.

The evaluation concluded that:

- As the IRCRO program efficiently achieved its goals, it should be continued in the future; and
- Entrepreneurs had a high level of satisfaction with the program, with companies and projects rating IRCRO financial support as very important.

The main recommendations to improve the program were:

- To better communication about the IRCRO program, to ensure that necessary information about the program is available to all potential beneficiaries;
- To improve the planning and evaluation phases, and minimize the number of projects in which planned financial resources prove to be inefficient for project completion;
- To encourage the creation of a database of services that the scientific community can provide to the economy, to help companies find partners from the scientific community; and
- To develop a program to assist companies in commercializing the results of IRCRO projects.

Until the end of 2011, TEHCRO’s tenant companies created 360 gross new jobs. The average share of revenue invested in R&D was high (27.26% in 2010, up from 22.14% in 2009). The percentage of revenue invested in training and education also increased from 6.07% in 2009 to 8.10% in 2010. These indicators reflect the quality of the jobs created and preserved within the tenant companies. TEHCRO’s economic and social impact is seen in the extent to which the program influences the successful establishment of regional support centers and incubators. 67% of owners of TEHCRO centers or parks indicate that their project would not be implemented at all without the support received.
3.5. Information and Communication Technology Agency (ICTA) in Sri Lanka

Overview

The Information and Communication Technology Agency (ICTA) is Sri Lanka’s apex body for implementing information and communication technology (ICT) and digital development projects across all sectors. ICTA is wholly owned by the government of Sri Lanka and also assists the cabinet in formulating national ICT policy.

Key Takeaways

ICTA’s programs aim to strengthen digital skills and improve government processes through digitization. As the implementer of most ICT projects funded by the Sri Lankan government, ICTA intervenes at multiple levels in the ICT sector. ICTA’s interventions have contributed to Sri Lanka’s ICT growth. Relatedly, the World Economic Forum (WEF) ranked Sri Lanka 32 out of 139 countries for skills necessary for digital progress and 63 on network readiness.

Role in the Country’s National Innovation System

ICTA plans and implements all ICT projects funded by the Sri Lankan government. The ICT industry has national goals of achieving US$ 5 billion in revenue, a 200,000-person IT workforce, and 1,000 start-ups by 2022. ICTA is involved with developing the IT industry, digitizing the government, developing the digital infrastructure (Lanka Gate), training and building ICT capacity, creating policy proposals, and also ensuring the security of Sri Lanka’s ICT systems.

With a broad mandate, ICTA has worked to boost digital development on several fronts. It has supported digitization of government operations by promoting a common e-government approach (such as the standardized online platform for government payments and processes). ICTA has also focused on improving access to ICT infrastructure and skills. ICTA’s Tele-Center Network Initiative has connected rural populations to the internet in order to improve digital skills and literacy in previously unconnected areas. ICTA’s contribution to economic development has led to programs supporting digital start-ups and the formation of SLASSCOM, which supports internationalization of the ICT industry. It has established a Computer Emergency Response Team (CERT) to oversee cyber-security in Sri Lanka; this operates as an ICTA subsidiary via a public-private partnership. CERT secured international membership quickly by leveraging a talented team. ICTA has also supported ICT policy reform and worked with the government on the adoption of a national-level framework for e-policy and its associated regulations.
Complementary Agencies

In Sri Lanka, the Ministry of Science, Technology and Research is responsible for formulating policies, programs, and projects pertaining to these sectors. It targets alignment of activities that strengthen research–industry collaboration, so that industry's products benefit from research findings.

The government has set up several agencies in support of research and science, including the National Science Technology & Innovation Coordinating Authority (NASTICA), which will facilitate the coordination of research and development activities at a number of research institutions and centers beginning in 2018. NASTICA will take over the responsibilities of the Coordinating Secretariat for Science, Technology and Innovation (COSTI) and also work toward promoting value addition and commercialization in line with the National Science Technology and Innovation (STI) Strategy of Sri Lanka approved by the cabinet in August 2010. The National Science Foundation is an organization under the Ministry of Science, Technology and Research which is set up to initiate, facilitate, and support basic and applied scientific research by universities, science and technology institutions, and scientists. Sri Lanka Institute of Nanotechnology (SLINTEC) is a public-private partnership between the Government of Sri Lanka and five private companies. With its in-house research team, SLINTEC supports the development of technologies which contribute to solving the most urgent and important problems that Sri Lanka, as an emerging economy, need to address, including affordable food security, safe drinking water, health care, and sustainable economic development.

Roles, Capabilities, and Organization

Origins and Evolution

Mandate

ICTA was formulated and operationalized under the 2003 ICT Act, initially to implement the national ICT roadmap within five years. The 2003 Act of Parliament mandated that ICTA would take all necessary measures to implement the government’s Policy and Action Plan for ICT and assist the cabinet in formulating national ICT policy. In 2008, the ICT Act was amended and ICTA was made a permanent organization to provide leadership in policy making and project implementation toward ICT development in Sri Lanka.

ICTA’s mandate gives it both a policy role and an implementation role, providing information necessary for developing ICT policy, and assisting in its implementation. Through its mandate and practice, ICTA has committed itself to encouraging both public and private sectors to adopt policies to change approaches, laws, and regulations. Legal reform has enabled electronic transactions and modernized the electronic payment and settlement system. A new cyber-crime protection system is in place, and ICTA enables cross-government cooperation by adopting open standards.

Legally, the ICTA has special status granted by Parliament for policy support and public private partnerships. This is the first time this approach is used in Sri Lanka. Its mandate has also enabled ICTA to work with key international organizations.

Country Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP, PPP</td>
<td>US$ 275.2 billion</td>
<td>2017</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>US$ 4,074</td>
<td>2017</td>
</tr>
<tr>
<td>Gross Expenditures on R&amp;D (GERD)</td>
<td>0.1%</td>
<td>2015</td>
</tr>
<tr>
<td>Public R&amp;D spending</td>
<td>59.64% of GERD</td>
<td>2015</td>
</tr>
<tr>
<td>Business R&amp;D spending</td>
<td>34.44% of GERD</td>
<td>2015</td>
</tr>
<tr>
<td>World Economic Forum (WEF) competitiveness rank</td>
<td>85/137</td>
<td>2017</td>
</tr>
</tbody>
</table>
**Sectoral Focus**

ICTA has both a horizontal and a sectoral focus. It has focused on catalyzing digital start-ups to increase the export revenue of the ICT industry while enabling the digitization of government services, providing the private sector with more efficient, cost-effective ways of doing business, and delivering internet access and e-commerce literacy to Sri Lanka’s citizens.

**Business Model Evolution**

ICTA was created as a government-owned company to ensure the independence and autonomy of the implementing agency leading the e-Sri Lanka Development Project. The original plan was to appoint a Steering Committee, chaired by the secretary of the Prime Minister, to facilitate and have oversight responsibility for the project. The idea was also to keep the core staff small and maximize opportunities for outsourcing. In recognition of this important mandate, the government removed ICTA’s original sunset clause and in September 2008, it was converted to a government agency.

To ensure the sustainability of the organization, ICTA has started to develop a business plan that focuses on a sustainable revenue-generating model, by charging for the services generated through its projects. Currently, ICTA is a permanent agency overseen by the Ministry of Telecommunication and Digital Infrastructure, along with an inter-ministerial committee.

**Organizational Structure**

**Organizational and Reporting Structure**

ICTA’s institutional home has evolved since its inception. From 2003 to 2005, ICTA was under the Prime Minister’s office, and from 2005 to 2014, the organization was under the Presidential Secretariat. After the original World Bank–funded project was completed in December 2013, ICTA was brought under a new Ministry of Telecommunication and Information Technology, beginning in 2014. In 2015, a new government was appointed, and during its first 100 days—from the presidential election to the general election—ICTA was under the Ministry of Foreign Affairs. With cabinet changes in August 2015, a new dedicated ministry was created in recognition of the enhanced role of ICT in the government’s development policy: the Ministry of Telecommunications and Digital Infrastructure (MTDI).

Since September 2016, ICTA has been administratively operating under the MTDI while for development aspects, it operates as an autonomous organization liaising directly to governmental departments such as the Prime Minister’s office and the Departments of National Budget and National Planning. Project funding is received through the MTDI’s recommendations, which are based on project performance. To measure progress, comprehensive meetings are held twice a month, chaired by the MTDI’s secretary. A comprehensive report on the project’s financial and physical progress is submitted twice a month by ICTA to the Department of National Budget through the MTDI.

An independent board of directors governs the ICTA. The board is appointed by the government and comprises academics, retired senior public officials, and private sector representatives. They provide overall direction and assistance to the Chief Executive Officer (CEO). The board has authority and is accountable to Parliament for achieving the results of the organization. Modeled after private sector boards, its primary function is to represent the shareholders (which includes government organizations). The current board has a mix of six independent professionals and ICTA consultants. The chairman provides leadership to the board and, along with the CEO, manages the entire administrative process, including the day-to-day operations of ICTA.

**Budget Sources and Allocations**

ICTA’s budgetary allowances have shifted greatly during its lifetime. In its earlier years, funding was secured through World Bank project financing with additional government commitments. The agency’s funding requirements have evolved beyond the scope of this project, and beginning in 2017, it has received more substantial commitments.

Until 2014 ICTA was mainly funded by World Bank financing, supplemented by counterpart funding from the government budget. However, the staff was reduced in line with the scaling down of the World Bank-funded e-Sri Lanka project’s scope and funding in 2013. After the project ended in 2014, ICTA funding came from the government budget to maintain project’s services and increase the number of tele-centers to 1,000.

In November 2016, with a new government in place, ICTA’s mandate was expanded and Rp 10 billion (approximately US$ 65 million) was allocated from the government budget to rapidly expand digital infrastructure in Sri Lanka. Subsequently, in the 2017 national budget, ICTA was allocated an additional Rp 15 million (around US$ 100,000) for the digitization of the economy. As a result of this expansion, ICTA increased its staff more than threefold, bringing it up to around 150 at the beginning of 2017.
### Table 9. Programs and funding

<table>
<thead>
<tr>
<th>Source of Funding and Mandate</th>
<th>Funding Level</th>
<th>Approximate US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Development Association (IDA) funding (US$ 44 million); additional financing (US$ 11 million)</td>
<td></td>
<td>US$ 55 million</td>
</tr>
<tr>
<td>Japan Social Development Fund</td>
<td></td>
<td>US$ 1 million</td>
</tr>
<tr>
<td>Government of Sri Lanka counterpart funding</td>
<td></td>
<td>US$ 30 million</td>
</tr>
<tr>
<td>Korean Exim bank funding for LGN Phase 1 and 2</td>
<td></td>
<td>US$ 15 million</td>
</tr>
<tr>
<td><strong>Total budget: 2004–2013</strong></td>
<td>US$ 101 million</td>
<td></td>
</tr>
</tbody>
</table>

| **2014: Ministry of Telecommunications and IT, Budget to upgrade Nenasala centers approved by Parliament** |
|---------------------------------------------------------------------------------------------------------|---------------|
| Enhancement of tele-casters                                                                         | Rp 275 million | US$ 2 million |
| Development of electronic services (e-Services) and mobile-based services (m-Services) to offer government services online | Rp 165 million | US$ 1 million |
| Private sector development: career guidance and capacity alignment; industry knowledge enhancement; SME IT business development; Spiralation, IT and Information Technology Enabled Service (ITES) vendor certification program | Rp 45 million | US$ 300,000 |
| E-society and e-Swabhimani award program                                                             | Rp 15 million | US$ 100,000   |
| ICT policy, strategic communication, and monitoring and evaluation (M&E)                            | Rp 52 million | US$ 350,000   |
| **Total budget: 2014**                                                                                | Rp 552 million | US$ 3.75 million |

| **2015: Ministry of Foreign Affairs (Jan–Aug 2015); Ministry of Telecommunication and Digital Infrastructure (2015 August onward)** |
|-------------------------------------------------------------------------------------------------------------------------------|---------------|
| ICT and Business Process Outsourcing (BPO) industry promotion and capacity building program                                  | Rp 66 million | US$ 400,000   |
| Citizen empowerment and connectivity development program, including free Wi-Fi facilities and tele-center development        | Rp 150 million | US$ 1 million |
| ICT for society development                                                                                                | Rp 10 million | US$ 70,000    |
| Forensic and cyber-security infrastructure development                                                                       | Rp 22 million | US$ 150,000   |
| Enhancing citizen and business services including local government services                                                  | Rp 194 million | US$ 1.3 million |
| Management of government software and hardware infrastructure                                                              | Rp 43 million | US$ 300,000   |
| Monitoring and Evaluation                                                                                                | Rp 20 million | US$ 130,000   |
| Other                                                                                                                   | Rp 45 million  | US$ 300,000    |
| **Total Budget: 2015**                                                                                                      | Rp 550 million | US$ 3.65 million |
### Source of Funding and Mandate

<table>
<thead>
<tr>
<th>Funding Level</th>
<th>Rp</th>
<th>Approximate US$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2016: Ministry of Telecommunications and Digital Infrastructure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer from National Budget 2016 approved from the Parliament</td>
<td>Rp 10 billion</td>
<td>US$ 70 million</td>
</tr>
<tr>
<td><strong>Total budget: 2016</strong></td>
<td>Rp 10 billion</td>
<td>US$ 70 million</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2017: Ministry of Telecommunications and Digital Infrastructure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer from National Budget 2017 approved from the Parliament</td>
<td>Rp 15 billion</td>
<td>US$ 100 million</td>
</tr>
<tr>
<td><strong>Total budget: 2017</strong></td>
<td>Rp 15 billion</td>
<td>US$ 100 million</td>
</tr>
</tbody>
</table>

While the current funding situation is under review, there are indications that government support to ICTA will continue. ICTA gets its funding through proposals made to the MTDI, which submits the budget requests to the Ministry of Finance and Treasury. After discussions with the respective agencies, the Treasury allocates funds. At present the national budget allocates funding to the Ministries of Health, Education, and Local government; since ICTA is a service provider to these ministries, they then allocate a budget to ICTA for projects. There are currently no additional sources of funding.

### Human Resources and Skills

When it was founded in 2003, ICTA employed just 60 individuals. Its roster has grown substantially to support its growth and the needs of both the private sector and the government. While early staff focused primarily on completing the e-Sri Lanka project, the staff today focus on a wide range of technology and training programs implemented across the country. As a result of this expansion, ICTA nearly tripled its staff, up to around 150 at the beginning of 2017.

ICTA has freedom to hire and retain key staff outside typical government constraints. It has independence of operations and is insulated from normal government remuneration and recruitment practices. ICTA’s board has been empowered through a cabinet paper to hire consultants with competitive remuneration to manage and implement ICT development projects. ICTA is made up of specialized program and project managers, architects and technical experts, cross-cultural professionals, legal and cyber-security experts, and Monitoring and Evaluation (M&E) experts.

The five-member Industry Development Program (IDP) team possesses a diverse set of skills instrumental to creating awareness among students about ICT and related career opportunities, attracting youth to join the ICT industry workforce, and building internal industry capacity via upskilling and reskilling the workforce in the latest technologies.

### Timeline

**Major Internal Events**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>ICTA established through ICTA Act</td>
</tr>
<tr>
<td>2005</td>
<td>Pilot programs helped define six program areas for ICTA: Information Infrastructure; ICT Policy, Leadership and Institutional Development; Re-engineering Government; ICT Human Resource Development; ICT Investment and Private Sector Development; and the eSociety program</td>
</tr>
<tr>
<td>2008</td>
<td>ICTA is made a permanent entity of the government and the original sunset clause removed</td>
</tr>
<tr>
<td>2010</td>
<td>Tech start-up support program initiated</td>
</tr>
<tr>
<td>2014</td>
<td>Organizational restructuring: ICTA brought under Ministry of Telecommunication and Information Technology</td>
</tr>
</tbody>
</table>
2015
ICTA begins reporting to Ministry of Foreign Affairs causing implementation of approved projects to stall due to lack of understanding of its priorities
ICTA’s Nenasala Technology Centers program to increase ICT literacy and empower the rural community receives Gates Foundation Award with US$ 1 million and an equal value of software

2016
ICTA now reports to the MTDI

Major External Events

2004 e-Sri Lanka Development Project launched
2014 New cabinet and new Ministry of Telecommunication and Information Technology established
2015 New government sets out to accelerate development across all sectors; 100-day program implemented
ICT as a subject shifted to the Ministry of Foreign Affairs
2018 Science Technology & Innovation Coordinating Authority (NASTICA) established, replacing the Coordinating Secretariat for Science, Technology and Innovation (COSTI), which has been coordinating and monitoring activities in these areas

Implementation, Capacity, and Programs

About ICTA programs

Industry Development Program
Through private sector-led initiatives the IDP promotes existing ICT industry in Sri Lanka and encourages emerging sectors and entrepreneurship, stimulating industry growth, and promoting competitiveness. Specifically, the IDP aims to strengthen the private sector’s capacity to create jobs, grow export revenue, and launch new businesses. Two flagship programs, Tech Start-up Support Program (established 2010) and the Country Branding and Business Promotion Program (established 2009), are complemented by several other initiatives set up to support this objective.

Tech start-up support program
The Tech start-up support program consists of Spiralation (a seed funding program), market access programs, and community building activities, such as Start-up Weekend and pitching contests. The program facilitates the major aspects required for start-up ecosystem growth, including a monthly forum bringing all stakeholders of the ecosystem together to identify and strategize for its growth. Through partnerships, the Tech Start-up Support Program facilitates community building and validation of start-up ideas through global pitching competitions and country-wide hackathons.

The government-funded Spiralation start-up accelerator program provides business development services to technology entrepreneurs and early-stage technology companies. The objectives of this program are to create awareness of and interest in innovation and entrepreneurship, particularly among students; facilitate public-private dialogue in the start-up ecosystem; and promote the development of the ecosystem that allows technology companies to flourish. The program includes seed funding (grants), training, networking sessions, business promotion opportunities and hackathons. Seed funding takes the form of grants for infrastructure, business development mentoring, and promoting the development of the ecosystem that allows technology companies to flourish. The program includes seed funding (grants), training, networking sessions, business promotion opportunities and hackathons. Seed funding takes the form of grants for infrastructure, business development mentoring, and promoting the development of the ecosystem that allows technology companies to flourish. The Spiralation programs have incubated 56 tech start-ups as of December 2017, with 45 start-ups receiving a total of US$ 245,000 in seed funding since 2011. Of these companies, over 25 were new businesses formed through the fund, while the rest were already existing companies looking to grow their products to the next stage. Selected companies are also given training, for example, on business model development, pitching, design thinking, legal, finance, marketing, digital media and security.

A critical area for the growth of start-ups is market exposure and access. With this in mind, ICTA promotes market access for young companies in Sri Lanka. Opportunities to exhibit overseas and locally are provided for any technology start-up in Sri Lanka that fulfills the criteria for application. Such opportunities include ‘4 Years from Now’, a conference held in Barcelona, Spain, and at the InnovFest unBound in Singapore. So far, ICTA has sponsored 21 start-ups from Sri Lanka have attended such conferences. ICTA also subsidizes a start-up pavilion at the Infotel Exhibition, the largest ICT expo in Sri Lanka. Over the years, more than 70 start-ups have exhibited through the start-up pavilion.

The Tech Start-up Support Program also includes training on topics such as software patenting and API integration. Disrupt Asia was started by ICTA in 2016. It is the premiere start-up conference and exhibition in Sri Lanka, providing a platform for start-ups, investors, associations, corporate incubators, mentors, seasoned founders, and others to engage with each other.
The National Youth Software Competition is a social innovation hackathon and incubation program sponsored by ICTA in collaboration with the MTDI and the UNDP. The competition aims to find innovative technology-based solutions based on the UN's sustainable development goals.

Start-up Weekends, Global Student Entrepreneurship Awards, and Seedstars are some of the international programs supported by the ICTA through the start-up program. ICTA also covers up to 50% of the cost to other organizations that undertake initiatives for entrepreneurs and start-ups to create an impact in the ecosystem.

Country Branding and Business Promotion

The Country Branding and Business Promotion program promotes international exposure of the Sri Lankan ICT Industry in designated countries. This program promotes Sri Lanka as a destination to source technology and skills.

Capacity Building Programs

ICTA also provides training, awareness raising, and networking opportunities across the ICT value chain. The IT for Regional SMEs and Professionals Program educates...
SMEs in industry verticals and provides opportunities for regional business development.

ICTA assists in upskilling current employees in the technology sector and bringing in new technological knowledge. ICTA collaborates with a reputed domestic or international consultancy firm to deliver market surveys based on industry need. The IT/ITES vendor certification program subsidizes the cost of international vendor certification for globally recognized technology vendors while the IT/ITES knowledge enhancement program offers the latest knowledge to ICT employees through a series of short courses to enhance competitiveness. A public-private partnership facilitation program provides a forum for communication and engagement between the two sectors in Sri Lanka.

Digitization Programs

As ICTA aims to increase the digitization of the Sri Lankan economy, a large part of ICTA's resources are used for digitizing government, building ICT infrastructure, and providing access to the internet, developing ICT skills in the population, and empowering citizens.

The Lanka Government Payment Service (LGPS), launched in 2010, facilitates credit card and mobile payments for government services. ICTA envisages that in the not-too-distant future, both small-scale entrepreneurs and low-income households will benefit from digital solutions, enabling them to grow their businesses and make fast and cost-effective financial transactions.

IT Business Process Management Career Guidance

ICTA also encourages the pursuit of ICT careers in the population. To boost the profile of the technology industry within a community that is largely focused on traditional careers (medicine, engineering, and law), ICTA raises awareness about career opportunities in these new sectors. Together with the Ministry of Education, industry associations such as SLASSCOM, and the Federation of IT in Sri Lanka (FITIS), career guidance sessions have been carried out throughout the country. To this end, information and advice is offered to students, teachers, principals, and parents to change the mindset of key individuals who influence students’ perspectives of the technology industry. As of December 2017, more than 48,000 people have been reached with these messages. Moreover, the IT Internship Support Program incentivizes companies to recruit more ICT interns, and with a more planned training plan.

Delivery Challenges

Institutional Reforms

Even though ICTA is outside conservative bureaucratic government structures, the agency has to rely on these organizations for funding and other approvals. Being placed under the Ministry of Foreign Affairs created challenges for ICTA in implementing planned programs in 2015, since the relevant skills and knowledge pertaining to ICT were housed in a different ministry. This has since been corrected.

Budgetary, Capacity and Political Issues

ICTA has enjoyed political support from successive presidents, prime ministers, and the parliament, due to the recognition of the critical role that ICT sector plays in achieving the country’s development goals. Digitization is seen as a positive force towards reducing unemployment, improving quality of life, and boosting access to knowledge and public services.

Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations

The ICTA has incorporated a Monitoring and Evaluation (M&E) program to guide the design and implementation of individual projects. The M&E framework is used to improve stakeholder participation in planning and implementing projects as well as human and institutional capacities. ICTA projects therefore require gathering diverse data first to establish baselines and then to measure outcomes and impact.

Evaluation Methodologies

Under the M&E system, program and project-specific baseline and evaluation surveys are undertaken to measure progress in achieving outcomes. Based on the findings, regular progress reports with recommended corrective actions for improving performance are produced by the M&E team and sent to ICTA management as well as other key stakeholders.
The M&E team works directly with project teams to identify data requirements, responsibilities, methodologies, and frequencies. Project-specific log frames are developed for each project and are validated with the key stakeholders through a participatory process to ensure the proper ownership, roles, responsibilities, and accountabilities. As a part of the monitoring process, the M&E team undertakes field visits to project sites to review specific activities. Such field visits involve direct discussions with project beneficiaries through focus group discussions, which is also done to strengthen the relationship between ICTA and its beneficiaries. The findings are communicated to the project teams to take appropriate corrective measures.

**Parties Responsible for Monitoring and Evaluation**

The dedicated M&E unit of ICTA leads the entire M&E process with the active participation of project staff. This unit is responsible for designing and implementing general and project-specific M&E strategies and activities; developing a project monitoring information system; and conducting M&E related capacity building where required. Monthly monitoring reports and annual evaluation reports are produced based on M&E activities and findings.

The M&E unit also reviews international benchmark indices such as the International Telecommunication Index, Networked Readiness Index, and the United Nations’ e-Government Index to understand Sri Lanka’s position in terms of ICT development.

**Impact Evaluations**

**Evidence of Results**

ICTA has delivered a number of projects to enable a digital economy in Sri Lanka. One of the flagship projects, the Lanka Government Network has established a government network with 2 Mbps to 100 Mbps last-mile connectivity to each government organization, including post offices and established wireless networks at each government location.

The e-Services project has implemented more than 50 e-services offered by approximately 23 government organizations since 2009 via www.gov.lk.

Under the Free Wi-Fi Initiative, the ICTA has provided free internet access at over 200 locations such as main bus stands, common shopping centers, government organizations, railway stations, public libraries, hospitals, universities, and other public places. More than 1,000 Nenasala Centers across the country have provided the rural community the chance to gain increased access to ICT services.

In an effort to increase ICT knowledge and skills in Sri Lankan society, ICTA has established SMART Social Circles in 60 Grama Niladhari divisions throughout the country and created 600 knowledge agents in the selected divisions. The project is scaling up to reach all provinces in the country.

The Lanka Government Payment Service (LGPS), launched in 2010, facilitates credit card and mobile payments for government services. ICTA envisages that in the not-too-distant future, both small-scale entrepreneurs and low-income households will benefit from digital solutions, enabling them to grow their businesses and make fast and cost-effective financial transactions.

By December 2017, 6,115 individuals were trained through ICTA projects on new technology areas and other key skills required in the technology domain, such as technical documentation and business negotiations. This also includes specialized cyber-security trainings for 300+ individuals in 2017 in partnership with IS2 and ISACA, as cyber security was identified as a key area of interest in the next five years. Additionally, 3,167 individuals were provided subsidized vouchers to complete certifications on Microsoft, CISCO, Java, and Oracle training programs. This program was completed in 2014 with the intention of upgrading the qualification trainings to a higher level in the future.

The IDP has created about 200 jobs through the tech start-up program Spiralation. This program has also led to the establishment of new businesses, such as Audinary, a language-learning platform. ICTA has hosted two hackathons to generate networking, skill development, and business opportunities. It has created networking and development opportunities for Sri Lankan businesses through a start-up conference and facilitated the participation of start-ups in international events, such as NASSCOM Emerge, organized by the apex body for the IT and business process management industry in India to highlight emerging companies and innovations. ICTA’s engagement with the Australian market since 2011 has contributed to improving Sri Lanka’s ICT industry rankings at global analyst firms every year. At present, Sri Lanka is ranked 11 in the Global Services Location Index by ATKearney and placed in the top six Primary Countries in Asia Pacific by Gartner. Furthermore, through business promotion activities, over 75 unique companies have received at least one opportunity through ICTA to be part of an exhibition or networking meeting in Australia with 80% of the beneficiary companies either realizing sales, setting up a partner network, or establishing an office in Australia. Looking at the revenues obtained by ICTA-facilitated companies, the IDP’s Australian market activities have yielded a return on investment greater than 14 times the total ICTA investment.
3.6. Innovation Fund (IF) in Serbia

Overview

The Republic of Serbia Innovation Fund (IF) aims to contribute to the country's economic development by supporting enterprise innovation with financial instruments, including mini and matching grants, as well as a collaborative grant program. It promotes linkages between the research and business sectors, encouraging the development of innovative technologies and products.

Key Takeaways

The IF operates in a transition economy, aiming to bridge the country’s technology and development gap by fostering commercial innovation. Operational since 2011 as a public intervention the IF is designed to increase the capacity of technology start-ups, SMEs, and innovative companies and the variety and volume of resources available for their growth. The IF has expanded the network of tech-based entrepreneurs by creating a relatively high number of collaborations with academia and industry, both locally and internationally.

The IF has served a catalytic function in the ecosystem, generating bottom-up demand for innovation financing. Initiated to fill a relative vacuum of start-up and SME support in Serbia, IF activities laid the foundation for the entrepreneurial community, which now boasts regular events, competitions, multiple funding windows, and efforts to link research institutions to private sector partners.

The IF’s governance structure and processes are based on international practices developed with the assistance of the World Bank. It has a network of sister agencies and has delivered training and transferred know-how to agencies in other countries, including the Republic of North Macedonia and Georgia.

The IF has positioned itself to leverage European Union (EU) accession funds and prepare Serbia to benefit from future structural funds for enterprise development by developing implementation procedures for effective operations.

Role in the Country’s National Innovation System

Serbia’s current innovation ecosystem is marked by low efficiency and quality of research, especially company-based technological development. The Global Competitiveness Report 2017–18 ranks Serbia 47th of 137 economies in the quality of scientific research institutions, 107th in company spending on research and development (R&D), and 95th in academic–industry collaboration. The EU Innovation Scoreboard for 2017 evaluates Serbia’s innovation performance as moderate, noting a 17.3% increase in performance relative to that of EU in 2010. Serbia has a high unemployment rate of around 15.3% (2016). Among youth, the rate is more than double that. Economic growth, already constrained by the post-conflict and post-sanctions environment, as well as political instability and late onset of transition, has been further compounded by the global financial crisis. The country’s poor demographic outlook (an ageing population and
low birth rate) is additionally burdened by brain drain, reflected in its 134th position (among 137 countries) for capacity to retain talent and 132nd position for capacity to attract talent.

The main public actors in Serbia’s innovation system are the advisory National Council for Science and Technology Development; the Ministry of Education, Science, and Technological Development; the Cabinet of Minister without portfolio in charge of innovation and technological development (since June 2017); the Center for Promotion of Science; and the IF. In addition to addressing the financial needs of innovative small and medium-sized enterprises (SMEs) and start-ups, the IF has served as a convener and promoter of enterprise innovation. It cooperates with other government entities to advance policy reform (including participating in coordinating the program of the Western Balkans Enterprise Development and Innovation Facility, WB EDIF) and supports private business associations in the development of business incubators and wider economy initiatives (StartLabs, Serbia Private Equity Association, StartIT, ICT Hub, Belgrade Venture Forum, and many others). Furthermore, the IF has initiated the Technology Transfer Facility (TTF) as an auxiliary function. It works closely with the higher education sector and other public research organizations to help strengthen linkages between the business and education/research communities and support technology transfer. Finally, the IF has played an important role in leveraging national and EU accession resources to create an investment pipeline for further venture capital funding, including the Western Balkans investment funds that are supported by EU financial institutions.

Complementary Agencies

A number of agencies complement the work of the Serbian IF. The Development Fund of the Republic of Serbia provides subsidized loans to businesses. The Development Agency of the Republic of Serbia provides grants and technical assistance to businesses. On a regional level, the Enterprise Innovation Fund (ENIF), operational since 2015, supports early-stage equity financing in innovative SMEs. It works under an initiative of the WB EDIF, which is coordinated by the European Investment Fund and implemented in close cooperation with the governments of the Western Balkans, the European Commission, the European Investment Bank, and the European Bank for Reconstruction and Development. The IF, with full endorsement from the Serbian government, has been instrumental in the creation of WB EDIF, including the ENIF fund, which signals that additional support, beyond the initial seed funding, is required for growing innovative enterprises. The IF also helped shape the ENIF program, requesting that it focus on technology-based innovations and the somewhat lower levels of equity financing which are more appropriate for existing market needs.

Finally, there are public and private actors that support business innovation on a relatively small scale, such as incubators and accelerators (for example, StartLabs, Belgrade Technical Faculties Business Incubator, StartIT, and ICT Hub). Serbia IF is located on the premises of Belgrade Technology Park, which is the first fully functioning technology park in Serbia.

Roles, Capabilities, and Organization

Origins and Evolution

Mandate

The Serbian IF is an executive public entity that provides donor-financed early-stage funding to innovative enterprises. It was established in May 2011, under the Law on Innovation Activity, which was adopted in 2005, and further revised in 2010 and 2013. Its goal was to fill the gap of policy support for commercial innovation, and in doing so, to leverage EU and national resources based on a transparent and effective governance structure. In December 2011, the IF started implementing the five-year €8.4 million (approximately U$10.3 million) Innovation Serbia Project (ISP), financed by the EU and administered by the World Bank.
Under the project, two flagship programs, the Mini and Matching Grants Programs, were developed, and these programs continued receiving national funding (through the World Bank Competitiveness and Jobs Project) from 2017. As stipulated by the government of Serbia’s Strategy for Science and Technology Development: Research for Innovation, 2016–20, the IF is an important institution contributing to the country’s goal of achieving excellence in science and research and ensuring the relevance of research results to the economy and society. This comprehensive strategic document further calls for progressive research finance reform and the reform of public research institutes based on functional evaluations.

**Sectoral Focus**

The funding support provided by the IF is sector-agnostic. The fund accepts applications from all sectors, revealing a capacity for firm-led innovation beyond the ever-dominant Information and Communication Technology (ICT) sector. Beneficiary companies have demonstrated potential in sectors as diverse as agribusiness, construction, and bioengineering.

**Business Model Evolution**

Experience in working with innovative companies led the IF to seek additional support from the EU and the World Bank to pilot the next generation of instruments designed to address coordination failures within Serbia’s enterprise ecosystem. The fund launched the Technology Transfer Facility and Collaborative Grants Scheme in February 2015 under the Serbia Research, Innovation, and Technology Transfer Project (SRITTP). The SRITTP is an EU-financed project administered by the World Bank and implemented in part by the IF, with a value of €2.5 million (approximately US$3.1 million). The program’s main goal is to facilitate reorientation of the public research sector toward the needs of the private sector, piloting a system of technology transfer and introducing a new financial instrument, the Collaborative Grants Scheme (CGS), to foster a knowledge-based economy. CGS is implemented through a Direct Grant Agreement between the Ministry of Finance and the IF; it has €2.4 million (approximately US$3.1 million) EU Instrument for Pre-Accession Assistance (IPA) 2013 funding, with €1 million (approximately US$1.2 million) from the budget of the Republic of Serbia, and €1 million from the private sector in a form of grant co-financing. CGS provides financial assistance in the form of grants of up to €300,000 (approximately US$370,000) to consortia consisting of at least one Serbian private-sector company and at least one registered Serbian public-sector R&D organization.

**Organizational Structure**

**Organizational and Reporting Structure**

The Serbian IF reports to the government by submitting annual reports and biannual and annual financial reports to the Ministry of Education, Science, and Technological Development. The IF employs 20 professional staff, a managing and supervisory board appointed by the government, a prominent, independent international investment committee, a strategic advisor, and environmental and procurement experts. The organizational structure is set up according to best practices as advised by the World Bank, based on trainings the IF staff have received during visits to similar institutions in Israel and Finland.

**Budget Sources and Allocations**

In 2017, the total budget of the Serbia IF was €7.72 million (approximately US$9.5 million), of which €720,000 (approximately US$890,000) was for operations (provided from the state budget); €2.7 million (approximately US$3.3 million) was allocated for the implementation of the Mini and Matching Grants Programs (provided from the state budget); €900,000 (approximately US$1.1 million) was earmarked for TTF operations and services (provided from the state budget); and €3.4 million (approximately US$4.2 million) for implementation of the direct grant for the CGS Program (IPA 2013).

**Human Resources and Skills**

The IF initially relied on external expertise to establish procedures and build administrative capacity. As noted earlier, the World Bank provided technical assistance and assisted the IF in establishing policies and procedures, and engaging five-member Investment Committee composed of distinguished international experts and members of the diaspora with experience in venture funds, technology, and research sectors. The 20 IF staff have been mentored by the members of the investment committee, a strategic advisor with senior experience from Israel who is still engaged with the IF, and a former operations advisor from Poland. They have also received additional training and participated in study visits to institutions in Israel, Finland, Croatia, and the United Kingdom.
Timeline

Major Internal Events

2005 | Law on Innovation Activity, which laid down the vision for the IF, adopted
2011 | IF operationally established
     | Innovation Serbia Project (ISP) initiated
     | Mini and Matching Grants Programs developed with the technical support of the World Bank and financial support of the EU
2015 | Serbia Research, Innovation, and Technology Transfer Project (SRITTP) designed
2016 | ISP completed
     | SRITTP initiated, including establishment of Technology Transfer Facility (TTF) and a new Collaborative Grants Scheme (CGS)
2017 | Public funding of Mini and Matching Grants and TTF Programs started

Major External Events

2000 | Political regime change in Serbia; international relations fully resumed
2008 | Serbia–EU Stabilization and Association Agreement signed
2011 | Serbia formally recognized as an official candidate for EU membership
2013 | Ratification process for Serbia–EU Stabilization and Association Agreement completed; agreement fully in force
2015 | Serbia and EU accession negotiations formally initiated;
     | Serbia and EU open negotiations of two chapters of the acquis communautaire; ENIF begins operations
2016 | Regional Development Agency and Serbia Investment and Export Promotion Agency merge into the newly-established Serbia Development Agency

Figure 13. IF Reporting Structure

Source: Innovation Fund
**Implementation, Capacity, and Programs**

**Selection of Projects**

Financing decisions are made on a competitive basis by the IF’s independent Investment Committee. External evaluators (two independent professional peer reviewers per applicant), highly qualified foreign nationals, or members of the diaspora, perform the first part of the evaluation/technical review, followed by the independent investment committee’s pre-selection decision. The final decision for financing is made by the IF’s investment committee via consensus at a live pitch event. During this event, all pre-selected applicants which have been previously environmentally approved are given the chance to present their projects in front of the investment committee. The number of awards is determined by the quality of the proposals and limited by the total funding allocated to the IF programs.
### Table 10. IF Programs

<table>
<thead>
<tr>
<th></th>
<th>Mini Grants Program</th>
<th>Matching Grants Program</th>
<th>Technology Transfer Program</th>
<th>Collaborative R&amp;D Grant Scheme</th>
</tr>
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<tbody>
<tr>
<td><strong>Objectives and stage</strong></td>
<td>Proof of concept, prototyping stage, intellectual property (IP) protection, business plan preparation for mobilization of initial capital</td>
<td>R&amp;D (technology development) and commercialization projects for new or improved technologies, products, and processes</td>
<td>TTO capacity building, public R&amp;D innovation commercialization</td>
<td>Increase collaborative R&amp;D activities and utilize existing infrastructure in public sector R&amp;D institutions to foster industry-driven research</td>
</tr>
<tr>
<td><strong>Beneficiary</strong></td>
<td>Innovative start-ups, spin-offs, micro and small enterprises, all with majority Serbian private-sector ownership</td>
<td>Innovative start-ups, spin-offs, micro and small companies, all with majority private-sector ownership</td>
<td>TTOs at 4 public universities, public-sector R&amp;D institutions, innovation support organizations</td>
<td>Consortia consisting of at least one Serbian private-sector company and at least one registered Serbian public-sector R&amp;D organization</td>
</tr>
<tr>
<td><strong>Grant size</strong></td>
<td>Up to € 80,000 (approximately US$ 98,000)</td>
<td>Up to € 300,000 (Approximately US$ 370,000)</td>
<td>Up to € 10,000 (Approximately US$ 12,000)</td>
<td>Up to € 300,000 (Approximately US$ 370,000)</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Up to 12 months</td>
<td>Up to 24 months</td>
<td>Ongoing</td>
<td>Up to 24 months</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>Up to 85% co-financing by the fund; awardee co-financing required</td>
<td>Up to 70% of approved project budget, 5% royalty component, or 15% of licensing revenue; up to 120% of IF financing; up to 5 years after project completion</td>
<td>Grants for proof of commercial readiness activities</td>
<td>Up to 70% co-financing by the fund and at least 30% secured by the lead applicant</td>
</tr>
</tbody>
</table>

**Note:** IF programs also provide support for financial management, IP protection, and business development training, as well as mentoring innovative enterprises to enable them to prepare for the next stage of development.
Delivery Challenges

Institutional Reforms

At present, the regulatory framework relating to IF operations is generally favorable. It has been fine-tuned to remove some of the limitations of the Law on Innovation Activity and improve IP legislation, but requires further reform to enhance the quality of research and linkages between science and business community. For example, the Law on Innovation Activity insists that innovation support beneficiaries be listed in the Innovation Registry administered by the Ministry of Education, Science and Technological Development (includes stringent requirements such as at least one employee with a doctoral degree). Furthermore, innovation financing programs are rendered subject to de minimis, rather than to a wider set of state aid regulations. There is also an initiative to adopt a new law or update the Investment Fund Law to regulate venture-capital financing, but this is not deemed crucial for enterprise development as most funds prefer to be registered in tax havens and are unlikely to register in Serbia.

Budgetary, Capacity, and Political Issues

A key challenge to future IF operation is the restrictive budgeting resulting from the fiscal consolidation required to improve Serbia’s macroeconomic environment. Whether a more significant investment will be made to channel additional support for enterprise innovation and benefit from the developed IF governance structure is a political decision.

Retaining qualified staff is a continuous challenge. The current reform of public-sector wages, if not undertaken carefully, may increase staff turnover due to higher migration to private-sector opportunities. IF staff compensation has been higher than in other public agencies. Furthermore, future increases in funding will necessitate an increase in the number of staff of similar quality, which will require a special approval due to a hiring freeze in Serbia’s public sector.

Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations

The Serbian IF’s programs and operations undergo regular evaluations, from independent application reviews to a thorough internal as well as independent external monitoring and evaluation process, including company visits and reporting over a project’s duration and upon its completion.

Evaluation Methodologies

The beneficiary companies regularly report to IF staff, which also organizes on-site visits in addition to compiling and reviewing relevant financial and project progress data. Although not required to do so by law, the IF engages an independent financial auditor annually and has performed an ex post evaluation analysis. Since the IF implements EU funding within projects that are administered by the World Bank, it also reports regularly to the World Bank and the European Union regarding applied procedures and expended funding, following a set of relevant monitoring indicators. Furthermore, the World Bank annually conducts an independent evaluation of program implementation, which includes a comprehensive, anonymous qualitative survey of beneficiary companies.

Impact Evaluations

Evidence of Results

The Serbian IF’s activities have been credited for generating new business, employment, protected IP, and sales of higher value-added products and services. Nevertheless, the IF supported just 52 projects in four years—a small sample to have an economy-wide impact. Within this sample, some of the successful results claimed by the fund are:

- 20 companies have generated revenue from the sale or lease of their innovative products;
- 9 companies have established international cooperation;
• 2 companies have secured distributors on the U.S. market;
• 33 national patent applications have been submitted by beneficiary companies;
• 25 international patent applications have been submitted by IF-supported companies to the Patent Cooperation Treaty, European Patent Office, USA, Australia, Eurasia and Japan;
• 18 companies have established new business cooperation arrangements or partnerships.

Studying differences between firms that received a mini grant and those that applied but were rejected reveals that the former increased their sales by an almost €27,000 (Approximately US$ 33,000) and employment by an additional five employees, on average. Evaluation analysis has generated similar results to the raw data: receiving a mini grant is associated with an increase in sales by nearly €20,000 (approximately US$ 25,000) and employment by five employees, on average, relative to what these firms would have experienced had they not received the mini grant. The effect on employment is statistically significant, but the effect on sales is not. Almost half (156 out of 326) of the technology start-up/spin-off firms that submitted applications for IF financing were created due to the IF opportunity. In addition, a high survival rate of 91.7% and 100% is found among firms that receive IF mini and matching grants, respectively. These are significant effects overall, because the pre-treatment sales and employment were zero and 0-1 employees, respectively, for the vast majority of the supported firms. Only 11 firms received matching grants, precluding an evaluation for wider impact. As concluded by an independent evaluation, 52 projects in four years is too small a number to have an economy-wide impact. It has been estimated that 200-300 R&D projects (based on a budget of €30 million, or approximately US$ 37 million) annually would significantly accelerate growth.

The success rate of the selected projects is very high, which is explained by a tough selection process—only 12% (55 projects) of all submitted projects (469) in four financing calls between January 2012 and October 2013 have been selected. It remains to be seen whether this success rate will continue after increasing the number of funded companies.

Finally, in addition to appreciating staff professionalism, an independent review found that project objectives and programs are deemed by beneficiaries to be clearly specified, accessible, and effective. This was confirmed by the 2016 evaluation of the CGS, which found the selection process to be fair and transparent, and the IF staff objective and professional. The evaluation found further evidence that this program was catalytic in promoting collaboration between research and business sectors, stressing the important role of the IF in Serbia's technological development.
Overview

INNpulsa is a Colombian government agency that supports the development of high-growth entrepreneurship. Originally, INNpulsa was created as a lending support for the development of high-growth entrepreneurship. Since 2015, following a merger with another agency, its scope widened to include support for entrepreneurship in general, as well as for the development of small and medium-sized enterprises (SMEs).

Key Takeaways

INNpulsa made concentrated efforts to promote the entrepreneurship and business innovation agenda to the economic forefront in Colombia. It has done so through simultaneously providing support for high-growth entrepreneurs; developing local ecosystems to act as springboards for high-growth entrepreneurship; and seeking cultural changes in Colombian society by encouraging citizens to develop attitudes and traits necessary for high-growth entrepreneurship. The characteristics of openness to experimentation and high preference for risk-taking have begun to emerge in Colombian society.

INNpulsa has leveraged modest budgets to attract external funding for programming. In 2015, US$ 45 million in external funds were committed for entrepreneurship and innovation activities, anchored by US$ 9.4 million of INNpulsa’s own resources.

Role in the Country’s National Innovation System

INNpulsa is a relatively small and young agency within Colombia’s evolving National Science, Technology, and Innovation System (NSTIS). Although the NSTIS has traditionally given priority to supporting basic scientific research, from the mid-2000s support for business innovation has become a growing concern.

Headquarters: Bogotá, Colombia

Founded: 2012

Staff: 70 employees

Budget: COL$ 71.6 billion in 2015 (approximately US$ 26.1 million)

Agency model: Government-owned agency. Resources come from profits of the Banco de Comercio Exterior (Bancoldex) and the national budget. Both Bancoldex and INNpulsa work under the Ministry of Trade, Industry, and Tourism.

Clients served: The entire innovation ecosystem, particularly SMEs, startups, and entrepreneurs.

Domestic market size: 49.1 million people (2017)

Mission statement: Make Colombia one of the three most innovative and competitive economies in Latin America by 2018, due to the sophistication and diversification of the productive base of the country.

Noteworthy results: Since its inception INNpulsa has reached over 2,000 businesses with capacity enhancement services. More broadly, it has contributed to promoting the entrepreneurial ecosystem in Colombia, largely through its high-profile events and awareness raising activities. Participation at the INNpulsa-sponsored Global Entrepreneurship Event increased from 2,200 to 66,209 between 2012 and 2013.

The primary institution in the NSTIS is the Administrative Department for Science, Technology, and Innovation (Departamento Administrativo de Ciencia, Tecnología e Innovación, known as Colciencias), which reports directly to the Presidency of the Republic (Figure 16). Historically, Colciencias focused on the development of basic science. However, a 2009 law made it responsible for providing support for business innovation as well. There is significant overlap between the roles of INNpulsa and Colciencias in the public policy space. However, INNpulsa is expected to focus its efforts on fostering high-growth start-ups and business innovation, and administer related instruments.

Complementary Agencies

There is significant overlap between INNpulsa and other public institutions that support business innovation.
and entrepreneurship. For example, the Ministries of Telecommunications and Agriculture also offer some programs for start-ups. A recent analysis by the National Planning Department has identified a wide array of instruments designed to support science, technology, and innovation across the Colombian government. The majority of these instruments are underfunded and poorly designed. An analysis of 129 instruments in use by eight government institutions showed that 91% of the instruments are supported by just 25% of the assigned budget. On a scale of 1 to 5 (with 5 being the best possible outcome), the average score across the 129 instruments was 3.2. Of the total budget, 75% goes toward just 12 instruments, none of which are managed by the Ministry of Trade, Industry, and Tourism, the likely future head of innovation and entrepreneurship policy, after reorganization of the NSTIS as is currently being discussed.

Country Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
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<tbody>
<tr>
<td>GDP, PPP: US$ 710.1 billion (2017)</td>
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<tr>
<td>GDP per capita: US$ 6,408 (2017)</td>
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<tr>
<td>Gross Expenditures on R&amp;D (GERD): 0.2% of GDP (UNESCO, 2017)</td>
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<tr>
<td>Public R&amp;D spending: 8.2% of GERD (UNESCO, 2017)</td>
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<tr>
<td>Business R&amp;D spending: 49.31% of GERD (UNESCO, 2017)</td>
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<tr>
<td>World Economic Forum (WEF) competitiveness rank: 66/137 (2017–18)</td>
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</table>

Roles, Capabilities, and Organization

Origins and Evolution

Mandate

INNpulsa is tasked with contributing to the national goal of increasing competitiveness through business development. The agency implements programs to promote entrepreneurship, innovation, and productivity. It contributes to fostering innovative and productive companies, encouraging them to achieve their greatest potential and lead Colombia's economic growth by being a source of wealth for the country.

Sectoral Focus

INNpulsa provides support for businesses from a horizontal perspective, without any a priori preference for specific sectors. The selection of firms and initiatives to be supported depends on an evaluation of their growth potential, not on the fulfillment of sectoral quotas of any kind.

Business Model Evolution

Bancoldex, a public bank created in 1991 with a mandate to finance international trade and investment, established INNpulsa. In 2012 Bancoldex was tasked with creating two new funds. One of these would finance a new administrative unit supporting the development of modern, entrepreneurial, high-growth businesses in Colombia. This resulted in the creation of INNpulsa Colombia. The objective of the second fund was to support the modernization of micro, small, and mid-sized businesses, inheriting the assets and history of the Fund for the Modernization of Micro, Small, and Medium-sized Businesses (Fondo de Modernización de la Micro, Pequeña y Mediana Empresa, FOMIPYME). This second fund became INNpulsa MIPYME, a separate unit. These operated as two independent organizational units, both reporting to Bancoldex. The objective of the new units was to enhance Bancoldex's role as a development bank by expanding its support for business creation and business growth. In 2015, these two entities merged into one agency—INNpulsa—with a unified agenda and budget, and a set of programs and initiatives that are expected to work in sync.

Initially, while Bancoldex provided institutional shelter for the two funds, the national government provided money for their operations; INNpulsa Colombia sought to leverage resources from both the national budget and international development institutions. The rationale for this arrangement was that Bancoldex, which is renowned for its technical prowess and for being largely immune to manipulation by political groups, would provide an appropriate structure for the funds to develop as sound technical, nonpolitical agencies. The mindset at the time was that Bancoldex should move toward becoming a true development bank, able to interact directly with businesses. However, Bancoldex was not allocated sufficient funding from the national budget to adequately support the two agencies.
INNpulsa MIPYME was financed using resources allocated by the law that created it. Although Bancoldex studied the possibility of using a part of its own capital to fund INNpulsa Colombia, it discovered that this decision would negatively affect its international credit rating. Therefore, INNpulsa’s budget remained an independent fiduciary account, isolated from the capital structure of the bank and unable to affect the bank’s credit rating.

Organizational Structure

Organizational and Reporting Structure

Today, INNpulsa appears under Bancoldex in the organizational chart of the NSTIS (Figure 16), but in practical terms, it depends directly on the Ministry of Trade, Industry, and Commerce. At the outset, INNpulsa Colombia received a percentage of the accumulated profits from Bancoldex, but in later years, it switched to being financed directly by the national government.

Since its creation, INNpulsa Colombia has dealt with ambiguity in terms of governance. While INNpulsa Colombia is placed within Bancoldex, its activity in providing direct support to entrepreneurs is not consistent with Bancoldex’s role as a rediscount bank. At the same time, INNpulsa is a very small agency in comparison to Colciencias, yet it is arguably the most visible public actor that supports business innovation and high-growth firms.

INNpulsa’s internal organizational structure reflects its combined mandates of supporting high-growth entrepreneurship, as well as small and mid-sized businesses, changing the business culture, and gaining an influential voice within the NSTIS. Its post-merger organizational structure is depicted in Figure 17, reflecting a flat hierarchy with five organizational units. The four programmatic units are described below.

The Innovation and Entrepreneurship unit focuses on the promotion and support of innovation in businesses of all sizes, though its most visible activities are related to start-ups. The Innovation and Entrepreneurship unit changed to a new format in 2016 (see Figure 17), whereby INNpulsa will work as a platform that connects firms and providers with services and resources. INNpulsa will invite firms to apply for vouchers for hiring business and innovation services, designed to help beneficiary firms improve their capabilities. The vouchers will be assigned competitively, based on each applicant’s performance and state of development. Once firms prove that they have developed certain capabilities, they will move to the financing stage, where they will be able to obtain investment or credit from the financial bodies in the ecosystem. INNpulsa’s work will focus on identifying and connecting key agents through its platform: entrepreneurs and firm managers with service suppliers, investors, and financiers.

The Mindset and Culture unit seeks to promote a long-term attitude shift toward high-growth entrepreneurship and innovation in Colombia, through activities such as developing a community of Colombian entrepreneurs, managers, and others and encouraging conversations around the ideas of innovation, entrepreneurship, and productivity. The unit’s activities include designing media content on entrepreneurship, conducting innovation and entrepreneurship events in Colombia, and supporting Colombian participation in international entrepreneurship events. In 2016, projects included developing a national entrepreneurship television show to be viewed by at least 1 million Colombian citizens and holding Heroes Fest, an annual meeting of 6,000 people designed to develop innovation and entrepreneurship abilities.

The Strategic Projects unit seeks to develop project and policy proposals aimed at strengthening the national and local entrepreneurial and innovation ecosystems. Usually, the unit collaborates with other governmental institutions on these initiatives. Some recent projects were a regional mapping of entrepreneurship ecosystems, which identified start-ups and support institutions in 32 Colombian cities, and the support for patent seekers project, developed jointly with Superintendencia de Industria y Comercio, which seeks to increase the number of commercially viable patents in Colombia.

The Business Development unit inherited the activities of MIPYME, and hence its established routines and practices needed time to adapt and become unified with the rest of INNpulsa. The unit reports that it has an impact on nearly 40,000 businesses and has leveraged US$ 50 million in co-financing resources, and close to US$ 21 million in private capital for small and mid-sized businesses. A key activity is coordinating projects that link smaller firms to producers that are anchors in major value chains. Another of its aims is to promote the role of small and midsized businesses in productive clusters across Colombia.

Budget Sources and Allocations

INNpulsa’s budget varies depending on the ability of the agency to channel government funds each year. INNpulsa Colombia’s budget for entrepreneurship and innovation support between 2012 and 2016 fluctuated between US$ 3.8 million in 2012 to a high of US$ 21.4 million in the following year. Between 2013 and 2016, the figure has decreased gradually, reaching US$ 1.4 million in 2016. INNpulsa resources earmarked for entrepreneurship and innovation were used to leverage access for entrepreneurs.
Figure 16. The Colombian National Science, Technology, and Innovation System

Figure 17. INNpulsa’s Organizational Structure
to other financing, including Bancoldex credit lines. These leveraged resources fluctuated from US$ 26 million in 2012 (with US$ 3.8 million being from INNpulsa’s budget) to US$ 15.3 million in 2016 (against US$ 1.4 million from INNpulsa). During this period, the leveraged resources reached a high of US$ 45 million in 2015, complementing INNpulsa’s own resources of US$ 9.4 million.

### Human Resources and Skills

INNpulsa Colombia had 70 people on its payroll by mid-2016. It puts great emphasis in selecting, hiring, and developing young, high-quality professionals. Alumni of the agency occupy influential positions in other public agencies and the private sector. Table 11 indicates the distribution of talent across INNpulsa.

### Table 11. Personnel Distribution at INNpulsa Colombia in 2016

<table>
<thead>
<tr>
<th>Division</th>
<th>Headcount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office of the Director</td>
<td>4</td>
</tr>
<tr>
<td>Planning and Control</td>
<td>17</td>
</tr>
<tr>
<td>Strategic Projects</td>
<td>9</td>
</tr>
<tr>
<td>Innovation and Entrepreneurship</td>
<td>12</td>
</tr>
<tr>
<td>Business Development</td>
<td>14</td>
</tr>
<tr>
<td>Mind-set and Culture</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
</tr>
</tbody>
</table>

*Source: INNpulsa Colombia*

### Timeline

**Major External Events**

- **1991**: Bancoldex (*Banco de Comercio Exterior*) founded
- **2003**: Entrepreneurship Fund, providing financing for university student entrepreneurship, created
- **2004**: Productivity and Competitiveness Agenda initiative requires regions to define their objectives in terms of sectors and competitive goals to be attained
- **2006**: Law 1014, supporting the development of a culture of entrepreneurship in Colombia, orders the creation of national and regional entrepreneurial support networks, including such measures as tax advantages for firms with fewer than 10 workers and the creation of support services for entrepreneurs
- **2008**: The new vision of the National Council for Economic and Social Policy (CONPES) pushes Colombia to concentrate efforts in developing world-class expertise in a reduced set of economic sectors; fostering productivity and entrepreneurship is considered a major strategic axis of the plan
- **2009**: Colciencias assigned responsibility for formulating and implementing national science, technology, and innovation policy
- **2011**: The Constitution amended to allocate 10% of public revenue from exploitation of nonrenewable resources to a science, technology, and innovation fund, which disburses this revenue regionally according to need and development level
- **2013**: The Development Plan (Law 1450) created; under its mandate, Bancoldex absorbs FOMIPYME and is tasked with creating INNpulsa Colombia

**Major Internal Events**

- **2000**: FOMIPYME created
- **2014**: Open Innovation grants launched, as well as Heroes Fest
- **2015**: FOMIPYME and INNpulsa merger; new agency responsible for both SME modernization and high-growth entrepreneurship support
- **2016**: Voucher system to subsidize firm access to experts and other resources launched (operational by late 2016)

**2000**

- FOMIPYME created

**2012**

- INNpulsa Colombia launched; key instruments, such as seed capital, support for incubators, and access to capital, begin operations

**2013**

- New instruments launched: angel investors, alliances with Mass Challenge and NXTP Labs, and support for universities for technology transfer
OECD Review of Innovation Policy for Colombia finds technology and innovation lacking in the country and recommends the development of a business-centered innovation system.

New CONPES document on the NIS system orients policy toward strengthening the role of business innovation; new division of duties between public agencies implies that INNpulsa will take a leading role in this area.

Implementation, Capacity, and Programs

Selection of Projects
INNpulsa’s support instruments are not applied as structured programs, but rather as initiatives offered to entrepreneurs over time. INNpulsa issues public calls to apply for resources and use specific instruments within set time frames, using a mechanism called Convocatoria (literally, a convocation to participate). The invitation to participate lasts for the defined time frame or until resources are exhausted. There is no obligation for INNpulsa to open new invitations to use any given instrument within any specific period (as would happen if the instruments were managed through structured programs). INNpulsa is considering a move toward offering permanent access to instruments in the future, instead of using the Convocatoria mechanism.

Implementation: Delivery Challenges

Institutional Reforms
The creation of INNpulsa Colombia is an important step in the recent evolution of public policy for entrepreneurship and innovation in Colombia. Since the 1990s, economic policy in Colombia has increasingly focused on private sector competitiveness and firm productivity. Earlier, the discussion focused on macroeconomic factors and policies. Michael Porter and the Monitor Company’s influential work for Colombia in the early 1990s led to periodic discussion of competitiveness and the role of regions and cities in economic development. In this context, the role of entrepreneurs as agents of change and productivity growth has progressively gained ground in the policy agenda. In 2003, a public fund was created with the objective of offering resources to young entrepreneurs. In 2006, a law was introduced with the objective of extending a culture of entrepreneurship in the country. In 2006, a CONPES document mentioned entrepreneurship as a key strategic factor in turning Colombia into a highly productive country.

The conceptualization of the relationships between innovation, productivity, and competitiveness is evolving again in Colombia; the government is moving toward a view that, first, recognizes that the NSTIS has focused too much on primary science and too little on business innovation and, second, recognizes that lagging productivity is the most pressing problem for Colombian productive sectors. The current interpretation is that the country should understand the relationship between the achievement of higher productivity and higher innovation as a continuum that firms have to go through, where the first priority should be absorbing existing knowledge and mastering international standards and best practices. The development of new products and services should be tackled with increasing emphasis as the knowledge absorption process achieves strength, not as an independent matter.

The new CONPES document on science, technology, and innovation highlights the fact that across the world, high levels of investment in innovation and development have a positive effect in terms of high productivity levels and GDP per capita. The document contextualizes innovation not as an end in itself, but as a lever to attain higher productivity. It defines entrepreneurship and innovation as traits of the productive sector, which push the demand for knowledge, and for R&D as part of the supply of knowledge, with technology transfer being the mechanism of exchange between the two. The CONPES document includes a proposal to change the governance of the NSTIS: issues related to innovation and entrepreneurship (demand for knowledge) will be led by the Ministry of Commerce, Industry, and Tourism (Bancoldex and INNpulsa), while science and technology will be administered by Colciencias.

These changes will be very important for INNpulsa. It is the most visible governmental agency in the promotion of entrepreneurship and innovation in the private sector, but its institutional basis has been weak. Following the new CONPES, INNpulsa needs to develop a more coherent position as an agent of productivity change, innovation, and entrepreneurship development in businesses of all sizes. INNpulsa is moving in that direction, but the definitive shape of things to come is not yet clear.

Budgetary, Capacity, and Political Issues
Given its role as energizers and public-relations, INNpulsa is a relatively small and underfunded agency. The assigned resources for entrepreneurship from Bancoldex and the national budget are relatively low. Nevertheless, INNpulsa
Figure 18. Programs Administered by INNpulsa

<table>
<thead>
<tr>
<th>Direct Financial Support</th>
<th>Grants</th>
<th>Non-financial Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity finance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Equity loans for start-ups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Equity loans for students and recent graduates, in cooperation with the Servicio Nacional de Aprendizaje (SENA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loan guarantees and reduced interest rates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Special credit line with low interest rates for strengthening links in value chains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vouchers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Voucher system to subsidize firm access to experts and other resources (operational by the end of 2016)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Grants

• Grants for cultural entrepreneurship
• Matching grants for entrepreneurial firms and for firms that strengthen links in value chains
• Support for open innovation
• Grants for strengthening capabilities of business incubators and supporting entrepreneurial firms affiliated to these incubators
• Grants for developing technology transfer offices (TTOs) at universities and supporting entrepreneurial spin-offs from universities
• Grants for the preoperative phase of new venture capital funds focused on start-up financing
• Grants for the development of angel investor networks

Advisory, extension, and training services

• SENA training and technology extension
• Support for continued education

Information and advocacy

• Heroes Fest, a large annual meeting (approx. 6,000 people), brings a roster of world-class entrepreneurs to Colombia and gathers individuals with leadership profiles from all over the country

Figure 19. INNpulsa financing process

Source: INNpulsa Colombia Report 2015
has been able to increase its own access to funds by presenting itself as a platform for other governmental initiatives, which has allowed it to channel resources from other large government initiatives.

**Measurement, Learning, and Results**

**Organizational Monitoring and Evaluation**

**Program Evaluations**

INNpulsa Colombia presents reports on an annual basis to Bancoldex and to the Ministry of Trade, Industry, and Tourism on the strategic objectives pursued and the results achieved. Indicators refer to the specific objectives of the programs and initiatives developed in the period, the number of firms served, the volume of resources assigned to the programs, and, in the case of Mindset and Culture projects, the number of people affected by the programs. INNpulsa also presents ad hoc reports to the National Planning Department.

All initiatives and programs are subject to audit by the office of the National Comptroller (Contraloría General de la República), which produces an audit on the appropriateness of the use of public resources by the entity.

An independent report on 10 policy instruments applied by INNpulsa Colombia was produced in 2015, by Fedesarrollo, an independent think tank.

**Evaluation Methodologies**

Annual reports by INNpulsa and audits by the comptroller office are based on information generated by INNpulsa’s own records. Internal reports are produced by each of the organizational units. External evaluations by the national comptroller are produced by its own auditors.

The evaluation by Fedesarrollo was based on interviews with users of the services and analysts, as well as on a review of INNpulsa’s own records.

There is no systematic report on data tracking from users of INNpulsa’s services. The organization has regular publications where Colombian entrepreneurs are highlighted. While many of the reviewed cases are past beneficiaries of INNpulsa’s programs, the reports are focused on the entrepreneurs’ achievements, not on their relationship with INNpulsa. There is no formal alumni network.

**Impact Evaluations**

**Evidence of Results**

In a recent review of INNpulsa’s activities produced for the Minister of Trade, Industry, and Tourism, the Business Development unit reported 2,031 engaged businesses through its business capability enhancement services, with co-financing resources assigned for COL$ 48.6 billion (approximately US$ 18 million and COL$ 24.5 billion (approximately US$ 9 million) of private resources leveraged through the program for use by beneficiary businesses. The Innovation and Entrepreneurship unit reported COL$ 284 billion (approximately US$ 105 million) in resources channeled by INNpulsa through its services between 2012 and 2015, with an additional COL$ 203 billion (approximately US$ 75 million) that were made available to beneficiaries leveraging INNpulsa resources.

The Fedesarrollo report on the impact of 10 policy instruments found that the key strengths of INNpulsa Colombia were the professionalism and commitment of its workforce; the existence of an organizational culture that prides itself on transparency and continuous learning; the effectiveness of the communication strategy; and a deep knowledge of the country and a recognized leadership in the missional theme, which were acquired in a brief period.

The evaluation also found several weaknesses: high and hard-to-fill requirements in application processes for entrepreneurs; slow resource disbursement; lack of a coherent path that would lead firms from one instrument to the next appropriate one at each stage of development; lack of an efficient articulation with other public institutions in the field, such as Colciencias; and low access for entrepreneurs who are not located in the largest cities in Colombia.
3.8. Kafalat in Lebanon

Overview

Kafalat is a Lebanese public-private credit guarantee agency that supports enterprise innovation in Lebanon. In addition to offering credit guarantees to small and medium enterprises (SMEs) and start-ups, Kafalat manages a government-financed innovation fund, therefore expanding its scope to support concept development grants and equity investments in innovative SMEs.

Key Takeaways

Kafalat plays a key role in facilitating access to finance for SMEs and innovative start-ups. It is self-sustaining and positioned itself as a professional and neutral financial intermediary with active outreach extending to all segments of the Lebanese business community. It is a recognized SME support entity within the Middle East region.

Kafalat is credited with changing the culture of conservative Lebanese banks by pushing the boundaries of commercial lending to address the financial needs of usually underserved early-stage ventures and start-ups.

Over time, Kafalat has adapted its mission and respond to changing market needs. Its initial mandate was to offer credit guarantees to SMEs operating in productive sectors. As it developed and built its internal capacity and external network, it was able to expand its operations—it currently offers equity co-investment and concept development grants to early-stage ventures and entrepreneurs.

In addition to its ties with the banking sector, Kafalat maintains links with all stakeholders in the innovation ecosystem, such as incubators, accelerators, universities, and venture capital (VC) funds. Kafalat has a lean operational structure leveraging strategic partnerships with banks and entrepreneurship ecosystem organizations. Management and staff come from a diverse mix of professional backgrounds, including economists, engineers, and lawyers with experience in the private sector.

Role in the Country’s National Innovation System

Kafalat took up a new role as an innovation support institution when it launched the Kafalat Innovative Program in 2006. The objective of the program is to support start-ups that have potential to create significant added value through innovation. Eligible start-ups are provided an almost interest-free, collateral-free loan with a limit of US$ 200,000, reimbursable over a period of five years, including a one-year grace period. Kafalat Innovative was the first building block in developing the entrepreneurial and innovation ecosystem in Lebanon. Since then, the ecosystem has significantly developed to include a wide range of support initiatives and programs: incubation, acceleration, training, mentoring, coaching, and networking.

Complementary Agencies

A number of public and private complementary agencies offer around 150 initiatives and programs designed to
support private-sector development in Lebanon. One-third of these programs are public sector-driven and focus mainly on improving the legal and regulatory environment through the “Improving the Business Environment in Lebanon” initiative led by the Prime Minister’s Office. Other programs focus on reducing the cost of capital through interest subsidies offered by the Ministry of Finance, promoting investments, and offering tax and non-financial incentives to investors through the Investment Development Authority of Lebanon (IDAL), supporting scientific research through grants offered by the National Council for Scientific Research (CNRS), and supporting applied/industrial research and testing through the Industrial Research Institute.

The majority of these initiatives and programs are led by the private sector and nongovernmental organizations. The programs mainly address capability development through incubators and accelerators, such as Berytech, BIAT, Altcity, Speed, and others. Some programs focus on training, mainly led by associations and Chambers of Commerce. Building on its initial programs, Kafalat launched a diverse set of instruments that cover the full life cycle of ventures, including concept development grants, angel investments, credit guarantees, and equity investments. In the past two years, more than seven new VC funds were established. This diversification and increased supply of capital is partly triggered by the Central Bank’s Circular 331, launched in 2014 to stimulate innovation, which allowed commercial banks to invest in the equity of start-ups, accelerators, and VCs. Other initiatives to support enterprise development and innovation are the result of joint efforts and PPPs, such as the Beirut Digital District, an all-inclusive zone dedicated to improving Lebanese digital industry through providing state-of-the-art infrastructure and support services for businesses at affordable rates.

Country Indicators

GDP, PPP: US$ 88.1 billion (2017)
GDP per capita: US$ 8,808 (2017)
World Economic Forum (WEF) competitiveness rank: 105/137 (2017-2018)

Roles, Capabilities, and Organization

Origins and Evolution

Mandate

In addition to implementing its credit guarantee programs, Kafalat participates in policy creation. It is regularly consulted by the government when designing policies and programs related to private sector development and is invited to participate in parliamentary committee discussions. For example, in 2014, Kafalat was invited by the Ministry of Economy and Trade to participate in the steering committee responsible for the design of the national SME strategy, which was launched in December 2014.

Sectoral Focus

Kafalat offers SMEs a variety of financial instruments focusing on sectors or themes. It was created to address the financing challenges facing SMEs and innovative start-ups operating in productive sectors, such as industry, agriculture, tourism, crafts, and high technology. It supported borrowers in these sectors by limiting the complementary collateral required by banks on top of the issued guarantee to a maximum of 50% for some types of loans and 0% for those that have a strong innovation component. In addition, all loans guaranteed by Kafalat benefit from an interest rate subsidy. These subsidies were set up to mitigate the crowding-out effect of the high interest rates induced by public sector borrowing and to support the growth of sectors with employment potential.

Business Model Evolution

Kafalat launched a new US$ 30 million funding program, Innovation in SMEs (iSME), in 2015. This provides two types of financing to enterprises with a strong innovation component: (a) concept development grants to stimulate idea generation and concept development, and (b) equity co-investment to support early-stage growth. The iSME fund is financed by the government of Lebanon through a loan from the World Bank and implemented by Kafalat.

Kafalat’s iSME fund is sector-agnostic and has a thematic focus instead. However, given that the Lebanese market is composed primarily of small enterprises in the services sector, it is expected that the iSME funding program will
invest primarily in those enterprises that are developing innovative products and processes in information and communication technology (ICT) and mobile applications and e-applications for education, health, media, and design. At the moment, the fund is still too young for an analysis of the sectoral diversity of its recipient firms.

**Organizational Structure**

**Organizational and Reporting Structure**

Kafalat is a financially stable and self-sustainable institution with a transparent governance structure. It is governed by a board of directors composed of six members, with three representing the National Institute for the Guarantee of Deposits (NIGD) (which has a 75% share in Kafalat) and three members representing the shareholding commercial banks.

With the expansion of its programs, the institution has grown from two staff members in 1999 to 27 in 2015. The organizational structure includes a separate division for guarantees managed by the Credit Manager and a separate unit to manage the iSME fund. The other units are in charge of management and corporate services. All units report to the chairman, who reports to the board of directors.

To ring-fence equity shares from Kafalat as an institution, a separate holding company has been established to manage equity investments. It has a joint stock-holding company with 98% of its shares registered to Kafalat as asset manager and the remainder in the names of two nominal shareholders, both board members of Kafalat.

As a financial institution, Kafalat is regulated by the Central Bank of Lebanon and the Bank Control Commission and reports to them on a monthly and quarterly basis. In addition, as most programs are donor-funded and in partnership with the government, Kafalat reports to donors and the relevant ministries on these programs’ performance.

**Budget Sources and Allocations**

Kafalat operates with significant financial autonomy. It maintains a close relationship with the government, but has operational independence. Unlike with other government-sponsored credit guarantee agencies, the government does not contribute directly to Kafalat’s budget. Programs funded by donors each have a budget and leverage ratio allocated to them.

In 2016, Kafalat’s total spending was approximately US$ 20.1 million, with US$ 11.3 million used for the execution of guarantees, US$ 6.06 million earmarked for the general provisions for risks and charges, US$ 2.6 million for operational expenses, US$ 20,000 for information technology, and US$ 30,000 for capacity building.

In 2015, Kafalat’s total spending was approximately US$ 10 million, with US$ 7.8 million for the execution of guarantees, US$ 2 million for operational expenses, US$ 110,000 for information technology, and US$ 135,000 for capacity building.

In the two years between its inception and October 2017, iSME’s total spending was approximately US$ 6.45 million, representing 23.45% of the US$ 27.5 million budget allocated to the program. Of this, US$ 4.59 million was committed funding for co-equity investments and US$ 1.86 million for grants.

Kafalat Plus and Kafalat Innovative are the result of a 2006 partnership between the European Union (EU) and the Ministry of Economy and Trade under the framework of the Integrated SME Support Program 3 (ISSP). The guarantee programs are composed of two funds: a €4 million grant from the EU to the Ministry of Economy and Trade, which has delegated the management of the co-guarantee fund to Kafalat, and another €4 million matching fund by Kafalat.

Kafalat Start-ups and Innovation is the result of a €3 million grant from the EU to the Presidency of the Council of Ministers in 2013.

Kafalat Agriculture is result of a 2013 partnership between the EU and the Ministry of Agriculture under the framework of the Agricultural and Rural Development Program (ARDP). The guarantee program is composed of two funds: a € 3.5 million grant from the EU to the Ministry of Agriculture managed by Kafalat and a € 3.5 million matching fund by Kafalat.

Kafalat Energy is the result of a € 2.5 million grant from the EU to Kafalat in 2013, equally matched by Kafalat, to support investments in energy efficiency and renewable energy.

**Human Resources and Skills**

Kafalat maintains professional and technically capable staff and management. Its staff come from a mix of backgrounds, and include economists, engineers, and lawyers, with experience in the private sector. Most staff have graduate degrees. They receive training and participate in relevant national and international seminars and conferences.
Kafalat provides extensive training to its partner banks on credit assessment and risk management to strengthen their capacity in SME lending. It also organizes informative sessions at the Association of Banks and the Central Bank of Lebanon to introduce banks to new programs offered.

Timeline

**Major Internal Events**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>Kafalat established</td>
</tr>
<tr>
<td>2000</td>
<td>Kafalat Basic Program launched</td>
</tr>
<tr>
<td>2006</td>
<td>Kafalat Plus and Kafalat Innovative Programs launched</td>
</tr>
<tr>
<td>2008</td>
<td>Kafalat receives technical assistance from IFC to improve its internal operation and outreach</td>
</tr>
<tr>
<td>2013</td>
<td>Kafalat Agriculture, Kafalat Energy, and Kafalat Start-ups and Innovation Programs launched</td>
</tr>
<tr>
<td>2015</td>
<td>Kafalat iSME Program launched</td>
</tr>
<tr>
<td>2016</td>
<td>Kafalat Micro, Small, and Medium Enterprise (MSME) Technical Assistance launched</td>
</tr>
</tbody>
</table>

**Major External Events**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>National Investment Law promulgated</td>
</tr>
<tr>
<td>2002</td>
<td>Paris II donor conference results in US$ 2.2 billion financial support to Lebanon</td>
</tr>
<tr>
<td>2005</td>
<td>Assassination of Prime Minister Hariri</td>
</tr>
<tr>
<td>2006</td>
<td>July 2006 war, which incurs about US$ 2.4 billion in direct damages and another US$ 700–800 million in indirect damages</td>
</tr>
<tr>
<td>2007</td>
<td>Paris III donor conference is held; US$ 5.384 billion pledged</td>
</tr>
<tr>
<td>2009</td>
<td>Central Bank of Lebanon issues a circular that allows banks to reschedule loans for all war damaged SMEs guaranteed by Kafalat and extend their maturities for an additional two-year period</td>
</tr>
<tr>
<td>2011</td>
<td>Capital Markets Law passed</td>
</tr>
<tr>
<td>2012</td>
<td>Syrian Crisis starts (losses for Lebanon estimated at US$ 7.5 billion up to 2013)</td>
</tr>
<tr>
<td>2013</td>
<td>Capital Market Authority established</td>
</tr>
</tbody>
</table>
Central Bank issues a circular that allows banks to reschedule loans for SMEs guaranteed by Kafalat and extend their maturities to up to 10 years.

The Ministry of Finance signs US$30 million loan with the World Bank to establish the iSME fund.

Central Bank issues Circular 331, which allows banks to invest in equity of start-ups, accelerators, and VCs.

Parliament ratifies iSME-related law.

Central Bank issues a circular that allows banks to reschedule loans for SMEs guaranteed by Kafalat and extend their maturities to up to 12 years.

Central Bank issues Circular 475, which limits subsidized loans to US dollars only, suspending the exemption of the statutory reserves for local banks making subsidized loans.

Implementation, Capacity, and Programs

Kafalat offers a mix of financial instruments to support start-ups and SMEs. Financial instruments include credit guarantees, equity co-investments, and concept development grants. In addition, it runs a small grant program financed by the World Bank to support business service providers in developing new tools and training programs to assist SMEs and entrepreneurs seeking equity investments.

Due to its deep knowledge of private sector needs and close ties with the Lebanese financial sector, Kafalat is able to actively participate in the design of its programs. Many of these programs are funded or co-funded by donors; and the donor, the government, and Kafalat are consulted on the need for and the design of the programs. Each program is developed to address a gap in the market. Kafalat organizes roundtable discussions when needed, to assess their specific needs. In addition, Kafalat lobbies for new instruments with donors and the government, and is invited to parliamentary debate sessions to discuss specific projects that are financed by the government through loans and require parliamentary approval, such as the iSME fund.

Table 12. Funding by Kafalat Program

<table>
<thead>
<tr>
<th>Program</th>
<th>Purpose</th>
<th>Investment Type</th>
<th>Loan Amount (up to) (US$)</th>
<th>Duration (up to) (years)</th>
<th>Guarantee Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kafalat Basic</td>
<td>To finance start-ups and SMEs in starting, expanding, and sustaining their production capacity</td>
<td>Fixed assets and working capital needs</td>
<td>200,000</td>
<td>7</td>
<td>75</td>
</tr>
<tr>
<td>Kafalat Plus</td>
<td>To finance registered start-ups and SMEs in expanding and sustaining their production capacity</td>
<td>Fixed assets and working capital needs</td>
<td>400,000</td>
<td>7</td>
<td>85</td>
</tr>
<tr>
<td>Kafalat Innovative</td>
<td>To finance innovative start-ups (under 2 years old) that demonstrate the potential to create significant added value through innovation</td>
<td>Fixed assets and working capital needs</td>
<td>200,000</td>
<td>5</td>
<td>90</td>
</tr>
<tr>
<td>Kafalat Start-ups and Innovation</td>
<td>To finance highly innovative SMEs and start-ups that demonstrate the potential to create added value through innovation</td>
<td>Fixed assets and working capital needs</td>
<td>433,000</td>
<td>7</td>
<td>Innovation: 90 Start-ups: 85</td>
</tr>
<tr>
<td>Kafalat Agriculture</td>
<td>To finance all agricultural activities of SMEs</td>
<td>Small agriculture</td>
<td>43,000</td>
<td>7</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trees</td>
<td>320,000</td>
<td>10</td>
<td>75</td>
</tr>
</tbody>
</table>
Selection of Projects

Three categories of equity co-investments are offered through the iSME Program: seed capital, followed by venture-stage capital, and finally, growth-stage capital. To qualify for the equity investment, the entrepreneur needs a commitment from an approved investor, which they can then ask the iSME to match. The approved partner investors list is limited to institutional investors (local and international), which includes funds, holding companies, formal business angel groups, and investment banks. Partner investors are required to have the capacity to appraise investment opportunities on a professional basis, provide mentorship and other support for the companies and entrepreneurs in which they invest, and offer additional financing to sustain the company in the event of a change of plans. Several funds are approved to be partner investors, including Berytech II Fund, IM Capital, Middle East Venture Partners (MEVP), LEAP, SANED, B&Y Venture Partners, Seeders, Phoenician Funds, and Azure Fund. New institutions may apply for a listing at any time. The list is reviewed annually to validate the capabilities of the investors. To date, iSME has received 21 co-investment opportunities for a total amount of US$ 8.35 million, of which 11 have been approved and 8 have been rejected. The remaining two are in the pipeline.

Concept development grants are for entrepreneurs to develop their innovative ideas and collect information and proof of concept to attract external investment by addressing key risks. To date, 229 applications for grants have been received, of which 128 were approved for a total of US$ 1.86 million. 90 applications were rejected and 11 are in the pipeline.

Table 13. iSME in Detail

<table>
<thead>
<tr>
<th>Program</th>
<th>Purpose</th>
<th>Investment Type</th>
<th>Amount (up to) (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>iSME Direct Equity Co-Investment</td>
<td>To grow early-stage innovative start-ups by co-investing in their equity</td>
<td>Seed capital</td>
<td>25,000-200,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Venture capital</td>
<td>200,000-500,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Growth capital</td>
<td>500,000-1,500,000</td>
</tr>
<tr>
<td>iSME Indirect Equity Investments</td>
<td>To support early-stage innovative start-ups by investing in financial intermediaries</td>
<td>Fund of Funds: VC Funds, Accelerators, Angel networks</td>
<td>2,000,000</td>
</tr>
<tr>
<td>iSME Concept Development Grants</td>
<td>To support the preparation and development of innovative business concepts, strategies, studies, and plans</td>
<td>Phase 1: Proof of concept</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Phase 2: Possible early-stage equity financing</td>
<td>up to 10,000</td>
</tr>
</tbody>
</table>
Credit guarantees are offered to start-ups and SMEs operating in the sectors of industry, tourism, agriculture, high technology, and crafts. All loans guaranteed by Kafalat benefit from interest-rate subsidies offered by the government and managed by the Central Bank.

Under the credit guarantee program, the selection and approval of projects to be guaranteed or financed is undertaken by two committees after a thorough review by the relevant units. A credit committee for guarantees, which includes the Chairman and two board members, reviews the proposals. A separate recovery committee is in charge of following up on executed guarantees.

Under the iSME plan, financing and investment decisions go through a two-step review process. A pool of independent technical experts reviews and decides on concept development grants after initial screening by Kafalat. For equity co-investments, an external investment committee (IC) composed of six private sector individuals from Lebanon, the Middle East and North Africa region, Lebanese diaspora, and international experts with strong and relevant business experience, decides and approves co-investments. The composition of the IC is intended to reassure investor partners of the serious intent behind their decisions, avoidance of regulatory capture, and good governance of the iSME funding program. Two-thirds of the members appointed to the IC serve two-year terms, whereas the remainder serve one year. Any of the initial members are eligible for reappointment. The World Bank gives its ‘no-objection’ to both IC members and the evaluators who are selected by Kafalat based on eligibility criteria. Both groups are not remunerated for their work.

Delivery Challenges

Institutional Reforms

Of the major challenges facing the Lebanese economy, most notable are political instability, the absence of a clear and updated economic vision, delays in the progress of reforms due to political back-and-forth, a decaying and costly infrastructure, and an inadequate legal and regulatory framework. Despite these, Kafalat has been able to effectively support the growth of local SMEs and start-ups.

Budgetary, Capacity, and Political Issues

A difficult political climate has caused delays in the implementation of some of its programs – for example, the iSME fund was delayed for almost two years because it required the Parliament’s ratification at a time when the Parliament was not convening due to political stalemate. Moreover, many draft laws related to businesses have been awaiting parliamentary approval for years. The delay in implementing reforms results in a loss of competitiveness and puts more pressure on business growth, which eventually will impact Kafalat’s performance.

Potential challenges may also arise in managing iSME, the first project of its kind implemented in Lebanon and the region, given the risky nature of the investments and the relatively small pipeline of projects. In addition, because the project designates the iSME as a silent partner, reliant on partner investors to provide the active mentoring and professional inputs needed for the firm’s development, the success of the equity co-investment relies on partner investors.

<table>
<thead>
<tr>
<th>Direct Financial Support</th>
<th>Non-financial Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity finance</td>
<td>Advisory, extension, and training services</td>
</tr>
<tr>
<td>• Innovation in SME (iSME) Fund</td>
<td>• Training on credit assessment and risk management to strengthen financial institutions’ capacity in SME lending (based on demand)</td>
</tr>
<tr>
<td>Grants</td>
<td>Loan guarantees and reduced interest rates</td>
</tr>
<tr>
<td>• iSME Concept Development Grants</td>
<td>• Kafalat Basic</td>
</tr>
<tr>
<td></td>
<td>• Kafalat Agriculture</td>
</tr>
<tr>
<td></td>
<td>• Kafalat Energy</td>
</tr>
</tbody>
</table>

Figure 21. Programs Administered by Kafalat
Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations
Kafalat monitors the implementation of its programs. The credit committee thoroughly assesses all applications for guarantees, independently from the assessment completed by the bank. Field Officers do on-site visits to monitor the beneficiaries’ operations during the guarantee period, before and after the loan is disbursed. An external IC reviews and decides on equity investments after an initial eligibility screening, and full analysis of the proposals is done by the iSME Project Management Unit at Kafalat. It also has a hotline for client complaints and an online client complaint form. At the program level, Kafalat submits narrative and financial reports on a quarterly basis to the EU and the concerned ministry during the implementation periods of the co-guarantee programs. Such reports include a predetermined set of indicators to report against. In addition, it requires the submission of an overall program report at the end of the program.

Evaluation Methodologies
For the Equity Co-investment Program, an M&E framework is in place. The framework includes indicators to assess accomplishments and show progress toward project outcomes. Kafalat shares the M&E report with the World Bank and the Ministry of Finance at least semi-annually, in addition to quarterly and semi-annually audited reports.

All programs are audited on an annual basis in accordance with international standards. Kafalat’s internal auditor and an external auditor, Deloitte, evaluates its activities. As a financial institution, it also reports to the Bank Control Commission and the Central Bank.

Impact Evaluations

Evidence of Results
Kafalat has been an important connector in the innovation ecosystem and bridged the gaps in enterprise support. Its strong linkages with all stakeholders (including incubators, accelerators, universities, VCs, and banks); its close relationship with the government and international donors; and its connection with entrepreneurs and businesses has allowed Kafalat to play a unique role as a policy driver and coordinator, resulting in the development of the Lebanese innovation ecosystem and a number of support initiatives, with the iSME fund being the most important. Since its inception, Kafalat has enabled more than 16,000 SMEs and innovative start-ups throughout Lebanon, who otherwise might not have been able to access bank funding to finance their business activities, with loans exceeding US$ 1.5 billion.

Kafalat does not follow up on its clients’ performance after the expiry of the guarantee. As such, rigorous impact evaluation studies to examine the degree of additionality and economic impact of Kafalat’s programs have not been conducted yet, but the M&E planned for the iSME program will provide results.
3.9. Malaysian Technology Development Corporation (MTDC)

Overview

The Malaysian Technology Development Corporation (MTDC) accelerates the commercialization of new technology in small and medium enterprises (SMEs) and universities by providing grants, soft loans, equity funding, and incubation centers, together with an array of services, such as mentoring, networking, and technical advice.

Key Takeaways

While Malaysia has enjoyed rapid economic growth, leaders from government and industry are concerned that the country may fall into the so-called ‘middle-income trap.’ MTDC is viewed as a critical component of Malaysia’s innovation ecosystem, important for sustaining economic growth and dynamism.

Established in 1992, MTDC has evolved to meet the unique innovation-based economic development needs of Malaysia. It has done this by continuously reevaluating its mission, funding programs and services, and frequently adapting to changing market conditions and the needs of university and enterprise-level clients.

MTDC pursues its mission in close cooperation with other government agencies and industrial partners. Instead of a ‘silo’ mentality, MTDC seeks to connect its clients to valuable entrepreneurship resources.

Role in the Country’s National Innovation System

MTDC plays an important role in the Malaysian innovation ecosystem by encouraging and supporting high-tech entrepreneurship. Since 1966, Malaysia has undertaken five-year plans, the intent of which are to spur economic and social development. Recent plans have emphasized the critical role of research and development (R&D) in innovation. Specifically, the Malaysia Plan (MP) 6, which was launched in 1986, prioritized public R&D funding. Introduced in 2006, MP 9 included significant increases in public R&D funding. MPs often include the establishment of new research institutes. For example, MP 9 led to the national biotechnology policy and the establishment of the Malaysia Genome Institute (MGI), Agro-Biotechnology Institute (ABI), and Institute of Pharmaceuticals and Nutraceuticals (iPharm).

While Malaysia has made progress in building R&D capacity, leaders from the government and industry have been concerned that these public investments have not yielded appropriate levels of economic and social benefit. Early studies demonstrated concern for relatively low levels of technology commercialization among Malaysian companies, universities, and public research institutes. Research attributes commercialization challenges to weaknesses within Malaysia’s innovation ecosystem. Further, Malaysia’s movement toward regional and global free-trade agreements such as the Trans-Pacific Partnership Agreement (TPPA) has made it important for Malaysian SMEs to become more innovative. Thus,
MTDC’s continuing efforts are critical to the development of a robust innovation ecosystem within Malaysia and the associated economic performance of the country.

MTDC pursues its innovation-oriented mission through a variety of specific funds: the Commercialization of Research and Development Fund (CRDF), Technology Acquisition Fund (TAF), Business Start-up Fund (BSF), Bumiputra Expansion Fund (BEF), and Halal Technology Development Fund (HTDF). Each fund was established in response to a specific need within the Malaysian innovation ecosystem. Further, fund recipients and non-recipients have access to a suite of innovation support services, including mentoring and coaching, networking, technical assistance, and commercialization support.

Complementary Agencies

MTDC is one of the several constituent organizations within the Malaysian innovation ecosystem. While MTDC focuses on the commercialization of new technologies within SMEs and universities, several other organizations also play a critical role. The Ministry of Science, Technology, and Innovation (MOSTI) and the Ministry of Higher Education are critical sources of funding and policy for university capacity building, technology transfer, and commercialization. SME Corporation provides services and programs to encourage the establishment and growth of all SMEs, rather than just innovation-based enterprises. The mission of Agensi Inovasi Malaysia (AIM) is to improve the innovation ecosystem through entrepreneurship programs within primary and secondary schools, capital projects, microloan programs, public-private partnerships, and sector-specific strategies such as the National Biomass Initiative. MTDC frequently works with the SME Corporation and the AIM on joint projects, given that resources and services are complementary. Further, MTDC has other ongoing partnerships and projects with the Economic Planning Unit, Ministry of Finance, and Ministry of Foreign Affairs, among others.

Roles, Capabilities, and Organization

Origins and Evolution

Mandate

MTDC was established in 1992 as part of MP 6 (and then, MP 7) to accelerate the commercialization of new technologies and promote innovation-based economic growth. MTDC is primarily focused on implementation, specifically the creation, evolution, and operation of funds and services designed to encourage and support high-tech entrepreneurship within Malaysia. While implementation is its primary focus, MTDC also works with the Prime Minister’s Office and other government agencies to help create policies and programs to support innovation and entrepreneurship within Malaysia.

Sectoral Focus

MTDC focuses on building horizontal capabilities that support growth among all innovation-based companies. In addition, it also allocates resources to areas that hold opportunities for growth within unique focus areas, such as the HTDF. While MTDC’s enterprise-level efforts include all firm sizes—from large firms to university spin-offs—its primary focus is on SMEs that have enormous potential for growth.

Business Model Evolution

MTDC has evolved substantially over the past 20 years to better meet the needs of SMEs and further develop Malaysia’s innovation ecosystem. Early in its history, MTDC focused primarily on the transfer of university technologies to industry. It did so through the establishment of a public venture-capital fund designed to provide early-stage resources to support commercialization-related activities. In 1993, MTDC signed a joint venture agreement with Hambrecht & Quist (HQ), a large venture capital company.
located in San Francisco, United States. This partnership, between MTDC and HQ Venture Capital Management, created a series of venture funds ranging from US$ 1.5 million to US$ 13.6 million in capitalization. The primary purpose of these funds was to accelerate the development and commercialization of universities’ technologies, primarily through spin-off companies.

In 1997, during its midterm review of MP 7, MTDC determined that pre-commercialization funding was needed to accelerate the development of early-stage technologies, as many technologies and technology-based companies were not yet ready for venture funding. In response, MTDC shifted funding from existing venture-capital mechanisms to two recently established grant programs: the CRDF and the TAF. Later, in 1999, the Technology Acquisition Fund for Women (TAF-W, renamed TAF 2) was established to encourage and support high-tech entrepreneurship among Malaysian women. Further, these funds signaled a shift from focusing only on university-generated technologies to a wider range of technology sources for SMEs, including other SMEs, companies, and university sources outside of Malaysia.

While these funds provided Malaysian companies with an important and much needed source of early-stage capital, the impact of this funding-centric approach was limited. Malaysia lacked other ecosystem elements important for technology commercialization. Consequently, in 2004, MTDC established Technology Development Centers (TDCs) on university campuses. TDCs provided a physical location for companies to conduct research in close proximity to researchers and students in relevant technical fields. Specifically, TDCs provide office space, wet and dry labs, meeting and training rooms, lecture halls, and a vast array of amenities for joint interaction. Further, MTDC established a wide range of client advisory services to augment its funding programs and university-focused programs. These services are available to fund recipients, Graduate Entrepreneurship Program (GEP) students, and based on availability, other Malaysian companies not necessarily participating in MTDC programs.

To expand the number of aspiring entrepreneurs in Malaysia, MTDC also established the student-focused program GEP, otherwise known as Symbiosis. The GEP screens students for aptitude, pairs them with various university technologies, and then provides services, resources, and space for them to establish and develop derivative start-up companies. The program was established in 2008 as a pilot with the Forrest Research Institute of Malaysia (FRIM) and was later expanded to five Malaysian universities. The program provides students with financial and mentoring support and opportunities to network, attend conferences, and learn skills important to entrepreneurship.

While nearly 10 years of pre-commercialization funding had helped develop technological capacity among startups, these companies required assistance relating to technology commercialization and enterprise growth. In 2006, the CRDF thus shifted its grant activities toward later-stage commercialization funding. In 2011, MTDC also established the BSF, a guaranteed loan program, and the Business Growth Fund (BGF), a hybrid loan/equity fund.

Organizational Structure

Organizational and Reporting Structure

MTDC is owned by Khazanah Nasional Berhad, Malaysia’s sovereign investment fund, and it is governed by an independent board of directors. The current board is composed of nine individuals: three from the private sector, two from Khazanah, one from the MOSTI, one from the Ministry of International Trade and Industry, and the chief executive officer (CEO) of MTDC, who reports to the board and manages the day-to-day operations of MTDC.

MTDC’s diverse board reflects its variety of funding sources. The BSF, BGF, and HTDF receive their funding from the Ministry of Finance. The CRDF and the TAF are managed on behalf of MOSTI. The BEF is managed on behalf of the Bumiputra Agenda Steering Unit within the Prime Minister’s Office. Further, MTDC has partnerships with the Ministry of Foreign Affairs and Ministry of Higher Education. In other words, MTDC is uniquely structured to provide the investment and growth expertise needed to focus the investments of multiple government mission agencies and achieve the greatest economic benefit for Malaysia.

MTDC is internally organized into five divisions (see Figure 22), including Corporate Services; CEO’s Office; Technology Ventures; Nurturing, Incubation, Commercialization & Entrepreneurship (NICE); and Advisory and Value-Added Services (AVAS).

Corporate Services Division (CSD): The CSD provides support services to other divisions across MTDC. Its constituent departments include finance, information technology (IT), legal, secretarial, administration, and procurement.

CEO’s Office: In addition to the primary organizational leadership responsibilities of the CEO, the CEO’s Office also includes functional departments such as strategic planning, knowledge management, and human resources, as well as the recently established research and publication (R&P).
Technology Ventures Division (TVD): TVD manages MTDC’s equity and hybrid funding programs specifically for companies at the growth and expansion trajectory. The funds managed by the TVD are BSF (convertible promissory notes), BGF (equity and grant), and BEF (convertible promissory notes).

Nurturing, Incubation, Commercialization & Entrepreneurship Division (NICE): NICE manages MTDC’s early-stage funds, including the CDRF, TAF, and HTDF. The division also manages MTDC’s campus-oriented programs, including the TDCs and the GEP.

Advisory and Value-Added Services Division: AVAS provides advisory and support services for MTDC’s fund recipients and other technology companies to grow their business. Constituent AVAS departments include business development, marketing advisory services, technical advisory services, and fund raising.

Budget Sources and Allocations
MTDC funding allocations are set every five years during the planning phases for each MP. These long planning horizons allow MTDC the funding and programmatic stability that is important for the long development cycles of high-tech SMEs. Funding levels are determined as part of an iterative discussion between Malaysian budgeting authorizes, MTDC, and funding agencies. Specific MTDC funding levels are illustrated in Table 14, organized by MP and each specific fund.

Human Resources and Skills
MTDC’s 134 employees (as of 2016) represent a variety of skills, backgrounds, and capabilities. MTDC employed just 13 individuals when it was founded in 1992, but its roster has grown substantially to support the program’s growth and the specific functional needs of clients. While early staff focused primarily on the award and disbursement of early-stage entrepreneurial funding, current staff fulfill a wider array of functional roles. They include technologists, coaches, and experts in relevant entrepreneurial fields such as marketing, accounting, law, and planning. MTDC conducts several programs and initiatives to build and maintain entrepreneurship-related knowledge and skills among its employees.

Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>MTDC established</td>
</tr>
<tr>
<td>1993</td>
<td>MTDC-HQ Venture Capital Management formed; several VC funds established</td>
</tr>
<tr>
<td>1997</td>
<td>MTDC review of venture funds, decision to focus on pre-commercialization funding</td>
</tr>
<tr>
<td></td>
<td>Commercialization of Research and Development Fund (CRDF) and Technology Acquisition Fund (TAF) established</td>
</tr>
<tr>
<td></td>
<td>First university-based TDC established at Universiti Putra Malaysia (then known as Universiti Pertanian Malaysia, Agriculture University of Malaysia)</td>
</tr>
</tbody>
</table>

Figure 22. Internal Organizational of MTDC
<table>
<thead>
<tr>
<th>Year/Fund</th>
<th>Program</th>
<th>Funding Level (RM, millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993–1997 MP 6 &amp; MP 7</td>
<td>Malaysian Technology Venture One (MTV One)</td>
<td>35.0</td>
</tr>
<tr>
<td></td>
<td>Malaysian Technology Venture Two (MTV Two)</td>
<td>75.0</td>
</tr>
<tr>
<td></td>
<td>Malaysian Technology Venture Two Agriculture (MTV Two-Agri)</td>
<td>17.0</td>
</tr>
<tr>
<td></td>
<td>Malaysian Technology Venture Three (MTV Three)</td>
<td>75.0</td>
</tr>
<tr>
<td></td>
<td>East Malaysia Growth Corporation</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td>Sumber Modal Satu</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>225.4</strong> (approximately US$ 56 million)</td>
</tr>
<tr>
<td>1997–2000 MP 7</td>
<td>Commercialization of Research and Development Fund (CRDF)</td>
<td>35.0</td>
</tr>
<tr>
<td></td>
<td>Technology Acquisition Fund (TAF) (including TAF 2)</td>
<td>113.0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>148.0</strong> (approximately US$ 37 million)</td>
</tr>
<tr>
<td>2000–2005 MP 8</td>
<td>CRDF</td>
<td>40.0</td>
</tr>
<tr>
<td></td>
<td>TAF (including TAF 2)</td>
<td>73.0</td>
</tr>
<tr>
<td></td>
<td>Non-ICT Venture Fund</td>
<td>750.0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>863.0</strong> (approximately US$ 216 million)</td>
</tr>
<tr>
<td>2005–2010 MP 9</td>
<td>CRDF</td>
<td>216.0</td>
</tr>
<tr>
<td></td>
<td>TAF (including TAF 2)</td>
<td>70.0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>286.0</strong> (approximately US$ 72 million)</td>
</tr>
<tr>
<td>2010–2015 MP 10</td>
<td>CRDF</td>
<td>235.2</td>
</tr>
<tr>
<td></td>
<td>TAF</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td>Business Start-up Fund (BSF)</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Business Growth Fund (BGF)</td>
<td>150.0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>515.2</strong> (approximately US$ 129 million)</td>
</tr>
<tr>
<td>2015–2020 MP 11</td>
<td>CRDF</td>
<td>400.0</td>
</tr>
<tr>
<td></td>
<td>TAF</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>BSF</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>BGF</td>
<td>50.0</td>
</tr>
<tr>
<td></td>
<td>Bumiputra Expansion Fund (BEF)</td>
<td>175.0</td>
</tr>
<tr>
<td></td>
<td>Halal Technology Development Fund (HTDF)</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>925.0</strong> (approximately US$ 231 million)</td>
</tr>
</tbody>
</table>

**Overall Total Funds Managed**

RM 2.96 billion (approximately US$ 740 million)

*Note: ICT = information and communication technology.*
TAF for women (TAF 2) established
Second university-based TDC established at Universiti Kebangsaan Malaysia (National University of Malaysia)
Third university-based TDC established at Universiti Teknologi Malaysia (Malaysia Technology University)
Non-ICT Venture Fund launched with an allocation of US$ 250 million to invest in strategic non-ICT sectors, for example, life sciences and biotechnology, advanced materials and advance manufacturing, and health care
Graduate Entrepreneurship Program (GEP) established to train next generation of technology entrepreneurs
Fourth research institute-based TDC established at FRIM
BSF and BGF established, marking shift from pre-commercialization to commercialization funds
Fifth university-based TDC established at Universiti Teknologi MARA (MARA Technology University)
Bumiputra Expansion Fund (BEF) established
Halal Technology Development Fund (HTDF) established

Major External Events

1986 | Malaysia Plan (MP) 5 prioritized funding of public R&D
1990-1991 | Annual report of National Council for Scientific R&D recommended the creation of an innovation intermediary organization
1991 | MP 6 includes the establishment of MTDC
2006 | MP 9 significantly increases R&D as well as R&D commercialization spending
2011 | MP 10 again leads to significant increases in R&D as well as R&D commercialization spending
2016 | MP 11 includes funds to spur commercialization among companies

Implementation, Capacity, and Programs

About MTDC programs

Commercialization of Research and Development Fund: CDRF is an incentive fund designed to encourage companies to work with universities and public research institutes to develop and commercialize technologies stemming from publicly-funded research. The fund provides increasing levels of support depending on the company type, from large companies to SMEs, to university spin-off companies. CDFR awards include grants of ticket size up to RM 4 million (approximately US$ 1 million) for two years with a requirement for the university and/or university spin-off company to provide a 30% funding match for the overall approved project size.

Technology Acquisition Fund: TAF is an enterprise grant program that incentivizes Malaysian companies to acquire proven foreign technologies, adapt them to the Malaysian context, and further develop them for commercialization. TAF awards up to RM 4 million (approximately US$ 1 million) for two years plus a 30% funding match for the overall approved project size.

Business Start-up Fund: BSF targets the needs of very early-stage start-up companies. BSF offers flexible funding through a convertible promissory note to companies. With convertible debt, the SME issues MTDC a promissory note for the amount invested. When debt is converted, typically based on future events such as raising funds from private sources or other specified mechanisms, the note will convert to equity. However, recipients can also repay the fund. In this case, payments are not due until the fourth year of the program. The BSF awards a maximum of RM 5 million (approximately US$ 1.25 million) and recipients must provide at least a 10% match.

Business Growth Fund: BGF is designed to accelerate growth among mid-growth firms before receiving institutional funding, including venture capital funding. BGF provides grants as well as equity financing. BGF considers two factors: (a) the extent to which these SMEs operate in industries designated by the government as critical to economic growth, including electronics and biotechnology, and (b) the extent to which these SMEs possess IP, products with strong market demand, and a sustainable revenue stream. BGF also supports SMEs which seek to expand their product variety and value and enter new international markets. For equity funds, MTDC asks recipients for equity shares in their companies while offering the unique opportunity to buy back shares. BGF awards up to RM 10 million (approximately US$ 2.5 million) for five years.
Bumiputra Expansion Fund: BEF is designed to accelerate growth among high-tech companies established by native Malay entrepreneurs. Similar to BSF, BEF works through a convertible debt mechanism. BEF awards up to RM 15 million (approximately US$ 3.75 million) for five years.

Halal Technology Development Fund: HTDF is designed for companies that wish to compete in domestic or international markets for Halal products. It does so by providing funding and services that ensure companies have the capability to comply with Halal practices and customs. HTDF awards up to RM 4 million (approximately US$ 1 million) for two years.

Selection of Projects

The evaluation process of grant applications for each fund involves three phases, including (1) screening, (2) evaluation, and (3) approval. Each MTDC fund comprises evaluation officers, a technical committee (TC), and an approval committee (AC). The TC comprises experts in specific scientific, technical, and business-related fields. During the initial screening process, an Evaluation Officer associated with a fund compiles information about their assigned applicants. Collected applicant information is based on criteria that enable decision makers to better understand the growth and success potential of SMEs. Applicant packages are presented to TCs within the respective funds for review and deliberation. The packages that the TCs recommend for approval are then forwarded to the AC. The AC reviews and validates the decisions of

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**Figure 23. Programs Administered by MTDC**

<table>
<thead>
<tr>
<th>Direct Financial Support</th>
<th>Indirect Financial Support</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Loan guarantees and reduced interest rates</strong></td>
<td><strong>Vouchers</strong></td>
</tr>
<tr>
<td>• BGF is a guaranteed loan program; BSF has loan-like components; recipients can ‘buy-back’ their equity shares</td>
<td>• Micro credit programs for university students to start businesses at four universities</td>
</tr>
<tr>
<td>• BEF is a combination of equity and loan-based financing</td>
<td><strong>Tax incentives</strong></td>
</tr>
<tr>
<td><strong>Equity finance</strong></td>
<td>GreenLane program for qualified MTDC companies to access a simpler government procurement process</td>
</tr>
<tr>
<td>• Equity finance provided by BGF and BSF</td>
<td><strong>Advisory, extension, and training services</strong></td>
</tr>
<tr>
<td><strong>Grants</strong></td>
<td>• Advisory services provided by MTDC staff (marketing, financial, business development, and technical advisory)</td>
</tr>
<tr>
<td>• Grants provided by CRDF, TAF and HTDF</td>
<td>• Training programs for university TTOs and Technology Licensing Offices (TLOs)</td>
</tr>
<tr>
<td>• MTDC Mini Grant: Dedicated to support empirical and field-research in areas relevant to MTDC’s core business, including, but not limited to commercialization of R&amp;D, technology transfer, technology entrepreneurship, and innovation. This grant is opened to all researchers from public and private universities, and government research institutions</td>
<td><strong>Collaborative networks and policies</strong></td>
</tr>
<tr>
<td><strong>Information and advocacy</strong></td>
<td>• Malaysia Technical Cooperation Program (MTCP) for South-South countries</td>
</tr>
<tr>
<td>• Industry-university networking programs.</td>
<td>• Asia Science Park Association (ASPA)</td>
</tr>
<tr>
<td>• CEO talks for university students</td>
<td>• Association of University Technology Managers (AUTM)</td>
</tr>
<tr>
<td>• University industry liaison committee</td>
<td>• CRDF Global/Global Innovation through Science and Technology (GIST)</td>
</tr>
<tr>
<td>• Winners TV series (Seasons 1, 2, and 3)</td>
<td><strong>Prizes and awards</strong></td>
</tr>
<tr>
<td>• Astro Awani In-Person TV series (<a href="http://english.astroawani.com/mtdc-in-person">http://english.astroawani.com/mtdc-in-person</a>)</td>
<td>• Book prizes for university researchers on commercialization and innovation to 4 universities</td>
</tr>
</tbody>
</table>
the TCs and oversees fund disbursement and advisory service assignment. Program officers work with the Advisory and Value-added Services Division to support and track awardee progress over time.

Delivery Challenges

Institutional Reforms

MTDC’s programs have evolved to address commercialization challenges and take advantage of broader market trends for the benefit of sponsored companies. One of the most difficult challenges has been to develop a model of technology commercialization and entrepreneurial development appropriate for Malaysia. MTDC was established based on the idea that the country required public venture-capital funding. While important, many technologies and SMEs were not yet ready for venture-capital funding and thus other services, support programs, and funds were required.

The adaptation of MTDC to the entrepreneurial needs of Malaysia is visible in the evolution of the program’s constituent funds. The first funds were focused almost entirely on venture capital. However, these resources were later redirected during MP 9 to focus on the earlier development of university technologies and other SMEs. Support services and facilities were added to further encourage and support high-tech entrepreneurship. After years of investment in early-stage technologies, services, and infrastructure, MTDC began to refocus on SME growth by redirecting funds toward later-stage SMEs and establishing start-up and growth funds. Finally, MTDC has recently introduced funding mechanisms, such as the HTDF, that take advantage of unique economic opportunities at the intersection of high-tech entrepreneurship and culture.

Budgetary, Capacity, and Political Issues

MTDC has enjoyed broad political support from successive prime ministers and their related governments. Its leadership believes that this is due to the flexibility and continuing evolution of the program. MTDC remains a relatively small organization; partnerships are used to leverage and extend existing capabilities as well as build new ones. Other than during the 1996–1997 Asian financial crisis, funding has grown steadily. Further, MTDC has augmented its funds using earnings from its SME equity investments. Malaysian policy makers increasingly expect MTDC’s clients to generate substantial returns to equity and thus, to MTDC. However, achieving positive cashflow for MTDC has been identified as the biggest challenge to future political and budget support.

Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations

MTDC’s success metrics are based on outputs and outcomes established by the government. Specifically, success is measured by growth in employment, high-skill (knowledge) workers, sales (local and international), intellectual property, private investment, and product sales. Internal program reviews are undertaken annually; intensive government reviews are undertaken at midcourse and near the end of the five-year MPs.

Malaysia’s Economic Planning Unit and the Performance Management Delivery Unit (Pemandu), both within the Prime Minister’s Office, perform the government reviews. Reviews are made in cooperation with the board, Khazanah, and the constituent government agencies. Further, two independent reviews were undertaken around 2010–2011 to assess research grant recipient performance as well as the economic impact of MTDC grants on the Malaysian economy.

Evaluation Methodologies

Project monitoring follows relevant fund agreements (2–4 years after receiving the grant or investment). Outcome data are collected from recipients for reporting purposes. Further, MTDC hosts quarterly workshops with fund recipients to collect feedback on service administration and gauge company performance. Data has been made available to researchers for study.

MTDC also recently established an R&P Department, which conducts primary and secondary research to better understand MTDC portfolio companies, the effectiveness of MTDC funds and services, and the impact of MTDC-funded companies on the Malaysian economy. The R&P Department also conducts research related to the Malaysian innovation and entrepreneurship ecosystem to identify components needed to improve start-up and SME success. The goal of the R&P Department is to be an important source of practical, operations-related knowledge, not only for MTDC and Malaysia, but also for developing countries interested in spurring technology transfer, technology commercialization, and entrepreneurship. R&P expects to share its research through a variety of publications, including case studies, research articles, and white papers, and through its outreach with international partners.
Impact Evaluations

Evidence of Results

From the US$ 104 million disbursed under MP 9 and MP 10, MTDC-funded companies have generated US$ 534 million in total domestic and export sales and attracted US$ 169 million in private sector investments. These companies created 5,747 knowledge-worker jobs and filed 494 patents. Six MTDC-funded companies are publicly listed—Codexis, Inc. and WaferGen Bio-System, Inc. on the NASDAQ, Globetronics Technology Bhd on the Kuala Lumpur Stock Exchange, BioAlpha Holdings on the technology-oriented ACE market within the Malaysian Bursa Stock Exchange, DagangHalal Plc on ICAP Securities and Derivatives Exchange (ISDX) Growth Market, and London, and Green and Smart Holdings Plc on the Alternative Investment Market (AIM), London.

Another recent example of company success is the Malaysia Phosphate Additives Company. The company, which specializes in phosphate production, recently built with assistance from MTDC a new manufacturing facility that is expected to employ over 1,000 workers and result in nearly US$ 3.25 billion in economic activity in the next 15 years, as well as attract billions more in private investment.

MTDC’s efforts have resulted in both tangible and intangible benefits to the Malaysian innovation ecosystem. First among these is the gradual emergence of a culture of knowledge-based entrepreneurship and commercialization within Malaysia, especially within universities, research institutes, and high-tech companies. MTDC’s efforts elevated awareness of the value of new knowledge among Malaysian researchers, faculty, and students. All Malaysian research universities have since established innovation and technology transfer units, while entrepreneurial activity has steadily grown. Further, several funds and services have sought to encourage and support collaboration between the private sector and academia. These facilitated networks have been an important component in the rapid growth of entrepreneurship and improved innovation performance of SMEs.

Another aspect of cultural change within universities and research institutes is an enhanced understanding among researchers and students of the value of intellectual property. Patenting has become part of universities’ key performance indicators and an important contribution among individual faculty. While patents are not necessarily innovations, they nonetheless represent potential new breakthrough technologies and thus, an asset around which university start-ups and SMEs focus their commercialization efforts.

MTDC has also been involved in collaborative efforts to improve the innovation and entrepreneurship environment in Malaysia. For example, MTDC was a key stakeholder in the establishment of the Malaysia Exchange for Securities Dealing and Automated Quotation (MESDAQ), which is the equivalent of the NASDAQ exchange in the United States and is focused primarily on information technology. MTDC helped formulate MESDAQ policies and guidelines for initial public offerings and other market transactions.

Finally, MTDC has been involved in building international networks to both benefit Malaysian SMEs and share the lessons learned with other countries. Managed through the MTCP under the Ministry of Foreign Affairs, MTDC has partnered with Sri Lanka, Kazakhstan, Egypt, and several African countries. MTDC is also a member of the ASPA, AUTM, and GIST, a partnership led by the U.S. Department of State and CRDF Global, an independent non-profit that promotes international scientific and technical collaboration.
3.10. National Center for Research and Development (NCBR) in Poland

Overview

The National Centre for Research and Development (NCBR) supports research and development (R&D) to increase innovation in the Polish economy. It does so by providing grants and equity instruments to businesses, universities, state-owned research institutes, consortia of these entities, and to investment funds (seed and venture capital). It also helps build human capital across sectors to boost technology transfer from universities and research institutes to businesses.

Key Takeaways

Due to the large scale of its operations and the high financial weight of its programs in the country's economy, NCBR plays an important role in any national endeavor aimed at increasing the competitiveness of Polish companies by intensifying their innovative activities, especially those built on technological and scientific research foundations.

NCBR, the largest R&D funding agency in Poland, is also the largest player in all of Central and Eastern Europe (at least in terms of financial means invested/disbursed on R&D undertakings). Therefore, it illustrates the potential impact of a substantial and sustainable investment in innovation.

Since its establishment in 2007, NCBR has evolved from a government agency funding almost exclusively academic-type scientific research, to a funding agency focused increasingly on R&D and technology commercialization projects carried out mainly by business companies, and further, to an organization which is not only a funding institution, but also a partner for business actors (associations of various industries, investors, and professional investment managers interested in technology-based ventures). From this perspective, NCBR demonstrates the evolution process in a relatively short period of time and analyzing factors that enhance or hinder this type of change, whether organizational, political, or affecting the organizational culture.

Role in the Country’s National Innovation System

NCBR plays a key role in Poland’s National Innovation System (NIS) as it decreases the risk inherent in any technological undertaking, by providing financial leverage for business companies, investors, investment managers, and research teams pursuing projects with high technological risk. Although there are other agencies whose mission is to support innovation and entrepreneurship, NCBR is unique in terms of its concentration on R&D and in sharing technological risk with businesses and universities. Over the last 10 years, the agency has acquired knowledge allowing it to conduct large-scale assessments of project proposals based on technology readiness, novelty of technological solutions, quality of intellectual property protection, and coherence of business plan.
NCBR addresses a funding gap for technology-based innovations between traditional funding of basic science (institutional funding, grants) and investment by businesses entering after the technological risk has already been tackled. Without NCBR, the NIS would not provide mechanisms and financial means for those who are willing to conceive and develop their original technological solutions and put them on the market.

Complementary Agencies

In Poland there have been complementary agencies to NCBR for many years. First, the Polish Agency for Enterprise Development (PAED) has implemented various programs aimed at the development of entrepreneurial spirit and growth of especially small and medium-sized enterprises (SMEs). Since its establishment in 2002, PAED has conducted a plethora of programs and initiatives that, among others, help entrepreneurs set up their small business, develop it to a larger scale, expand on international markets, introduce innovations to traditional industry branches, acquire a new set of skills for human capital, and create collaborative links among companies in the same sector or geographical area (clustering). From 2008, PAED also conducted activity parallel to NCBR, awarding grants for R&D projects to business companies, but since 2012, this has become a rather marginal part of its mission.

National Science Centre (NSN) is another agency that complements NCBR’s mission. It is a typical fundamental science funding agency, built on the model of the European Research Council or United States National Science Foundation. NSN is a premier financier, through competitive grants, of research projects that are aimed at advancing scientific knowledge, but not necessarily having a practical or commercial goal. Since it was set up in 2010, NSN has had a significant role in the dissemination of a “research grants awarded on competitive basis” culture, which helps Polish basic science catch up faster with Western European and U.S. competitors.

The third agency whose area of interest is meaningful for NCBR, is the Industrial Development Agency, set up in 1990. It specializes mainly in restructuring processes in large companies. It has evolved from an agency helping large, formerly state-owned, players in traditional industries to a partner of business companies of all sizes, helping them in operation and development of business activity, particularly in scaling up innovations and expanding abroad.

The Polish Development Fund (PFR) has been carrying out operations since mid-2016. Through PFR Ventures it operates as a fund-of-funds organization, having in its portfolio a number of programs investing public money in venture capital (VC) or seed funds. Investee funds are managed on a commercial basis, are in principle privately owned, focus their investment activity on young companies that pursue innovative projects, and are usually not listed on the stock exchange. PFR is the largest organization of this type in Central and Eastern Europe.

Finally, there are 16 regional development agencies focused on boosting innovation in specific areas of Poland by awarding grants and equity or mezzanine funding to smaller business projects.

Roles, Capabilities, and Organization

Origins and Evolution

Mandate

NCBR was established in 2007 as a part of a larger reform of the R&D government funding system. In the post-Communist era, Poland’s governmental funding of science and technology was almost entirely focused on academic science in its origins, built around ideas linked to Michael Polanyi’s republic of science concept. After Poland’s accession to the European Union (EU) it became evident that the NIS lacked support mechanisms for applied science and technology development aimed at specific products and usually carried out in business companies. Moreover, before 2007, a linear model of innovation (the assumption that innovations start from
basic science, whose outcomes are developed in applied science projects, the results of which are then transferred to business enterprises which finalize the technology development process and introduce the ready product to market was a hidden foundation of the government support system, which proved to be wrong. It was almost universally replaced by a systemic model of innovation (innovation might happen at every stage of scientific research, in any kind of organization, end-user involvement from the very beginning is crucial). Another problem within Poland’s NIS at that time was excessive fragmentation of the science and technology landscape, both in terms of the large number and small scale of R&D and technology development projects, as well as in terms of the relatively large pool of undersized R&D teams and organizations carrying out technology development undertakings. Thus, the establishment of NCBR was an attempt to overcome these challenges.

The most important part of NCBR’s mission from its very beginning was the design and implementation of strategic R&D programs. A reality check showed that it was a tough task for an agency equipped with competencies only in one part of the innovation ecosystem. As the socioeconomic priorities of subsequent governments were changing, it was difficult to align strategic R&D programs to government priorities.

Alignment of implementation rules and processes, as well as the structural design of the agency to further government economic and innovation policy, emerged as a challenge after the first three years. The structure of the institution and of its fundamental processes was in line with old policies that focused on funding academic scientific research, where peer review conducted by distinguished academics was at the heart of the system. But changing strategic goals meant that more attention needed to be paid to business-oriented R&D projects, which required a different approach in the selection of projects for funding and hence, a different set of reviewers with a concrete track record in business activities. This change was gradually injected into the processes and organizational culture of the agency between 2011 and 2014.

During its period of experimentation and learning (2011-2014), NCBR also started collaboration with Venture Capital (VC) investors and managers, using its money not only for awarding grants, but also for investments. Consequently, in 2015, NCBR became a slightly different type of organization, focused primarily on funding, with grants applied to research and technology development in business enterprises and in consortia of businesses and universities or research institutes.

**Sectoral Focus**

In the first four years, a horizontal approach dominated NCBR’s policy. Before 2012, three strategic R&D programs were the only sign of a sectoral approach, and their weight in the agency’s budget remained relatively small (around 20%). In 2012, the sectoral approach started to gain increasing attention, with the launch of R&D programs dedicated to the aviation, medical, and pharmaceutical industries, and in collaboration with the relevant industry associations. Inspiration for the design of sectoral programs was found in the European Union Joint Technology Initiatives. After two years of learning based on the first two cases, NCBR launched an open call to industry associations requesting proposals for sectoral programs. Proposals were competitively assessed based on their quality and ambition levels, as well as the readiness and capability of industry players to provide their own financial contribution. At present, there are more than 10 sectoral programs implemented in collaboration with industry representatives. They are a good supplement to horizontal policies, as they allow the concentration of some funds on R&D priority areas indicated by industries, not by the government.

**Business Model Evolution**

One can distinguish three trends in NCBR’s business model development that have coexisted since the establishment of the institution. In the first period of approximately five years, NCBR was focused on using grants as the sole instrument of its intervention. The vast majority of its financial resources were awarded to academic institutions (universities, research institutes) or to consortia, in which the presence of businesses was still small. Between 2012 and 2014, the focus on industry-academic consortia prevailed, and a large portion of NCBR’s budget was spent on consortia projects, largely through the InnoTech program, targeting innovative projects in selected scientific and industrial sectors; and Strategmed, a large strategic R&D program focused on medtech. The most recent development is marked by rechanneling the largest part of the agency’s financial resources to business enterprises. The flagship programs here are: Fast Track, Demonstration Lines, and sectoral programs.

At the same time, another evolution in NCBR’s business model was taking place. The agency started to pay special attention to the completeness of its intervention: it aimed to cover all the crucial elements of the innovation ecosystem which were based on science. To that end it started the Lider program focused on building human capital, and the Bridge suite of programs to boost venture
capital for early stage technology ventures. NCBR also introduced the SpinTech program to help Technology Transfer Offices (TTOs) at universities start their business operations (funding for due diligence of technologies coming from research teams at universities).

Of these, the Lider Program, Bridge VC and Bridge Alfa still continue, and the budgets of the latter two have been substantially extended.

One cannot ignore the intangible impact of the new programs NCBR dared to start. Through close collaboration with a new group of business partners—investment managers and private investors—NCBR’s organizational culture was exposed to and influenced by the business way of sourcing, selecting, monitoring, and finally managing the portfolios of technological projects. The partial adoption of business logic, where effectiveness and efficiency in achieving specific commercial goals is prioritized while disbursing money, by NCBR which, as a public organization, must be driven by bureaucratic procedures, can be seen as an additional positive outcome of those experimental programs.

Organizational Structure

Organizational and Reporting Structure

NCBR is an implementing agency created to perform tasks related to scientific, science and technology, and innovation policies adopted by the Polish government. On behalf of the state, it is supervised by a member of the government: the Minister of Science and Higher Education (S&HE).

NCBR is managed by a director, appointed by the Minister of S&HE. Candidates for the post of the director are selected through an open competitive procedure, run by the Minister of S&HE. The director is allowed to hire up to two deputies who help him/her run the whole organization. Deputies are also selected through an open competition, launched by the director. The director is responsible for managing all the business matters of the agency and is its main executive body.

Besides the director, in NCBR’s organizational structure there are also two collegial bodies: the Council and the Steering Committee. The latter is responsible for managing R&D programs dedicated to defense and security. The Council acts mainly in an advisory capacity, giving opinions on the thematic scope and calls for proposals on the rules of new programs. The only part of NCBR’s mission where the Council is actually a decision-making body is in the crucial design of strategic R&D programs; preparing the program, its thematic scope, goals, general rules of implementation, and budget. The Minister of S&HE approves these new programs.

The Council’s composition reflects the cross-sectoral (within government) mission of NCBR. It is composed of 30 members. One-third of the Council represents the scientific community, another third is proposed by business associations and representations, and the final third is nominated by 10 ministers (including, among others, the Ministers of S&HE, Economic Development, Infrastructure, Defense, Homeland Security, Environment, and Health).

The director is responsible for the preparation of annual financial plans that are subject to the Minister of S&HE’s approval, after taking the opinion of the Council. Similarly, the director presents yearly financial reports that also need the Minister of S&HE’s approval, after taking the opinion of the Council.

Regarding reporting lines within the government, NCBR is also subject to a separate line of financial and operational reporting under the authority of the Minister of Economic Development. Since 2011, NCBR’s budget has been to a large extent (70–80%) financed from European Union (EU) funds. That is why the agency actually has to ensure two streams of operational and financial reporting: to the Minister of S&HE and to the Minister of Economic Development, responsible within the government for proper management and disbursement of the EU Structural Funds, who finally reports to the European Commission.

NCBR’s internal organization has experienced multiple changes over the last 10 years, finally stabilizing during the last three years. Since then, it has been built around three divisions: coordination of NCBR’s activities, including policy creation and program design; program implementation; and support for the whole institution (including back office functions).

Budget Sources and Allocations

In the first four years after its establishment, NCBR’s budget was almost entirely based on funds coming from Poland’s state budget via the Ministry of S&HE (with the exceptions that a small portion of the agency’s budget was from the EU’s 7th Framework Program and later, Horizon 2020). Since 2011, however, an increasingly substantial part of NCBR’s budget comes from the EU’s Structural Funds (managed in Poland by the Ministry of Economic Development). During 2012–2017, up to approximately 75–80% of NCBR’s budget originated from the EU’s Structural Funds.
Human Resources

One of the inherent characteristics of state agencies supporting the development of innovation and scientific research in Poland is collaboration with external experts who carry out peer reviews and, to some extent, due diligence of submitted project proposals. In 2016, NCBR employed around 360 people as permanent internal staff. They design programs and calls for proposals, including negotiations of their specific rules with external stakeholders, especially the Ministries of Economic Development and S&HE; organize the evaluation of programs; and administer and organize the evaluation of submitted proposals, including collaboration with external experts (hiring and selection of experts, assignment of work, technical quality checks). They are also responsible for managing contracts with grantee entities (universities, companies); auditing granted projects on sites; and financial settlements.

External experts are not permanent staff. They are allotted specific work on a case-by-case basis (for example, assessing proposals submitted in response to calls, evaluating programs, ad hoc assessments of ongoing granted projects).

In recent years, as NCBR has entered new areas of activity requiring new sets of skills (for example, investments in VC funds, technology transfer programs), it seems that the way to handle this new kind of work professionally will be by procuring professional external contractors. For VC, this will be done through hiring commercial managers of funds-of-funds organizations (usually a private firm managing funds for commercial purposes).

Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>Major Internal Events</th>
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</thead>
<tbody>
<tr>
<td>2007</td>
<td>NCBR was established July 1</td>
</tr>
<tr>
<td>2007-2008</td>
<td>NCBR takes over a number of programs from the Ministry of S&amp;HE: grants to academia and—to some extent—companies</td>
</tr>
<tr>
<td>2009</td>
<td>Lider Program (R&amp;D projects for young scientists) started</td>
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<tr>
<td>2010</td>
<td>NCBR launches first two strategic R&amp;D programs: “Advanced technologies for energy generation” and “Interdisciplinary system for interactive scientific information”</td>
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<tr>
<td>2011</td>
<td>NCBR's mission significantly broadened by new laws empowering it to initiate new programs to develop applied research and commercialization of technologies</td>
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<td></td>
<td>New top management recruited</td>
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<td></td>
<td>NCBR takes over from the Ministry of S&amp;HE as the implementing body for EU Structural Funds programs aimed at R&amp;D and human capital for science</td>
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<td></td>
<td>Rapid growth from 80 to approximately 200 staff</td>
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<td>2012</td>
<td>Third strategic R&amp;D program established: Strategmed aimed at fighting civilization diseases (lifestyle diseases) and promoting healthy aging, among others</td>
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</table>

Figure 24. NCBR's Budget 2010-2016 (millions)
First NCBR program dedicated to collaboration with venture capital launched: Bridge VC pilot
New program for funding scientific-industry consortia projects launched: InnoTech
First sectoral program agreed with an industry association: Innolot (aviation industry)
NCBR takes over EU-funded portion of programs funding (with grants) R&D in business companies
Fourth strategic R&D program approved: Biostrateg (new technologies for agricultural, food, and forestry economy)
NCBR starts effective implementation of new operational programs funded from EU Financial Perspective (2014–2020), the first in the country
NCBR launches first call for proposals in a new flagship instrument: Fast Track (offer of grant money for SMEs and large companies)
Management companies for new funds-of-funds contracted to select VC and corporate VC [CVC] funds, mandated to invest in undertakings based on R&D outcomes

Major External Events

2008
World financial crisis breaks out; Poland does well, as the only EU member country to avoid recession

2010
Government passes new acts of law to establish a new agency dedicated to funding basic science—National Science Centre—and at significantly extending NCBR’s competencies

2014
Negotiations of operational programs to be funded from EU Financial Perspective 2014–2020 are started
Government passes a strategy for smart specialization (national economy development strategy)

2015
Nationwide operational programs to be funded from EU 2014–2020 Financial Perspective approved by the European Commission
NCBR appointed an intermediary body for operational programs funding R&D and human capital for academia and science

Implementation, Capacity, and Programs

Financial and non-financial support programs
Of note in direct financial support are pilot programs addressing the VC community: Bridge VC and Bridge Alfa programs allowed 12 VC funds to focus their attention on very early-stage technology ventures. Privately run and owned management companies were incentivized by NCBR’s investment commitments, ranging from 50% to 80% of funds’ capitalization, to source projects from academia, screen them, and invest public and private money. This approach attracted private investors and managers to early-stage technology projects that otherwise were too risky for these investors. From the perspective of inventors, it was a unique opportunity, not only to get investment, but also to collaborate on a day-to-day basis with investment managers and end-users of future products.

The Lider program, aimed at building human capital among young scientists to carry out scientifically ambitious, high-risk projects was extended; besides funding research projects, it was supplemented by trainings for young leaders in building commercialization skills, developing their managerial competences, and introducing them to potential business partners.

NCBR’s Bridge Mentor Program offers technical assistance to universities and state-owned research institutes in transferring their scientific research outcomes to business partners (via licensing or spin-offs).
## Delivery Challenges

### Institutional Reforms

NCBR went through two waves of institutional changes aimed at enhancing its capability to realize its mission. The first significant change took place in 2011—the first calendar year when NCBR was empowered to initiate new programs on its own and take responsibility for their design, evaluation, and implementation. The new legal framework introduced more detailed and unambiguous rules on the scope of competence of the NCBR Director and Council, and of the Minister of S&HE as the supervising authority. Before this, most of NCBR’s activity consisted of implementing programs designed and launched by the Ministry of S&HE. Consequently, over the following years NCBR built its own capacity to analyze, design, and carry out evaluations (ex ante, mid-term, ex post) of new programs.

Another reform was just as important, but took several years to implement, which perhaps is why it is hardly visible. Since NCBR earmarked increasingly more finances for R&D in business companies, it necessitated a different set of skills on the part of experts and peer reviewers. Academic R&D projects (rather theoretical) were replaced by projects that were supposed to produce tangible economic outputs. So, NCBR started to hire a significant number of business experts and people with experience in R&D projects in industry, as opposed to in academic environments. Currently they represent an important part of the external expert pool.

### Budgetary, Capacity, Political Issues

Since its inception, NCBR has been a classic funding agency, distributing the finances received from the State or EU Budget. So far, NCBR has not generated revenue since its grants do not carry any obligation of repayment in case

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### Figure 25. Programs Administered by NCBR

#### Direct Financial Support

<table>
<thead>
<tr>
<th>Equity finance</th>
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<tbody>
<tr>
<td>• Bridge VC</td>
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<td>• Bridge CVC</td>
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<table>
<thead>
<tr>
<th>Grants</th>
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<tbody>
<tr>
<td>• Fast Track (grants for R&amp;D carried out by businesses, SMEs, and large companies)</td>
</tr>
<tr>
<td>• Demonstration Lines (grants for pilot lines, technology readiness levels [TRLs] 7-9)</td>
</tr>
<tr>
<td>• Bridge Alfa (grants for seed funds investing in projects at proof-of-principle and/or proof-of-concept stage)</td>
</tr>
<tr>
<td>• Application projects (grants for R&amp;D carried out by consortia in collaboration with businesses and academic institutions)</td>
</tr>
<tr>
<td>• Lider (grants for R&amp;D projects managed by young scientists and first time managers)</td>
</tr>
<tr>
<td>• Strategic R&amp;D programs (usually grants for consortia, and in thematic area linked to government strategy)</td>
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#### Non-financial Support

<table>
<thead>
<tr>
<th>Public procurement</th>
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<tbody>
<tr>
<td>• Guide for scientific and academic institutions explaining Polish and EU rules on procuring goods and services, and on contracting out research</td>
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<tr>
<th>Information and advocacy</th>
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<tbody>
<tr>
<td>• Bridge Info portal (practical information for professionals handling R&amp;D commercialization projects)</td>
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<tr>
<td>• Commercialization of R&amp;D (guide for practitioners [several editions])</td>
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<tr>
<th>Infrastructure</th>
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<tbody>
<tr>
<td>• Science Infrastructure Management Support (SIMS) project (training and coaching for prospective managers of new R&amp;D laboratories)</td>
</tr>
<tr>
<td>• Bridge Mentor (two external firms hired to help selected academic institutions transfer results of some large R&amp;D projects to business partners)</td>
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</tbody>
</table>

#### Indirect Financial Support

<table>
<thead>
<tr>
<th>Tax incentives</th>
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<tr>
<td>• Outside of NCBR's mission</td>
</tr>
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</table>
of commercial success. That is supposed to change over approximately the next 10 years, when the first VC funds invested by NCBR will repay their investors, including NCBR. The agency’s first VC fund, started under a pilot program, made its first investment in 2015, another started operations in 2017, and many more are awaited between 2017 and 2019.

The share of NCBR’s budget from the national budget has been increasing steadily over the years, but the growth level is close to the pace of inflation. At present, the largest portion of the agency’s budget is financed from EU Structural Funds. This is a relatively comfortable situation, but one has to remember that EU Funds are committed for the limited periods of EU Financial Perspectives. That brings us to the conclusion that around 2020, when the current perspective will close, NCBR will enter a period of uncertainty. The financial resources from this source in the next period of 2021–2027 are unknown. Even slight changes within EU Structural Funds will have great impact, since they represent approximately as much as 80% of NCBR’s budget.

Successive governments from different political viewpoints have paid much attention to innovation policy and to NCBR as one of the key state agencies allowing the implementation of their political goals. Thus, NCBR enjoys broad support from the main political powers in terms of agreement that funding R&D, technological development, and advancing the Polish economy by boosting its innovativeness needs financial resources from the national budget.

Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations

According to the law, NCBR has a legal obligation to carry out three types of evaluations of its programs:

- **Ex ante**—This evaluates whether a subject program is really needed, whether the particular program would address the need, and whether its design will be efficient. For programs launched autonomously by the director, this should be carried out before the program is approved and published; for programs approved by the Minister of S&HE (strategic R&D programs) it should be conducted before a program is submitted for approval;

- **Mid-term**—To gather information about the reality of the implementation and check it against assumptions used at the program inception phase; it helps decision makers to decide on the continuation of programs or whether to introduce changes in their course;

- **Ex post**—Helps NCBR top management and supervising ministries to assess the effectiveness and efficiency of various forms of intervention.

To enable all these evaluations, from 2011 NCBR has progressively broadened the scope of data collection both within the organization and from external players. First, financial data concerning project implementation by customers and financial outputs of projects was collected and systematically processed. Then, NCBR started to gather other data from applicants (including unsuccessful ones) and beneficiaries. This enables cross-sectoral, cross-program, and even cross-institutional checks of information on the track record of companies and individuals (especially in terms of their involvement in various R&D and business undertakings).

Evaluation Methodologies

As far as ex ante evaluations are concerned, mainly desk research, expert analysis, surveys, interviews, and focus groups are employed. For the other two types of evaluation, predominantly data analysis (based on data mainly collected by NCBR) and surveys are used.

In 2015, NCBR started systematic gathering of data to use in future counter-factual evaluations. In this evaluation method, as it is important to use data collected over a significant period of time and to properly identify the treated group (entities that received NCBR’s support) and a comparison group (the ones that applied but did not get support), NCBR is currently preparing itself to fully employ counter-factual evaluation in a few years.

Parties Responsible for Monitoring and Evaluation

NCBR’s own staff is responsible for developing evaluation methodologies. In some cases this is in partnership with external players; for example, counter-factual evaluation methodology was prepared in partnership with the World Bank Group. Evaluations themselves are in principle outsourced and carried out by appointed entities. Usually they are conducted by consulting firms specializing in evaluations; however sometimes individual researchers/analysts are contracted too.

Monitoring of projects funded by NCBR and data collection from beneficiaries are carried out by an in-house team. In particular, financial data relating to applicants’ or
beneficiaries’ economic situation and other data used for quantitative analysis, for example, on intellectual property production and protection, scientific publications, and commercial outcomes of grant-funded R&D, are systematically collected and processed by NCBR’s internal services.

Customer Engagement

NCBR’s customers are engaged in multiple types of monitoring and evaluation activities by the agency. Some are targeted at the ex-ante evaluation stage itself. For the purposes of mid-term and ex post evaluations, all beneficiaries are contacted by the evaluating teams, who carry out surveys, interviews, or invite them to focus groups.

With a view to creating possible control groups for counterfactual evaluation, NCBR has been able to collect contact information from unsuccessful applicants and consent for contact and participation in future surveys or other data collection. This data has been gathered on a regular basis since 2015.

Impact Evaluations

Evidence of Results

In 2016, The World Bank conducted an evaluation of NCBR’s In-Tech program, which facilitates cooperation between science and industry. The evaluation found that the program resulted in more collaboration, more patents and publications, and some commercialization of the resulting product. In addition, the program appears to be alleviating funding constraints for R&D activities by funding projects that would otherwise not take place.

NCBR has been using other methods to identify its impact on Poland’s academic and business worlds in recent years. It is worth noting that for the purposes of the state budget, financial reporting data on academic papers (including as a separate category, data on reviewed academic papers and data on citations of publications in renowned scientific journals) and on intellectual property generation and protection has been collected on regular basis for around 10 years now. However, this data is subject to agglomeration and so far, it has been hard to distinguish the impact of NCBR from that of, for example, Ministry of S&HE or National Science Centre.

However, NCBR’s impact can be relatively easily detected if one factor is taken into consideration while measuring Poland’s economy’s innovativeness: business expenditure on R&D (BERD). Since 2011, NCBR’s programs addressed to businesses generated financial input amounting steadily to 10-15% of the BERD generated in the whole country. It must be noted that this number shows only a direct financial impact of NCBR’s programs on the behavior of business companies. We still do not know the indirect impact of NCBR on strategies and situations of businesses in the country. It is expected that these kinds of outcomes will be shown when the first full-fledged counter-factual evaluation is finalized.
The Rwanda Development Board (RDB) is tasked with promoting the nation’s private-sector development agenda. By consolidating several agencies into one organization, RDB is expected to coordinate efforts across the government to increase exports and investments (especially FDI) and improve business registration processes, all geared toward accelerating private sector growth.

Within RDB, the ICT business development department works closely with the private sector to enable its development, and implements the country’s flagship programs to drive innovation.

Key Takeaways

In 2000, Rwanda embarked on an ambitious strategy to transition from an agricultural to a knowledge-based economy, titled Vision 2020. Although the nation was still rebuilding, the government decided to invest heavily in its human capital and focus on its central location to become a regional ICT hub and grow into a middle-income country.

In 2008, six agencies were consolidated to establish RDB by law, in order to better coordinate and accelerate private-sector development. Since then, RDB has spearheaded several reforms contributing to the nation’s rise in the World Bank’s Doing Business rankings from 143rd to 41st in the world (2018); it is now 2nd among its regional peers. In addition, Rwanda ranks 6th for getting credit, and 2nd for registering property among 190 countries.

In the last two decades, Rwanda has achieved fast economic growth, sharp reductions in poverty, and a decrease in inequality. RDB has played an important role in this success, which has emboldened ambitions to foster innovation and further accelerate growth.

Role in the Country’s National Innovation System

RDB has been tasked with a challenging set of goals to foster innovation and inspire the creation of a large number of ICT-based companies by 2025. Over the past 15 years, the Rwandan government has addressed innovation in several strategic documents outlining the roles of universities, research centers, and the private sector in developing the national innovation ecosystem. However, until recently, these documents did not include explicit goals and specific mechanisms to provide direct government funding and programming to drive private sector innovation. The SMART Rwanda Plan (2015–2025) has now set ambitious targets to accelerate the development of ICT innovation hubs in Kigali, catalyze over US$ 200 million in FDI, and generate a large number of innovation projects, ICT start-up companies, and stock market-listed companies. While the SMART Rwanda plan also covers a broad number of ICT initiatives to be implemented by various ministries, each of the innovation-related targets have been assigned to the RDB’s ICT department.
Since 2000, the Rwandan government has invested heavily in ICT infrastructure. It leverages web-based and mobile platforms to deliver several government services. Thus, the strategy to enable private sector-led innovations similarly focuses on developing the local ICT industry by promoting entrepreneurship, and growing the number of local ICT start-ups. Given the nation’s progress in developing a strong business-enabling environment and ICT infrastructure, RDB can now focus on creating platforms that catalyze the human capital and investment financing needed to enable digital innovation.

RDB’s flagship innovation initiative is the Kigali Innovation City (KIC). The KIC initiative aims to bring together a highly connected eco-system of growth-stage local and international technology companies, a special innovation center nurturing a network of early-stage companies, a community of world-class learning institutions, an industry skills academy comprising global technology academies, a professional services cluster, and the Rwandan Innovation Fund (target size of US$ 250 million).

Complementary Agencies

RDB’s ICT department works closely with several other agencies within the Rwandan innovation system. The roles of these institutions evolved significantly during 2016–2017, and entirely new agencies were established during this period.

The Ministry of Youth and ICT (MYICT) assumes policy-making responsibilities and sector leadership, taking ownership for all targets outlined in the SMART Rwanda plan; however, it also leads coordination efforts across several government agencies. The National Commission of Science and Technology (NCST), a think-tank established in May 2016 to advise the government on science, technology, and innovation (STI) policies, legislation, and regulation is also tasked with mobilizing resources for the National Research and Innovation Fund and setting the country’s priorities for STI. A recently established National Industrial Research and Development Agency is in charge of implementing industry development policy, supporting commercialization of technology through patent support and technology incubation centers, and advising the government on national industrial research and development policy.

In January 2017, the Rwandan Information Society Authority (RISA) was born from RDB to coordinate and implement government-centric ICT initiatives and projects across the country. Originally, the ICT department within RDB assumed both the role of government chief information officer (CIO), as well as that of promoting ICT private sector development. The creation of RISA has significantly reduced the staff size of RDB’s ICT department, as well as the scope of its mission. With a leaner team and more specialized role, RDB ICT can now focus more sharply on innovation programs and building its financing platform.

Given Rwanda’s focus on the ICT sector, it is worth noting that these agencies also collaborate closely with the Rwanda Utilities Regulatory Authority (RURA), which regulates the ICT sector among other things, and the National Cyber Security Agency (NCSA).

Several private and non-profit incubators, accelerators, and entrepreneurship programs have moved into Rwanda during the last few years with the aim of cultivating a broader ecosystem of innovation actors. These programs originate from multinational companies and development partners such as international non-governmental organizations. Some highlights include Spring, an accelerator with a specific focus on supporting social enterprises that benefit adolescent girls aged 10–19 across East Africa and South Asia. In addition, Impact Hub hosts networking events for entrepreneurs, helps run a network of accelerators, and provides services to entrepreneurs to help build their capacity, gain access to capital, and develop communities. Inkomoko, the Rwanda-based flagship accelerator of African Entrepreneur Collective, a US-based entity, offers an 8-month package with deep-dive business consultation, mentorship and access to capital. Sector-specific programs include 42Kura (Israel), which provides co-working space for ICT start-ups and incubation services, and Rwanda Media Hub, which is managed by the Institute for War & Peace Reporting and provides seed funding for entrepreneurs operating in the local digital media and media-production space in Rwanda.
Roles, Capabilities, and Organization

Origins and Evolution

Mandate

The National Information and Communication Infrastructure I (NICI) (2001–2005) primarily focused on building institutional and policy infrastructure for future ICT growth. Since then, RDB has worked diligently on policies to enable private sector development and raise Rwanda’s position in the Doing Business rankings, fostering a good business environment. The RDB’s ICT department recently created RISA as a separate agency to focus on policy and supervise the sector.

Sectoral Focus

Rwanda’s strategy to become a knowledge-based, middle-income economy began with developing institutional capacity and technological infrastructure to support a sectoral focus on ICT development, fueled by breakthrough innovations. This process included building capabilities (in both the public and private sectors) and reforming relevant policies targeted toward using technology-enabled innovations to transform various sectors/industries.

The current ICT and innovation strategy, SMART Rwanda, has a vertical focus, whereas NICI I–III were horizontal. SMART Rwanda is far-reaching, assigning tasks and targeted outcomes to the Ministries of Health, Education, Agriculture, Finance, Youth & ICT, Trade & Industry, Infrastructure, Local Government, Gender & Family, Justice, Natural Resources, Defense, Internal Security, the National Cyber Security Agency, and RDB.

Business Model Evolution

In the years after the conflict in 1994, Rwanda had to rebuild the entire foundation of an innovation ecosystem, including all government institutions and agencies, universities and research centers, and communications infrastructure. By the late 1990s, the government had engaged in a national consultation process and had also sought expertise from South Korea, China, Taiwan, Malaysia, Singapore, and Thailand in order to learn from their experiences of rising rapidly from poverty to modest prosperity in a single generation.

The development of the ICT sector began in 2000, when President Kagame launched Vision 2020 which set a broad list of development goals for Rwanda to become a middle-income, knowledge-based economy over 20 years. This broad and ambitious strategy cascaded down into a series of more targeted five-year plans developed by each ministry or sector.

Rwanda has implemented three strategic plans, NICI I, II, and III, between 2000 and 2015, and has embarked on a fourth stage of development for implementation during 2016–2020. NICI I began laying the groundwork by establishing institutional, legal, and regulatory frameworks between 2000 and 2005. NICI II, implemented during 2006–2010, focused on enhancing ICT infrastructure, including a national fiber-optic network. RDB was established in 2008, in order to consolidate the existing government agencies responsible for attracting investment, increasing exports, business registration, privatization, and institutional capacity building across various sectors, including ICT and Tourism. NICI III, implemented during 2011–2015 under RDB ICT’s lead, aimed at improving service delivery, for example by introducing computers in the school system, through the One Laptop per Child (OLPC) program. Finally, operating within the framework of the SMART Rwanda plan, NICI IV (2016–2020) aims to enhance skills, develop the private sector and community, and introduce e-government and cyber-security features.
Thus, the RDB became the institution responsible for attracting foreign investors, encouraging entrepreneurship, and promoting the use of ICT products and services. By 2011, RDB’s ICT department could list several successful programs, implemented in coordination with other partners, including:

- National Backbone Network (2014): 5,000 km of fiber-optic cables connecting 30 districts,
- ICT Bus Project (2009): Mobile cybercafés equipped with computers and internet access in rural areas,
- OLPC (2008): More than 110,000 laptops provided to 150 primary schools, in collaboration with international partners,
- National Data Center (2011): Three-tier data center, first of its kind in the region, powered by a cloud-computing platform to provide hosting, co-location and backup services, and
- 10 gbps broadband capacity.

Given the country’s limited resources, Rwanda has sought out opportunities to partner with international organizations, foreign-owned companies, government donors, and universities to invest in ICT-enabled projects that would deliver government services more efficiently.

### Organizational Structure

#### Organizational and Reporting Structure

The CEO of RDB is a member of the nation’s cabinet and reports directly to the President of Rwanda. The Head of the ICT Business Development Department reports directly to the CEO and works closely with counterparts in each of the relevant public agencies and private sector organizations.

#### Budget Sources and Allocations

A significant portion of RDB’s budget is determined by the national budget. The 2016/2017 national budget of RF 1,950 billion (US$ 2.3 billion), dedicated 27% (over US$ 600 million) to economic transformation. However, RDB ICT’s department budget is partially covered by donor-funded projects and ICT programs are expected to be increasingly funded through private investments in the future.

### Human Resources and Skills

The recent establishment of RISA has significantly reduced RDB ICT department’s staff from nearly 70 employees to only five full-time staff. The restructuring allows the team to focus more closely on improving the local innovation ecosystem and accelerating the growth of local tech start-ups.

### Timeline

#### Major Internal Events

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<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>2007</td>
<td>RDB ICT leads implementation</td>
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<tr>
<td>2008</td>
<td>RITA absorbs into RDB to become its ICT department</td>
</tr>
<tr>
<td>2010</td>
<td>RDB ICT assumes management of NICI II</td>
</tr>
<tr>
<td>2015</td>
<td>RDB ICT leads implementation</td>
</tr>
<tr>
<td>2017</td>
<td>SMART Rwanda (2015–2025)</td>
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- Rwanda IT Authority (RITA) leads implementation
- NICI II (2006–2010): Investment in physical infrastructure leads to first group of ICT-enabled government projects
- RITA leads implementation
- National Backbone Network project begins building 2,300 km of fiber-optic cable to connect all 30 districts
- RDB established by Law no. 53/2008
- RITA absorbs into RDB to become its ICT department
- RDB ICT assumes management of NICI II
- RDB ICT leads implementation
- SMART Rwanda (2015–2025)
- National ICT Steering Committee includes private and public stakeholders to lead implementation and measure progress
- Measurable targets/goals assigned to 14 government ministries and agencies
- RISA spun off from RDB
- National Cyber Security Agency spun off from RDB
Major External Events

1994  Rwandan genocide against the Tutsi
2000  Vision 2020 launched
2006  President Kagame awarded ‘Best Head of State in Africa in support of ICT’
2007  Rwanda hosts Connect Africa conference; partners include International Telecommunications Union, African Union, World Bank Group, GSM Association; attended by the presidents of six African countries
2012  Ministry of Youth and Culture becomes Ministry of Youth and ICT (MYICT)
2016  National Commission of Science and Technology established.

Implementation, Capacity, and Programs

About RDB-ICT programs

Kigali Innovation City Site: RDB ICT is leading the development of the KIC site as a technology park, home to world-class universities, start-up incubation and acceleration programs, local ICT companies, an industry skills academy, a professional services cluster, and the Rwanda Innovation Fund program. The technology park will build on RDB’s experience with the pilot project, ICT Tech Park at Telecom House, which has provided office space to several ICT companies and PPP initiatives since 2007. Current occupants include kLab, an innovation incubator, and Carnegie Mellon University (CMU).

Figure 27. Programs Administered by RDB-ICT
KIC has already been allocated land for development within the Kigali Special Economic Zone (KSEZ); kLab, CMU, and others will relocate there upon completion. Beyond this flagship initiative, the government intends to create innovation hubs across the country in order to transform into a knowledge economy.

To attract foreign technology companies, RDB offers a package of investment incentives in its marketing. These include preferential corporate income-tax rates, income-tax holidays, and exemptions from specific customs taxes, accelerated depreciation, and a VAT refund. But the main draw is the pan-African talent pool accessible to technology companies for “continuous internships” until eventually employed.

A key outcome of the KIC initiative is accelerated growth of human capital. CMU Africa, which has been operating in Rwanda for the last six years will occupy its newly finished campus within the KIC site in early 2018. Other higher learning institutions (for example, African Institute for Mathematical Sciences, African Leadership University, University of Rwanda’s Centre of Excellence for Biomedical Engineering and e-Health) are also currently operating in Kigali on the KIC campuses. The International Centre for Theoretical Physics will continue to reside outside the KIC site, but will otherwise be a key member of the community. The institutions of higher learning will provide an annual supply of high-aptitude pan-African talent comprising 600 engineers, mathematicians, scientists, and business entrepreneurs (150 of each). Employers are likely to take advantage of the co-domiciled industry skills academy to turn their talented employees into world-class professionals able to innovate and produce highly competitive products and to provide the professional services required to deploy these in Africa’s many economies. This talent pool is also expected to contribute significantly to the creation and commercialization of start-ups.

Other outcomes of the KIC initiative include the creation of 250 new technology companies by 2022, graduation from the Rwanda Innovation Fund portfolio of companies of at least ten corporations with a combined market valuation of over US$ 500 million, and an increase in export earnings of at least US$ 180 million by 2025.

Entrepreneurship Support Programs: RDB ICT works diligently to attract and enable entrepreneur support programs to further develop the national innovation ecosystem. kLab is a start-up incubation center, launched and managed in close coordination with the Private Sector Federation’s ICT Chamber. FabLab Rwanda (in collaboration with Massachusetts Institute of Technology) is Africa’s first fabrication lab, providing innovators and designers with access to 3D printers and more.
Delivery Challenges

Institutional Reforms

Since 1999, the ICT and innovation agenda has been championed by the president, and has thus benefited from widespread political support. This agenda, as outlined by the NICI I–III plans, has been primarily led and coordinated by the RDB ICT department, and its predecessor, RITA.

Given the size and limited budget of the country, ICT infrastructure, skills development, and private sector support programs had been coordinated by a limited number of agencies. However, in 2016 and 2017, the government introduced reforms to delegate authority to newly established independent agencies. NCST, the Rwanda Cyber Security Agency, and RISA have all been established in the past two years. This has enabled each agency to focus more closely on a limited mandate.

Budgetary, Capacity, and Political Issues

Given these recent reforms, the RDB ICT development department has been reduced to a limited budget and currently has five full-time staff. It is important to note however, that the government of Rwanda remains heavily dependent on attracting development partners as they fund nearly 37% of the national budget. RDB ICT has been successful in attracting a number of private and non-profit organizations to invest in programs and companies based in Rwanda. In this regard, political support and momentum works in RDB’s favor.

Figure 29. Assessment Results of Rwanda’s National ICT Maturity level

Prerequisite and foundation for national ICT (network, resource consolidation, ICT capability, executive organisation, etc) are still at the Initial stages. ICT readiness of agriculture, finance, energy and SOC is still immature.

Source: SMART Rwanda 2020 Master Plan
Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations

Rwanda has diagnosed its overall ICT maturity level according to a methodology developed in collaboration with the World Economic Forum, Gartner (a US-based information technology consulting firm), and the Republic of Korea. As of 2015, Rwanda was at 2–3 on a 5-point scale, indicating continued room for growth in ICT infrastructure, service, ICT capabilities and governance.

Evaluation Methodologies

Each of the past NICI plans implemented by RDB has included a long list of time measurable goals and targets. Evaluation methodologies are at the discretion of the implementing agencies.

Parties Responsible for Monitoring and Evaluation

Although the government does not seem to publish its own analytical assessments of RDB’s performance, several development partners have made positive assessments of its ICT development programs, including the World Bank. In 2013, an infoDev report on Rwanda’s ICT transformation noted, “There is hardly a stronger example of policymakers’ determination to turn a country into a regional and worldwide ICT hub than the Rwandan case. “The current SMART Rwanda Plan calls for the establishment of a National ICT Steering Committee which will include both private sector stakeholders and public officials. The steering committee will be charged with leading implementation and analyzing the government’s progress on its stated agendas.

Impact Evaluations

Evidence of Results

Given the nascent stage of Rwanda’s private sector innovation ecosystem, there have been no detailed analyses of its progress. RDB ICT has only recently streamlined its resources to focus more closely on the national innovation agenda and launched plans for the Kigali Innovation Center in 2016. Nevertheless, RDB has contributed to a number of specific innovations that contribute to building the innovation ecosystem and raise awareness of the ICT sector. During 2005–2015, the economy-wide ICT focus quickly spread across government to various ministries and sectors. In this period, several new programs were introduced with an ICT-enabled component to its public-service delivery model, which further accelerated technology adoption across other economic sectors. Examples of such RDB projects include:

- **Health care:**
  - TRACnet: A collaboration with Voixiva, an American for-profit company, has enabled health care workers to share HIV/AIDS patient information and monitor drug supplies since 2016;
  - OpenMRS: Set up in 2006, the adoption of this electronic medical record storage and retrieval system allows for treating millions of HIV/AIDS and tuberculosis patients in the developing world;
  - Zipline: In 2016, the Silicon Valley start-up began delivering blood to remote hospitals. Raised $US 19 million from Sequoia Capital.

- **Agriculture:**
  - eSoko: Launched in 2010, eSoko provides farmers and agents market prices for crops on their mobile phones through a World Bank project.

- **Telecommunications and infrastructure:**
  - 4G LTE: Established in 2013 in partnership with Korean Telecom, the government of Rwanda has rolled out a nationwide high-speed 4G LTE network expected to cover 95% of the population by December 2017;
  - National Backbone Network;
  - National Data Center.

- **Government e-services:**
  - iRembo: Launched in 2015, an online platform to access a broad range of government services through a 25-year PPP agreement with local start-up, RwandaOnline;

- **Education:**
  - One Laptop per Child (OLPC);
  - ICT Bus Project;
  - Positivo BGH: In 2015, the Brazilian and Argentinian joint venture began building the first 'Made in Rwanda' laptops. RDB has a contract for 150 laptops per year.
3.12. Technology Innovation Agency (TIA) in South Africa

Overview

The Technology Innovation Agency (TIA) enables and supports technological innovation across the economy to deliver socio-economic benefits for South Africa and enhance its global competitiveness. It supports development and commercialization research from higher education institutions, science councils, and industry.

Key Takeaways

TIA is a young agency that supports innovation, ecosystem development, and commercialization of technologies to drive economic diversification and competitiveness, while being rooted in inclusive development and the socio-economic welfare of South Africa.

TIA has deployed innovative ways to gain buy-in and raise awareness for its role in the ecosystem. Through the “Parliament Connect” program, Parliamentarians learn about TIA’s achievements and role and understand its importance.

TIA has established partnerships to promote collaborative innovation programs and capacity-building initiatives that support the Department of Science and Technology’s (DST) priorities, within Africa and globally.

Role in the Country’s National Innovation System

TIA was established in 2009 through the Technology Innovation Act (Act 26 of 2008) “to support the state in stimulating and intensifying technological innovation” in order to improve economic growth and the quality of life in South Africa. The agency primarily supports the progression of ideas across the innovation value chain through “gap” funding for technology development and pre-commercialization to projects with high social and economic impact. Typically, these are projects are that unable to attract commercial funding and market uptake due to the high-risk nature of early-stage technology development. In addition to funding, TIA has established innovation enabling and support programs for the development of successful start-ups and technology enterprises.

In executing its mandate, TIA is positioned to play four strategic roles:

- **Connector**: Catalyzes partnerships between SMMEs, industries, universities, and science councils to develop an environment that enables sector-specific innovations, thereby increasing global competitiveness;
- **Funder**: Provides risk funding and support for innovators to progress ideas towards market entry and commercialization;
- **Facilitator**: Attracts and facilitates access to late-stage funding from companies, venture capital firms, and development finance institutions for the commercialization of market-ready technologies;
- **Enabler**: Improves access to expensive high-end skills and equipment for innovators through technology stations and platforms.
Complementary Agencies

The government has set up a number of institutions, programs, and funding instruments to develop and support the country's capacity for innovation. Upstream are research-oriented institutions: 23 universities and 10 science councils, complemented by a number of Technology Transfer Offices (TTOs) whose primary role is to identify, evaluate, and exploit intellectual property (IP). In 2010, the DST also established the National Intellectual Property Management Office as a dedicated mechanism supporting TTOs to identify, disclose, protect, manage, and commercialize IP from publicly funded research.

The government has also established a number of complementary funds to support innovation and commercialization of new technologies. The Technology and Human Resources for Industry Program enables South African industry to access skills, expertise, and infrastructure from the higher education sector to develop innovative solutions to industry-specific needs. In addition to technology development, it aims to enhance the quality and quantity of skilled labor available for local industries. The Support Program for Industrial Innovation aims to promote and assist technology development in local industries by providing financial assistance for projects that develop innovative products and/or processes. Third, the Industrial Development Corporation manages a number of sector-specific funding programs, including the Technology Venture Capital Fund, which directly funds the commercialization of projects that have passed the technology-development stage.

Downstream, a dynamic and well-endowed enterprise development ecosystem contains many government and private-sector incubators and innovation centers to support the establishment of viable technology enterprises. Key among these is the Small Enterprise Development Agency's (SEDA) Technology Program that has established a network of 44 incubators nation-wide. The SEDA reports to the newly established Department of Small Business Enterprise.

Roles, Capabilities, and Organization

Origins and Evolution

Mandate

TIA is a public entity set up to enhance the country's capacity to translate a greater proportion of local R&D into commercial technology products and services. It was tasked with exploiting the existing body of knowledge at universities and public research institutions and channeling it effectively towards the development of technology-based industries. To meet its mandate, the agency was to provide financial and non-financial support across technology areas in various sectors of the economy via:

- Appropriately structured financial and non-financial interventions for the commercialization of R&D;
- Development and maintenance of advanced human capacity for innovation as opposed to merely R&D-oriented human capital;
- Development of a culture of innovation in the South African economy; and
- Local and international partnerships to facilitate inbound technology transfer, build local technological competencies, and encourage foreign direct investment aimed at commercializing technologies in South Africa.

Sectoral Focus

TIA's innovation funding and support programs are designed and applied as horizontal interventions to stimulate innovation and support the commercialization of output from the research sector, industry, SMMEs, and communities across all sectors of the economy. TIA is aligned to key DST strategies, such as the Ten-Year Innovation Plan, the National Research and Development Strategy, the Bio-Economy Strategy, and national priorities as articulated in the National Development Plan.
Through the Innovation Funding and Pre-commercialization (IFPC) division, TIA supports various sectors, including advanced manufacturing; agriculture; energy; health; information, communication and technology (ICT); and natural resources. The focus on these areas was informed by the historical portfolio of investments inherited by TIA.

**Business Model Evolution**

TIA’s establishment was prompted by the Review of Innovation Policy: South Africa, a report by the Organisation for Economic Co-operation and Development, which pointed to a gap between South Africa’s research activity and the development of marketable products and services. This chasm arose out of a fragmented ecosystem, lack of funding dedicated to high-risk innovation, and a poor culture of innovation.

TIA was established through a merger of seven pre-existing entities originally established by the DST to promote commercialization of technologies. Four were biotechnology regional innovation centers, while the rest were positioned to support technology development and commercialization in the industrial sectors. These were Tshumisano, Innovation Fund, and the Advanced Manufacturing Technology Strategy.

TIA has evolved significantly since its establishment in 2009. During 2009 to 2012, TIA focused primarily on consolidating investments and defining new approaches and instruments to execute its mandate. During the early years, TIA’s funds emphasized financial sustainability with a return on investment based on financial returns and equity as the main instrument. This approach negatively impacted TIA’s risk appetite, limiting funding to projects at higher technology readiness levels (TRLs), to the exclusion of the target client-base at research institutions, whose projects were at much earlier stages. For a long time during this period, TIA suffered from a low pipeline of investment opportunities, with consequent under-spending in successive years.

In 2013, the Minister of Science and Technology initiated an institutional review of TIA to assess its fitness for purpose and define its role in the national innovation system. The report encouraged TIA to “seek out and find innovative ideas from all sources in the innovation ecosystem”, both public and private. The report further clarified that TIA’s primary focus in the immediate term should be on the early stages of the innovation value chain where there currently is a paucity of support instruments. In response to the institutional review, TIA revamped its funding instruments and service offering via three measures:

- The main TIA fund, the Technology Development Fund, was reformulated to introduce a soft-loan element and convert the equity instrument into a royalty-grant that emphasizes socio-economic rather than financial return on investment.
- TIA established the Seed Fund for Higher Education Institutions (HEI-Seed Fund), in partnership with Offices of Technology Transfer, as a funding instrument to increase the readiness of applications at TRL 3 from researchers based at universities. The HEI-Seed Fund supports prototype development, primary market research, business plan preparation, and so on. In addition to this, the fund was extended to SMMEs, providing similar support in partnership with regional development agencies and selected partner incubators across the country.
- TIA established the Pre-commercialization Support Fund to increase the attractiveness of funded technologies, the uptake of TIA in the market, and access to follow-on funders such as development finance institutions and venture capital (VC) funders with an eye to scaling up.

These changes brought projects from universities into TIA’s pipeline and demonstrated a high success rate in applications. Since the establishment of the HEI-Seed Fund, there has been a significant increase in successful applications to TIA’s main funds. TIA continues to work closely with TTOs and other network formations such as the South African Technology Network and the Southern African Research and Innovation Management Association to strengthen the ecosystem’s productive capacity in this regard.

From 2015 onwards, with the appointment of the current chief executive officer (CEO), Mr Barlow Manilal, TIA has adopted a more robust and comprehensive strategy, centered around three high performance drivers: T for Teamwork; I for Impact; and A for Accountability.

**Organizational Structure**

**Organizational and Reporting Structure**

TIA was established through an Act of Parliament (TIA Act 26 of 2008), and is governed by a board that reports to the DST. The board is appointed by the minister, and serves for a period of five years. TIA is fully funded by government through an annual funding allocation from the national treasury. Whilst it enjoys some measure of autonomy in setting its funding priorities, its strategy is approved by the Minister of Science & Technology and is generally required to align with the Department’s strategy and other government policies. On a five-yearly basis, the board is required to enter a shareholders’ compact with the minister.
TIA organizational structure consists of five divisions: the CEO’s office; People, Systems, Facilities & Knowledge Management; Finance and Supply Chain Management; Innovation Funding and Pre-commercialization (IFPC); and Innovation Enabling & Support.

CEO’s Office: In addition to the primary organizational leadership responsibilities of the CEO, the CEO’s Office also includes functional business units such as PRIME (planning, reporting, business intelligence, monitoring and evaluation), legal services, corporate relations and strategic engagements; and investment and internal audit.

People, Systems and Facilities and Knowledge Management is responsible for creating an enabling environment for the development of a high-performance culture by nurturing and growing human resource capacity, maintaining IT platforms, and building TIA’s knowledge management architecture to preserve and manage TIA’s intellectual assets.

Finance and Supply Chain Management is responsible for budget planning and compliance, organizing and managing financial resources, facilitating internal and external audits, reporting on the usage of financial resources, forecasting based on spending patterns, and asset management.

IFPC is responsible for managing TIA’s main funds to support technology development and commercialization. It interacts mainly with clients in the higher education sector, science councils, and industry.

Innovation Enabling and Support (IES) is responsible for various programs and interventions that aim to build a productive ecosystem through stimulating a culture of innovation; facilitating access to high-end infrastructure and expertise for technology innovation; lowering the barriers for others to participate in technology innovation; and strengthening and enhancing business and innovation skills amongst SMMEs.

Budget Sources and Allocations
TIA receives its funding allocations from the Treasury through the DST on an annual basis. However, the annual allocation is generally part of the Medium-Term Expenditure Framework (MTEF) set by the National Treasury. The MTEF is a five-year horizon budgeting framework. Table 15 below shows the funding levels for the financial years from 2010/11 to 2015/16. Over and above the allocations from the treasury, TIA continues to receive royalty payments and equity from its historical investments, generally described as additional income. The DST, in a move to focus its activities primarily on policy, transfers specific programs to TIA under agreed contractual terms for implementation.

Growing budgetary constraints and the resultant tightening of the treasury require that TIA sources additional funding through partnerships with industry, institutional funders, other government departments, and international funding sources. As part of its new strategic outlook, TIA has now started to implement the hub and spoke model, which positions the agency as a service provider to various partners in government and industry in managing innovation programs. Through this contract-funding approach, the agency avails its institutional capabilities, support programs, and expertise in fund management, technology assessment, project management and Monitoring and Evaluation, to manage programs on behalf of other partners.

Human Resources and Skills
TIA has 165 employees with a variety of skills in science, technology, engineering, and finance. This number was reduced substantially from 220, following the organizational re-design that took place in 2014. The staff includes the technical experts assigned to the various technology platforms, but does not include 85 employees at the 18 technology stations country-wide. Many of TIA’s

<table>
<thead>
<tr>
<th>Table 15. Income (R 1,000)</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Total Revenue</td>
</tr>
<tr>
<td>Parliamentary grant</td>
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<tr>
<td>Specific contracted income</td>
</tr>
<tr>
<td>Other income</td>
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</table>

Source: TIA
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<th>Source: TIA</th>
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**Table 16. Allocation of Funds by Program**

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<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Allocation letter</td>
<td>204,447</td>
<td>156,048</td>
<td>36,237</td>
</tr>
<tr>
<td>Utilised</td>
<td>287,473</td>
<td>156,048</td>
<td>105,000</td>
</tr>
<tr>
<td>Administration</td>
<td>159,049</td>
<td>7,802</td>
<td>166,910</td>
</tr>
<tr>
<td>Support and infrastructure cost</td>
<td>61,172</td>
<td>780</td>
<td>64,222</td>
</tr>
<tr>
<td>Human resources</td>
<td>97,877</td>
<td>7,022</td>
<td>102,688</td>
</tr>
<tr>
<td>Innovation Funding and Pre-Commercialisation and Support (IFPCS)</td>
<td>101,220</td>
<td>52,549</td>
<td>106,837</td>
</tr>
<tr>
<td>Innovation Enabling and Support (IES)</td>
<td>27,204</td>
<td>85,697</td>
<td>105,000</td>
</tr>
<tr>
<td>Technology Platforms Programme (TPP)</td>
<td>56,401</td>
<td>60,270</td>
<td>65,502</td>
</tr>
<tr>
<td>Technology Stations Programme (TSP)</td>
<td>105,000</td>
<td>105,000</td>
<td></td>
</tr>
<tr>
<td>Incubation Support Programme (ISD)</td>
<td>4,000</td>
<td>7,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Youth Technology Innovation Programme (YTIP)</td>
<td>2,000</td>
<td>3,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Technology Innovation Programs (TIPS)</td>
<td>9,204</td>
<td>4,296</td>
<td>9,180</td>
</tr>
<tr>
<td>Seed fund</td>
<td>10,000</td>
<td>15,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Thought leadership</td>
<td>2,000</td>
<td>9,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Consortium based funding</td>
<td>10,000</td>
<td>8,732</td>
<td>9,605</td>
</tr>
<tr>
<td>Overutilisation</td>
<td>(82,026)</td>
<td>(68,763)</td>
<td>(91,622)</td>
</tr>
</tbody>
</table>

*Source: TIA*
staff are experts in their fields, recruited from industry and research institutions. They are not considered as civil servants as their employment conditions are not regulated under public service laws and regulations but through policies approved by the TIA's board.

Institutional Networks

TIA benefits from linkages and networks with institutional partners spanning the innovation value chain. The agency maintains a strong national network of 20 technology stations that provide support to SMMEs and eight technology platforms offering support to researchers and SMMEs in the bioscience sectors. In addition, TIA collaborates with 20 TTOs at universities and science councils, the regional development agencies of nine provinces, and the network of 44 incubators managed by SEDA.

Timeline

Major Internal Events

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>TIA Act</td>
</tr>
<tr>
<td>2009</td>
<td>TIA established</td>
</tr>
<tr>
<td>2012</td>
<td>Youth Technology Innovation Fund established to support young innovators</td>
</tr>
<tr>
<td>2013</td>
<td>Seed Fund established to support researchers from universities</td>
</tr>
<tr>
<td>2013</td>
<td>TIA's institutional review held</td>
</tr>
<tr>
<td>2014</td>
<td>Organizational restructuring process completed and new divisions established</td>
</tr>
<tr>
<td>2014</td>
<td>Redesign of funding instruments</td>
</tr>
<tr>
<td>2016</td>
<td>Launch of the hub and spoke model and focus on innovation for inclusive development</td>
</tr>
</tbody>
</table>

Major External Events

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>Dismantling of apartheid begins</td>
</tr>
<tr>
<td>1991-1993</td>
<td>Decline in R&amp;D expenditure as international isolation drove military-industrial expenditures</td>
</tr>
<tr>
<td>1994</td>
<td>First post-apartheid elections held</td>
</tr>
<tr>
<td>1996</td>
<td>White Paper on Science and Technology (DACST, 1996) stating the new government’s priorities</td>
</tr>
<tr>
<td>2002</td>
<td>National Strategy for Research and Development launched, aiming to increase government investment in science and technology</td>
</tr>
<tr>
<td>2004</td>
<td>Separate ministry created for science and technology</td>
</tr>
<tr>
<td>2004</td>
<td>DST becomes an independent department</td>
</tr>
<tr>
<td>2004</td>
<td>Establishment of SEDA to support entrepreneurs and businesses</td>
</tr>
</tbody>
</table>

Implementation, Capacity, and Programs

About TIA programs

Risk Funding Instruments

Seed Fund: With grant funding up to R 650 000 (approximately US$ 55,000) per project available for proof of concept and other market validation activities, this fund aims to assist researchers from higher education institutions, science councils, technology entrepreneurs, and SMMEs to advance their research outputs and ideas for proof of concept, development of prototypes, and business cases that could be used for further development.

Technology Development Fund: This fund offers royalty-grants and soft loans for prototyping and piloting activities to assist innovators in advancing technologies along the innovation value chain, from proof of concept to technology demonstration.

Commercialization Support Fund: This aims to prepare innovators for follow-on funding, through limited support for market testing and validation. In this instance, TIA’s role is to connect technology innovators to onward business and investment opportunities.

Innovation Enabling and Support Programs

Technology Innovation Programs: TIA provides technology development support funding to catalyze relationships and increase a sector’s capacity to develop effective technology solutions. These are collaborative initiatives.
for entrepreneurs, companies, suppliers, manufacturers, and research institutions along the value chain within a particular industry.

Technology Stations Program: TIA provides financial support to 18 technology stations at various Universities of Technology throughout South Africa. Each of these offers a range of technical services in engineering to SMMEs and private sector companies, covering technology solutions, services, and training. The stations provide access to technical experts and state-of-the-art equipment for industry and entrepreneurs.

Technology Platforms Program: TIA has eight Technology Platforms throughout South Africa, providing technical services to researchers in the bio-science disciplines, SMMEs, and private companies. These aim to reduce barriers for public and private users to engage in technology innovation.

Innovation Skills Development Program (ISD): The program is set up to foster a culture of innovation thinking by strengthening entrepreneurial capacity of researchers and innovators. ISD also provides capacity building for TTOs and other innovation intermediaries.

Youth Technology Innovation Program (YTIP): Through redeemable vouchers to support prototype development and access to incubators, YTIP promotes a culture of technology innovation and entrepreneurship among young South Africans between the ages of 18 and 30. It enables youth to develop new technologies that can solve market and societal challenges, through mentorship and business support services, and prepares young entrepreneurs to access other TIA funds and programs.

Programs with International Partners

Global Cleantech Innovation Program (GCIP): This program organizes business acceleration and business plan competitions, with the final competition held at the Global Cleantech in Silicon Valley. In partnership with United Nations Industrial Development Organization, GCIP promotes SMMEs with technology solutions to the greatest energy, environmental, and economic challenges in South Africa. These include energy efficiency, renewable energy, water efficiency, and other areas of national relevance.

Southern African Innovation Support Program: A program with the Ministry of Foreign Affairs of Finland, which improves national innovation systems and enhances innovation cooperation across five partner countries in the Southern Africa Development Community (SADC) Region.

Programs managed on behalf of the DST

Innovation for Inclusive Development Program: A newly established social innovation program in TIA recently transferred from the DST to promote and fund grassroots innovation, innovation for local economic development and service delivery innovations from rural and township communities.

Living Labs Program: TIA is in the process of establishing a Fund to support the establishment of Living Labs and to upscale existing as co-working and co-creation centers with end-user communities that develop ICT solutions for economic development in the poorer parts of the country.

Figure 30. Programs Administered by TIA

<table>
<thead>
<tr>
<th>Direct Financial Support</th>
<th>Non-financial Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan guarantees and reduced interest rates</td>
<td>Infrastructure</td>
</tr>
<tr>
<td>Technology Development Fund</td>
<td>• Global Cleantech Program.</td>
</tr>
<tr>
<td>Pre-commercialization Support Fund</td>
<td>• Technology stations: engineering support</td>
</tr>
<tr>
<td>Vouchers</td>
<td>• Technology platform programs</td>
</tr>
<tr>
<td>Youth Technology Innovation (YTIP)</td>
<td>• Innovation skills development</td>
</tr>
<tr>
<td>Grants</td>
<td>Advisory, extension, and training services</td>
</tr>
<tr>
<td>Seed Fund</td>
<td>• Technology stations</td>
</tr>
<tr>
<td></td>
<td>• Technology platforms</td>
</tr>
<tr>
<td></td>
<td>Collaborative networks and policies</td>
</tr>
<tr>
<td></td>
<td>• Technology innovation programs</td>
</tr>
<tr>
<td></td>
<td>Information and advocacy</td>
</tr>
<tr>
<td></td>
<td>• Innovation skills development</td>
</tr>
<tr>
<td></td>
<td>• YTIP</td>
</tr>
</tbody>
</table>
Selection of Projects

TIA has well-documented funding rules, selection criteria, and application and approval processes that are publicly available through its website. The agency is working toward ISO certification of all its processes and systems. All applications for funding are currently evaluated internally by TIA staff through dedicated investment assessment committees and approved either by the executive committee, the board or the minister, in line with the various delegations of authority.

Delivery Challenges

Institutional Reforms

At the upstream end of the innovation value chain, TIA has found it challenging to attract the right set of early-stage technology innovations from universities, as many of these lacked the capacity to develop bankable proposals for funding by TIA through its main funds (geared for technologies at TRLs 4–8). The Seed Fund was thus established as a bridging fund mechanism to improve the bankability of proposals, though support for business plan, prototype development, and primary market surveys.

The ecosystem continues to be plagued by a number of challenges, including the lack of transformation in the racial, age, and gender composition; fragmentation amongst various innovation initiatives and instruments; and weak participation by industry. The poor participation of previously disadvantaged individuals and institutions in the innovation ecosystem is accounted for largely by the residual legacies from discriminatory policies of apartheid. This continues to be a main challenge that also negatively affects TIA’s ability to deliver effectively on its mandate in an equitable manner. The DST has thus set key performance indicators for each of its entities, including TIA, to directly incorporate in their programs, including specific targets to address the challenges of transformation in their annual plans.

At the downstream end of the value chain, few early-stage technologies have succeeded in commercializing either through licensing, technology transfer to industry or spin-out companies. This is largely explained by the over-emphasis on TRLs as a primary measure to assess opportunities. Consequently, TIA has recently introduced market and business readiness levels as additional measurement dimensions to assess applications. This approach is also underpinned by appropriate support interventions: an augmented Pre-commercialization Support Fund, and entrepreneurship development services offered through the Innovation Skills Development Program.
Budgetary, Capacity, Political Issues

From 2011 to 2016, TIA, like many other institutions across the national system of innovation, has experienced decreasing grant allocations from the fiscus, largely due to general successive budget cuts across government. Nevertheless, TIA has enjoyed broad political support in Parliament and generally across government, due to the concerted efforts of the successive Ministers of Science and Technology who have ardently advocated for science, technology and innovation to be centrally located as key instrument in South Africa’s economic development policy mix and drive towards a knowledge economy.

Over the last few years, the DST has implemented several initiatives to encourage business sector investment R&D. These include, inter alia;

• Implementing the R&D Tax Incentive Scheme that enables companies to claim a rebate of up to 150% of R&D related costs and an accelerated capital equipment depreciation regime.

• Establishing the Sector Innovation Fund as a co-funding mechanism with industry associations and bodies.

• Partnering with selected local corporations and multinational companies such as General Electric, CISCO, and IBM to promote industry-led innovation initiatives.

Recently the DST has approved a framework for science and technology cooperation that aims to guide the prioritization of the science and technology cooperation with other government departments in line with its Strategic Plan 2015–2020.

TIA’s “Parliament Connect” program is an initiative to promote and showcase its achievements to Parliamentarians. In a recent visit to TIA-funded projects, the Chairperson of the Committee on Science and Technology, Ms Lindiwe Maseko, said: “When TIA comes to Parliament to report, we hear theory. Today we are happy at what we have seen, in fact we are impressed. Innovation is the core of development, job creation and entrepreneurship. These young scientists are not only putting our country on the map, but they are growing our economy.”

Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations

Program evaluations are systematic assessments of TIA’s respective programs (or projects); they determine its alignment to specific policies, and the design, implementation, efficiency, and effectiveness of activities undertaken. More importantly, it is a measure through which outcomes and impacts are determined in relation to government-spending priorities and the use of public resources.

Evaluation is time-bound and done periodically. It is linked to the respective reporting cycles (of both the Medium Term Strategic Framework and MTEF). The process measures relevance and alignment with national policies and development plans, and identifies cross-cutting issues with the aim of improving effectiveness and productivity.

In 2016 and 2017, program evaluations have been conducted for the Technology Innovation, Innovation Skills Development, and Seed Fund Programs. The findings from these have been used to effect improvements and redesign the program to improve their effectiveness and fitness for purpose. Since its establishment in 2009, TIA has undertaken two formal customer satisfaction surveys, in 2012 and 2016 respectively, and has institutionalized this as an annual process. These surveys provide valuable insight on the effectiveness of the agency’s offerings, service level efficiency, and the design of new interventions. The last survey revealed a satisfaction level of 5.7 out of 10, occasioned largely by clients who have been denied funding. The study further found that this rating is also accounted for by those who secured funding but have experienced poor level of service due to inconsistent communication. In response to these findings, TIA has begun implementing several initiatives, including:

(a) Improved turn-around times for applications, with time-commitments for each step of the approval process,

(b) Establishment of a rapid funding instrument,

(c) Establishment of an independent dispute-resolution and appeals process, and

(d) An IT-enabled Customer Journey Mapping functioning as a key tracking mechanism and assessment of customer experience.
Evaluation Methodologies

TIA evaluates its performance at the level of projects, innovation enabling programs, and funding instruments. Project reviews typically assess the extent to which TIA funding and support have successfully grown the innovation through the various TRLs and contributed to successful commercialization, skills development, and job creation. Program and funding reviews measure the uptake and identify the challenges faced by clients in accessing the offerings, as well as their impacts and outcomes. The DST has established a five-yearly institutional review process that evaluates the fitness for purpose of all its reporting entities, including TIA.

Parties Responsible for Monitoring and Evaluation

Internally, TIA has established the PRIME Unit as a dedicated department in the CEO’s office that is responsible for planning, risk management, business intelligence, monitoring, and evaluation. In addition to PRIME, the Investment and Internal Audit Unit, reporting to the Audit & Risk Committee of the TIA Board plays an important role in the Monitoring and Evaluation (M&E) process. This unit performs several key functions relating to M&E, including providing an independent objective view on the acceptability of any evidence received by M&E for reporting purposes.

Externally, in 2004, Cabinet initiated plans for a monitoring and evaluation system for the government. The Presidency, through the Department of Planning, Monitoring and Evaluation, subsequently developed the Policy Framework for the Government-wide Monitoring and Evaluation System. The DST also undertakes institutional reviews on a five-yearly basis of all institutions that fall under its mandate. For its own programs, TIA commissions independent evaluations conducted by external consulting companies appointed through a competitive tender process.

Impact Evaluations

Evidence of Results

In the budget year 2016/17 TIA instituted an independent socio-economic impact assessment of the previous six years. The impact modelling exercise was conducted using the national Social Accounting Matrix (SAM). The agency’s programs were analyzed in the assessment and the results revealed that the agency’s financial performance, and therefore its impact, could be at a higher level.

The implications of the study reveal that for the TIA to realize its mandate, it would have to strengthen its IES program, as this derived the most impact for the period under review. This would mean that further similar studies would have to be undertaken at a sub-program level in assessing the adequacy, scope, and structure of the instruments in addressing the needs of the targeted beneficiaries.

TIA would also have to reassess the funding instruments within the IFPCS program to take into account the need for rapid access to funding for technology development by innovators and for bridging the finance gap for small-scale technology piloting in assisting SMMEs to commercialize their technologies.

Undertaking these activities would improve TIA’s service offerings and enable the agency to be relevant and responsive to the evolving needs of the NSI.
3.13. Technology Development Foundation of Turkey (TTGV)

Overview

TTGV was established in 1991 to operate the first public-funded program to promote and actively support R&D, technology development, and innovation activities by private enterprise in Turkey. Its establishment was led by the Turkish Treasury and The Scientific and Technological Research Council of Turkey (TÜBİTAK). It has positioned itself as a future-oriented organization with a unique model for program implementation. TTGV designs and operates impact models to address gaps between resources, capabilities, and opportunities to enable technology-driven innovation. Some models developed and operated by TTGV have been adopted nationally and internationally. It maintains a diverse portfolio of tools covering broad aspects of innovation: strategic, intellectual, financial, and social.

Key Takeaways

As an autonomous entity with a strong public mandate, TTGV brings together different parts of the innovation ecosystem, bridging the gap between the government, private sector, and academia.

With its “non-profit program implementing agency” model, TTGV is the only foundation in Turkey operating in the technology development and innovation fields. It provides an element of trust and stability in the ecosystem, and is considered a key partner for stimulating innovation, which allows it to deliver beyond its own means and resources.

TTGV has adopted a lean structure to experimentation, evaluation, and redesign, hence demonstrating program impact for other public and private organizations.

In its 28-year-long history, TTGV has undertaken vast changes to its own business model. Beginning as an implementer of public programs, TTGV has built on its own experience and knowledge base and learned to find funding from new sources and develop interventions outside public programs, targeting gaps in the technology and innovation ecosystem in Turkey.

Role in the Country’s National Innovation System

TTGV was created to operate a public program supporting private sector technology-development projects, occupying a unique space in Turkey’s innovation ecosystem. As a not-for-profit private entity with a public mandate, TTGV can moderate stakeholder dialogue for technology and innovation policy-making in Turkey. It is also attempts to add dynamism to the innovation system, which is otherwise subject to slow decision-making and implementation by public agencies. Recently, TTGV’s role as a program agency has grown less significant as program implementation is increasingly consolidated under TÜBİTAK.

TTGV offers an important platform for innovation discourse and linkages in Turkey and abroad, where different stakeholders come together to discuss and develop new policy and program ideas. TTGV’s board, with its public-private composition, is one of the spaces for such dialogue.
TTGV also promotes linkages to international networks of practice, foremost through its membership with the European Network of Innovation Agencies (TAFTIE).

Programs initially designed and piloted by TTGV have inspired other national plans by various public institutions, a number of which have been scaled. One example is the support provided for Phaseout of Ozone-Depleting Substances (PODS), which enabled TTGV to attract funds through the Montreal Protocol plan. This model was later adopted in other countries and eventually received a global award. In addition, a model for commercialization support to SMEs through small grants was piloted by TTGV and later adopted by The Small and Medium Enterprises Development Organization (KOSGEB) as a national program. Similarly, the Industrial Symbiosis project undertaken with private funding was later adopted by various regional development agencies.

A key asset of TTGV is its reputation as an operational organization, which lends credibility in setting the policy agenda. Its role as an institutions incubator places the agency favorably for influencing innovation policy. TTGV’s institutional experience in soft-loan and equity programs has positioned it as a capable and private-sector minded implementer of public funds, providing policy makers with a reliable partner for “arm’s-length” program implementation.

Complementary Agencies

TTGV was established in 1991 to manage public funds to promote and support R&D, technology development, and innovation activities by the private sector in Turkey. KOSGEB was established in the same year to support the development of small and medium enterprises (SMEs) in Turkey and introduced its own direct funding programs. KOSGEB’s programs include technology development support in the form of loans and grants. In 1995, TÜBİTAK established its own program agency, TEYDEB, which currently has the largest budget among public programs. It exclusively provides grants to projects by entrepreneurs, SMEs, and large companies, as well as industrial R&D projects. Regional development agencies established from 2006 onwards also provide project and infrastructure support to local companies through grants.

The Ministry of Science, Industry, and Technology (MSIT) is the major umbrella ministry for private sector R&D, technology development, innovation policy, and program implementation. The Turkish Patent Institute, Turkish Standards Institution, Turkish Accreditation Agency (TURKAK), KOSGEB, TÜBİTAK, and The Turkish Academy of Sciences all function as attached and affiliated institutions of MSIT. The ministry also operates its own direct and indirect funding programs supporting private sector R&D. The Ministry of Development provides direct funding to university research infrastructure and research centers. Many other ministries, such as the Ministry of Health, the Ministry of Communication and Transportation, and the Ministry of Energy operate their own support programs. These ministries are in the process of gradually transferring program operations to TÜBİTAK, though funding for TEYDEB continues to be earmarked from ministry budgets.

Roles, Capabilities, and Organization

Origins and Evolution

Mandate

TTGV’s original mandate was to implement a public program to support technology development projects in the private sector. Over time, TTGV introduced other programs to support the development of different aspects of the innovation and technology ecosystems. Although it does not have a direct role in developing innovation policy, TTGV, through its reputation, experience, and information platform role, informs policy making.

Sectoral Focus

In general, TTGV has not had a focus on any particular sector. However, as system capacity developed, a strong preference emerged for projects taking an

Country Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
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<tbody>
<tr>
<td>GDP, PPP</td>
<td>US$ 2.1 trillion (2017)</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>US$ 10,546 (2017)</td>
</tr>
<tr>
<td>Gross Expenditures on R&amp;D (GERD)</td>
<td>0.9% of GDP (UNESCO, 2015)</td>
</tr>
<tr>
<td>Public R&amp;D spending</td>
<td>27.56% of GERD (UNESCO, 2015)</td>
</tr>
<tr>
<td>Business R&amp;D spending</td>
<td>50.10% of GERD (UNESCO, 2015)</td>
</tr>
<tr>
<td>World Economic Forum (WEF) competitiveness rank</td>
<td>53/137 (2017-18)</td>
</tr>
</tbody>
</table>
original approach to technology development and with demonstration potential. Since 2010, additional criteria screened projects based on their impact on common problems and challenges, technology content, and alignment with stated policy priorities. As TTGV continues to detach itself from public funding, it has been strengthening verticals in areas where it can create higher value with its own resources. The business model is shifting toward generating greater income from direct investments, which requires deep sectoral knowledge. New focus areas will be outside the sectors where Turkey already has strong industrial and capital assets, such as automotive, electronics, and defense. Diversifying into new ‘flexible’ funding sources will require demonstration of the impact of technology on more visible areas, such as health, education, environment, and agriculture.

TTGV has started developing thematic accelerator modules, with health technologies being the most recent theme introduced in 2017. The modular design will help ensure optimal integration with existing programs and provide add-on features to the thriving accelerator and incubator market in Turkey. A pilot is being conducted in cooperation with Istanbul Technical University in the form of the “Big Bang Business Plan Competition” for health technologies. This pilot represents the first of three successive and complementary modules, with Module 1 being the Business Plan Competition. Module 2 is a more focused professional market-entry development program which involves a US$ 50,000 voucher to purchase special services and consultancy (designed and operated by TTGV). Finally, Module 3 is a co-investment plan offered alongside potential credible market investors in one of the larger university accelerator programs. The next thematic module will likely be focused on agriculture.

Business Model Evolution

TTGV’s business model has been shaped by its funding situation, and strengthened by its own learning and interaction with the ecosystem during its 28 years of existence. TTGV was started by TÜBİTAK’s chairman personally in 1991, responding to the government’s interest in incentivizing R&D in order to build national competitiveness in technology and innovation against eventual direct international competition. The initial business model was designed to recoup costs through income-based royalty payments from companies it would support. Difficulties with the accounting and tracking of revenues prompted TTGV to change its terms to allow payment for its services in fixed installments with no interest.

In 1995, TÜBİTAK set up its own in-house program agency, TEYDEB, providing pure grants, alongside TTGV, which provided soft loans. Given TEYDEB’s long funding cycles, most companies used TTGV’s funds for bridge financing for the same projects. In 2004, the government’s decision to provide direct funding to TÜBİTAK for its programs ended this joint oversight of R&D funds by the Ministry of Economy, leaving TTGV to manage the soft-loan program alone. Concurrently, increasing activity by KOSGEB for the support of SMEs and an abundance of grant funds for projects damped the demand for TTGV’s loans. In 2010, the government eliminated TTGV’s funding of soft loans, causing the agency to severely limit its direct funding programs to four areas with strong demonstration potential: agribusiness, biomedical devices, advanced materials and production (focused on cleaner production), and education. TTGV continued to operate a soft-loan program until 2016 with its own limited resources. The board decided to terminate that program in 2017, after a detailed independent evaluation.

While implementing a World Bank-funded project in 1999, TTGV provided loans and equity investments in technology-development projects alongside other complementary services to stimulate the growth of a venture-capital industry and SME upgrading. TTGV was required to repay 50% of the Turkish government funds used to finance firms in this project, irrespective of its collection from these firms. During this time, TTGV diversified its financial products and developed more institutional capacity for business development and program design. Since 2002, TTGV has become an investor of local private equity (PE) or venture-capital (VC) funds. By assuring the role of local institutional limited partner, it has considerably developed the market for private capital in Turkey.

Today TTGV is no longer managing government-funded programs. A new TTGV identity has emerged following a period of reflection and realignment during 2011–2016. Going forward, TTGV focuses on its core capabilities and is guided by three strategic objectives: finding a balance between ecosystem needs and capacity; designing lean prototypes to demonstrate value; and seeking ecosystem partnerships to scale up proven models.

Organizational Structure

Organizational and Reporting Structure

Among the seven foundations established by law in Turkey, TTGV is the only one providing services in the field of technology and innovation. As a foundation, TTGV is subject to all rules and regulations concerning the operations of foundations in Turkey, including full transparency to the public. As a private entity, TTGV is also subject to private law.
TTGV is governed according to a Foundation Statute. Any amendments to the statute have to be approved by its Founders’ Assembly and are subject to final Treasury approval. TTTGV’s Founders’ Assembly has 56 members representing reputable entities in Turkey, including public institutions, private sector institutions, chambers, associations, foundations, and private individuals. The assembly accepts new qualified members.

TTGV’s board of directors consists of 15 members, including 10 private and independent individuals elected by the Founders’ Assembly. Its chairman is one of these 10 members. The remaining five members of the board are appointed by the institutions and organizations defined in TTTGV’s Articles of Foundation: the Ministry of Economy, Ministry of Development, Undersecretariat of Treasury, KOSGEB, and TÜBİTAK.

TTGV’s internal organization reflects its current priorities (see Figure 32). Its daily operations are carried out by professional staff. Recruitment is similar to private sector procedures, with staff signing open employment contracts.

**Budget Sources and Allocations**

From inception, TTTGV has striven to achieve financial sustainability in its operations. US$ 66 million has been granted as TTTGV’s long-term endowment through two World Bank projects. Except for these two capital injections by the Turkish government as part of World Bank-financed projects, TTTGV has never received direct government capital. TTTGV has completely repaid a US$ 27 million loan from the Treasury of Turkey for the second project. The Ministry of Economy also provided US$ 84 million as soft loans from its budget; this has been returned.

TTGV’s yearly revenues include fees collected from project and advisory services, interest payments from its cash reserves, and returns on its Private Equity (PE) and Venture Capital (VC) investments. The agency is developing new networks and capacity to raise flexible funding through donations, sponsorships, and revenues from project or consultancy services. In addition, a more active role in PE and VC investments is expected to give it more freedom to operate.

*Source: TTGV*
The budget has been steadily decreasing since 2011. TTGV's 2017 operational budget was around US$ 4 million and has remained at this level for the last three years.

Human Resources and Skills

TTGV has 28 full-time professional staff. As TTGV's previous operations focused on evaluating and financing technology development projects, most operational staff had engineering backgrounds. However, with changing activities, social science, business, and other liberal disciplines are being represented at TTGV. Preference is given to self-driven individuals with strong communication and other creative skills.

TTGV has the flexibility to hire staff through different models. Its business model tries to keep core staff at a minimum and hire external professionals on short- or long-term contracts. Such professionals have typically been active in evaluation and monitoring projects for TTGV's loan programs, and are being contracted to open up TTGV's culture and provide professional drive and expertise in specific areas like strategy and business-model development. TTGV has also introduced entrepreneur-in-residence and fellowship positions in 2017, for the development and operation of new activities.

All teams are encouraged to work with high-profile professionals in well-defined roles as consultants, entrepreneurs-in-residence, technology evangelists, mentors, and fellows. TTGV is currently undergoing cultural change, involving a more fluid Human Resources (HR) system to help reverse the legacy of a structured and deterministic operational environment. The new HR system aims to encourage functions rather than titles and promote contributors faster and in a more transparent manner. Although there is a strong argument to hire specific technical expertise at the board level, TTGV's current focus remains on finding "connectors" from all disciplines who are open to communication and learning.

Timeline

Major Internal Events

1991 | TTGV established
1991 | Technology Development Project begins, supporting private-sector R&D projects
1997 | TAFTIE membership

2000 | Operations to VC business expanded, supporting Turkish Private Equity Fund and Business Venture Capital Mutual Fund
2001 | Consultancy services on a partial grant basis for SMEs offered
2002 | Nationwide awareness campaign for technology based innovation started
2007 | Award for best thesis applications to industry established
2008 | Financial and business plan support provided for Turkey's first technoparks
2014 | First fund-of-funds investor in Turkey, participating in the €160-million (approximately US$ 200 million) Istanbul Venture Capital Initiative (iVCi), together with KOSGEB, the Development Bank of Turkey, and European Investment Fund (EIF)
2015 | Regional and industrial sector-specific capacity development programs started
2016 | Ideaport program introduced
2016 | Kivlcm Industrial Creativity Center, the meeting point of all communities associated with technology and innovation, opened
2016 | Second Turkish partner of the European Venture Philanthropy Association
2016 | Second Turkish shareholder at EIF
2016 | First Turkish institutional investor of MEDITERRA II Fund, aimed at financing innovative Turkish SMEs

Major External Events

1991 | Loan agreement signed between the Turkish government and the World Bank for the first Technology Development Project
1998 | TÜBİTAK and TTGV begin supporting private-sector R&D from public sources
1999 | World Bank Industrial Technology Project begins
2006 | End of World Bank Industrial Technology Project
Figure 33. Programs Administered by TTGV

<table>
<thead>
<tr>
<th>Direct Financial Support</th>
<th>Non-financial Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity finance</td>
<td>Prizes and awards</td>
</tr>
<tr>
<td>• Limited partner in various VC and PE funds</td>
<td>• Technology awards (with TÜBİTAK &amp; TÜSİAD)</td>
</tr>
<tr>
<td>• Owner of Teknoloji Yatırım co-investment fund</td>
<td>• Dr. Akın Çakmakci University-Industry Collaboration Awards</td>
</tr>
<tr>
<td>Loan guarantees and reduced interest rates</td>
<td>• Dr. T. Fikret Yücel Award Program for achievements in innovation management</td>
</tr>
<tr>
<td>• TTGV's “Program II”: US$ 250,000 convertible loan and eventual right to join new investment rounds up to US$2 million</td>
<td>Advisory, extension, and training services</td>
</tr>
<tr>
<td>Vouchers</td>
<td>• INOREKA (an innovation based competitiveness assessment model)</td>
</tr>
<tr>
<td>• TTGV’s “Program I”, formerly TechExcel: Voucher for up to US$ 50,000 in business development services to secure the first customer</td>
<td>• Technology Transfer Accelerator (TTA Turkey)</td>
</tr>
<tr>
<td>Grants</td>
<td>Collaborative networks and policies</td>
</tr>
<tr>
<td>• Ideanest, a crowdsourcing platform launched in 2017</td>
<td>• Ideaport program</td>
</tr>
<tr>
<td></td>
<td>• Kivilcim program</td>
</tr>
<tr>
<td></td>
<td>• Memberships in European Venture Capital Association, Licensing Executives Society, TAFTIE, Turkish Philanthropy Funds</td>
</tr>
<tr>
<td></td>
<td>Information and advocacy</td>
</tr>
<tr>
<td></td>
<td>• Workshop series on design thinking, internet of things, smart cities, and industrial creativity</td>
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Implementation, Capacity, and Programs

Direct Financial Support

TTGV makes equity investments in technology companies. The agency is currently developing plans for a US$ 24 million co-investment and follow-on investment fund for early stage technology companies, through its special purpose vehicle company, Teknoloji Yatırım. The arrangement will involve fund managers and a profit-sharing plan.

In addition, TTGV makes investments as a limited partner into other funds, such as iVCi, Turkey’s first dedicated fund-of-funds and co-investment program, in collaboration with the EIF. In 2016, TTGV also became the first Turkish corporate investor in MEDITERRA II Fund, established to financing innovative Turkish SMEs. In 2017, it invested in Taxim Capital Fund, a Turkey-focused mid-market private equity firm.

While TTGV phases out its signature soft loans, it will be introducing new funding programs involving convertible loans and hybrid equity finance. In 2018, Program II will offer a US$ 250,000 convertible loan and eventual right to join new investment rounds with up to US$ 2 million, to support existing companies in extending their sales to new international markets. Program I, in collaboration with university-business competitions, will boost acceleration capabilities and support new firms in securing their first customer in the market. This program will provide 50,000 grants to purchase business development services and give TTGV the rights to participate in equity investments at a discount, up to US$ 900,000.
TTGV has also developed several programs to leverage financing from other funding sources for technology innovation projects. Ideanest is a crowdfunding platform managed by TTGV, bringing funders together with entrepreneurs (not businesses) while TTGV’s experts evaluate the projects. Proof-of-idea grants for new technology areas and research scholarships have already been accepted.

In addition, TTGV funds technology-themed philanthropic projects, mobilizing donations and sponsorships through matching co-funding. Currently, the program supports an education project to train and equip high-school teachers in new technology through hardware development kits. A collaboration with Intel to provide education under this program has attracted intense interest and demand, leading to plans to scale it up in other areas. The program matches large program donations (above US$ 75,000).

Non-Financial Support

TTGV provides advisory, extension, and training services to firms to help them upgrade their innovation and technology capabilities. INOREKA evaluates the companies’ competitive capacity based on their innovation competence. The program offers company-based analyses in addition to a review of potential clusters or teams, specifications, and sharing of their needs. To date, TTGV has provided consulting services to approximately 25 sector clusters covering 500 companies.

TTGV also manages a number of prizes and awards meant to stimulate innovation and technology uptake. Technology Awards is a joint initiative between TTGV, TÜBİTAK, and the Turkish Industrialists and Businessmen Association (TÜSİAD) since 1997. This is the most prestigious award organization regarding innovation and technology development within Turkey.

The TTA-Turkey Project assists intellectual property-based projects, start-ups, and established companies in commercializing knowledge and skills from universities (spin-offs) and boosting the intellectual property assets of SMEs in return for equity partnership. TTGV collaborates with Bpifrance Financement (France) and VentureWell (USA) to provide the consultancy services and network-building component.

TTGV fosters collaboration while informing innovation policy through the Ideaport and the Kıvılcım Programs. Ideaport is a business, idea, and policy development platform, which aims to bring together creative skills and experts from various areas using extensive multimedia content. It disseminates information and knowledge accumulated in the ecosystem, to raise awareness and create networking opportunities. The program started in 2014 and is now scaling up.

TTGV’s Kıvılcım Program brings sector-specific knowledge and skills together with expertise in the field, understanding the need and the market in order to create real and flexible knowledge for the innovation needs of the industry. It aims to redesign and manage the innovation processes as creative, iterative, and self-learning processes by bringing together experts, practitioners, and resources from different fields.

TTGV has provided financial support for the infrastructure to establish two technoparks: Bilkent Cyberpark, (Bilkent University) and Arıteknokent (Istanbul Technical University). These aim to form and develop new businesses as R&D results from universities and research centers can be transferred here. The technoparks currently host around 220 firms and more than 2,000 employees.

Delivery Challenges

Institutional Reforms

TTGV was established through a government-led initiative as an innovative project. The idea at the time was to develop an independent agency with private-sector capabilities to manage public programs. The agency’s non-government design was meant to provide strong performance management, with TTGV as the implementer and the ministry as the owner. Given that the Turkish support system suffers from weak professional capacity, TTGV’s model provides a viable alternative to publicly managed programs. However, TTGV’s relation to the public space is not clearly defined. A trade-off exists between precise definition through a law or other legislation and keeping a neutral or independent position in the system.

Aside from a sense of independence, TTGV’s structure as a foundation has very limited advantages. Accessing public funding as a non-government entity remains a persistent challenge. Technology is not considered as an area for charitable contributions and most foundations are required to be passive spenders. Given that TTGV’s mission involves many venture and technology risks, the structure of TTGV presents challenges as foundations in Turkey are static and limited. A not-for-profit corporation structure may suit TTGV’s mission better, though this model is not currently possible in Turkey.

The PPP model offers broad stakeholder representation, although encouraging active participation and ownership from both sides is difficult. A cultural bias whereby the public is considered to be the ‘giver’ and the private the ‘taker’ impedes TTGV’s ability to mobilize private funds to support the development of technology in Turkey. Interestingly, the public component of the partnership has worked much more actively and efficiently than the
private component, because of TTGV’s relationship with the government. By demonstrating value as a service provider to the private sector, the agency is expected to increase the benefits of private-sector participation. In addition, the representative but large board of directors can stymie the execution of transformational projects.

Budgetary, Capacity, and Political Issues

As an implementer of publicly financed programs, TTGV has been expected to contribute to macro indicators such as economic growth and qualified employment creation. However, these outcome indicators are poorly aligned with TTGV’s mission of fostering innovation and technology development within enterprises. There have been few opportunities to introduce rigorous impact assessment and result measurement, aside from a World Bank program evaluation study in 2006. In addition, since the number of projects supported by TTGV with its own resources has been limited, introducing monitoring and evaluation systematically into programming has been difficult. Observable progress such as setting up or extending an R&D department, adjusting competition strategy, or repositioning away from commodities toward features-based products are some potential indicators that could be attributable to TTGV’s support and observed over an extended duration following program interaction.

As a mandated component of the national innovation support system, TTGV is required to be inclusive of all levels of technology capacity. Therefore, the agency has continued to provide ‘retail’ support to technology companies at the expense of positioning itself as a supporter of specialized high-technology sectors in Turkey. Re-positioning itself after 28 years is proving to be challenging and has garnered disapproval from many stakeholders.

TTGV currently has enough resources to support its existence and offer limited funding activities. However, the objective of self-sustainability limits the range of financial models that it can experiment with. Moreover, the rigidity inherent to the foundational model is emerging as another challenge to manage risks. Given that an abundance of “free” money in the forms of public grants exists in the market, TTGV’s financial models fail to attract much quality demand. Hence, TTGV requires more professional capacity to perform “financial engineering” within the boundaries of its mission.

TTGV’s current objectives can be achieved through a highly professional and capable team with a capacity for strategic business development and marketing. Given the very limited scope of the non-profit sector in Turkey, the expertise needed to build the right framework is either not available or too costly. TTGV has been attempting to develop its own talent base from within a corporate culture that lacks mentorship traditions and personal investment. TTGV’s recent transformation involves many entrepreneurial tones.

Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations

TTGV was the Central Project Implementation Unit under the Industrial Technology Project (ITP; the World Bank’s loan program) between 1999 and 2006. The agency was responsible for implementing the monitoring and evaluation of the program. The ex post evaluation was completed in 2006.

Although the evaluation efforts of the innovation support programs are weak within the country, TTGV gained knowledge and experience of M&E practices by participating in TAFTIE task forces and the European Union’s 7th Framework Program for Research and Technological Development (FP 7). For FP 7, TTGV participated in several projects which involved development of new M&E frameworks and tools. These collaborations helped TTGV gain experience with the methodology, governance, and relevance of the impact assessment studies under the program. In the meantime, via the strategy applied by MSIT, TTGV has become one of few visible consultancy institutions in the impact assessment market, with evaluation and impact assessment studies being recognized as policy-making instruments, and becoming more visible in recent years. TTGV completed an assignment in 2016 on the “The Impact of Entrepreneurship and Innovation Support Programs in Turkey on Expanding the Culture of Entrepreneurship” for MSIT.

Evaluation Methodologies

For ITP, monitoring was conducted at the beginning (as a reference point), at mid-term, and after completion. Firms were surveyed by the Turkish Statistics Institute,
while inputs and outputs were reported by TTGV as the implementing institution. Empirical analysis of ITP activities was carried out by a consultant, based on data collected by the Turkish Statistics Institute. In parallel, an economic impact analysis of ITP-supported activities was conducted to evaluate the benefits of the ITP to industry, compare those benefits to the costs of conducting the ITP, and to complement ongoing studies. During the implementation of the ITP, three sets of indicators were selected to monitor project progress and achievements:

- Input indicators to track the extent to which implementation met expectations and schedule,
- Output indicators to track the results of implementation in accordance with project plans, and
- Outcome indicators to evaluate the impact of the project on technology development in industry.

Parties Responsible for Monitoring and Evaluation

TTGV staff has been responsible for the M&E of the two World Bank projects for which the agency was the main implementer. External parties have carried out other evaluations, such as the program study of the Support for Advanced Technology Projects Program (ITEP).

Internally, TTGV undergoes continuous audits by the Directorate General for Foundations for operations and by the Treasury for compliance to its establishment mandate. In addition to these two formal audits, TTGV’s operations are also audited annually by an independent international firm. TTGV’s private audit reports are publicly available.

Impact Evaluations

Evidence of Results

The 2006 evaluation found that TTGV offered substantial value addition to firms undertaking innovation activities. TTGV’s interventions appear to have boosted investments in R&D for 27% of SMEs and 13% of large companies, who state that they would not have carried out research without TTGV’s support. A conservative estimate of R&D spending resulting from TTGV’s interventions is about 20–30% more than would otherwise take place; a considerable effect given that the subsidy element in TTGV’s funding is quite low. Almost all firms (86%) who received TTGV support plan to conduct new R&D projects in the next three years. The average number of new projects planned in the next three years is 3.7 for SMEs and 8.5 for larger companies. The majority of the firms (72%) would like to apply for TTGV support for these projects as well.

TTGV-supported projects have achieved considerable commercial and technological success: 83% of firms state that an industrial application is expected by the end of the project. All firms that aimed to develop new products by the end of the project report having done so. About 70–80% of the firms that indicated entering new markets was an objective were successful by the end of the project, and the rest expect to achieve it in the next three years.

The impact can be noticed in other areas too: more than 50% of the beneficiaries enhanced their ability to monitor new technologies, improved production infrastructure, codified knowledge generated by R&D activities, initiated new R&D projects, and established an R&D unit. About 33% of firms claim that the employment of production workers increased as a result of the project, whereas about 10% claim they employ fewer production workers. Finally, TTGV’s impact on skills upgrading and creating industry-science links was found to be positive. In the case of large company beneficiaries, there is an additional indirect effect, in that 40% reported that their competitors were incentivized to develop their own innovations.

Between 1991 and 2010, TTGV’s Technology Development Project provided over US$ 250 million in financial support to more than 900 projects. The main objective of the program was to increase the international competitiveness of Turkish private sector companies through research, development, and innovation (RD&I) capacity-building activities. The program led to an R&D volume of approximately US$ 500 million. From 1994 till 2010 2,349 RD&I project applications were evaluated, with 77% led by SMEs. TTGV committed US$ 311.2 million for 938 projects, which in turn created an RD&I volume of US$ 632 million, including private-sector contributions.

Under ITEP, TTGV’s signature soft-loan program, 16 projects were approved by the TTGV board during 2011–2016, with support contracts signed with 12 companies. As of June 2017, approximately US$ 11 million has been disbursed. An evaluation study on ITEP by external experts led to the closing of the program in June 2017, as it found that the program did not have a sustainable financial structure.
3.14. SPRING Singapore

Overview

SPRING promotes innovation primarily through developing capabilities in small and medium-sized enterprises (SMEs) and nurturing the growth of innovative local start-ups.

As the primary enterprise development agency in Singapore, SPRING works with partners to help enterprises with financing, capability and management development, technology and innovation, and access to markets. As the national standards and accreditation body, SPRING develops and promotes an internationally recognized standards and quality-assurance infrastructure. SPRING also oversees the safety of general consumer goods in Singapore.

Key Takeaways

SPRING is a key agency in Singapore for promoting capability development in local SMEs and start-ups. With its genesis as a standards board, SPRING has generated market access opportunities for local companies, while creating a reputation for quality among Singaporean products and companies. Building on this core mission, SPRING has been able to hone its offering based on the ecosystem’s evolving needs and the changing innovation landscape.

Over the years, SPRING’s activities have contributed to a steady growth in entrepreneurial activity. In 2014, Singapore was placed 6th out of 27 advanced economies for the highest willingness to start a business within three years, up from 8th place in 2013 (Global Entrepreneurship Monitor [GEM] 2014 report). The number of active start-ups doubled from 23,000 in 2004 to about 43,000 in 2016. In 2016, the total employment created by active start-ups was about 316,000. These start-ups created about 345,000 jobs. Singapore was ranked 12th in the Global Startup Ecosystem Ranking 2017 by Startup Genome.

Role in the Country’s National Innovation System

SPRING Singapore operates under the Ministry of Trade and Industry (MTI) and is the agency responsible for promoting the growth and development of Singaporean enterprises and building trust in Singapore’s products and services. SPRING provides financing, capability upgrading, management development, market access, and other technology and innovation services. As the national standards and accreditation body, it provides international standards recognition and a quality-assurance infrastructure. SPRING also acts as the consumer protection organization for goods in Singapore. In 2018, SPRING merged with EI Singapore and become Enterprise Singapore. Enterprise Singapore will enable the growth of Singapore’s companies through an integrated support network, providing opportunities to develop business capabilities and access overseas markets.

Complementary Agencies

Although SPRING represents only one of many government agencies in Singapore involved in the development of the country’s national innovation system (NIS) (see Figure 34), it plays an important role when it comes to local SMEs and start-ups.
Other key institutional players in Singapore's NIS include the National Research Foundation (NRF), which sets the national direction for R&D by developing policies, plans, and strategies for research, innovation, and enterprise; the Agency for Science, Technology, and Research (A*STAR), which promotes and encourages science, engineering, and biomedical research, and nurtures talent to raise the level of science and technology (S&T) in Singapore; and the institutions of higher learning (IHLs), which conduct basic research, develop S&T talents, and facilitate commercialization of their inventions through licensing and spin-offs.

In parallel with SPRING under the MTI, the Economic Development Board (EDB) focuses on attracting foreign direct investment into Singapore, including R&D and innovation activities by global multinational companies, while the Intellectual Property Intermediary (IPI) facilitates access to and use of intellectual property (IP) by local enterprises. Finally, a number of agencies under other ministries, such as the Infocomm Media Development Authority (IMDA) (from a merger between the Infocomm Development Authority and the Media Development Authority (MDA) in 2016) in the Ministry of Communications and Information and the Public Utilities Board (PUB) in the Ministry of Environment and Water Resources, promote sector-specific innovations (information and communication technology/media development and diffusion, and water technologies, respectively).

Technology-based entrepreneurship has, in recent years, become an important aspect of Singapore's NIS. SPRING is the lead implementation agency for nurturing innovative start-ups. It cooperates with both the public and private sectors. A key private-sector partner is Action Community for Entrepreneurship Ltd (ACE), which provides start-ups with access to mentorship and connects them to the larger business community locally and overseas. ACE has also been working with schools to increase students’ exposure to entrepreneurship through events such as workshops and hackathons. SPRING also works closely with the various IHLs in Singapore to support their entrepreneurship development initiatives. For example, SPRING has provided financial support to NUS Enterprise, the entrepreneurship and innovation promotion arm of the National University of Singapore (NUS), to run its on-campus start-up incubation support program as well as its Launchpad in San Francisco, which helps Singaporean start-ups to expand their activities to Silicon Valley.

### Origins and Evolution

#### Mandate

As a statutory board, SPRING primarily plays an implementation role in promoting the policy direction of its parent ministry and the Singapore government. In addition to developing the SME sector, SPRING serves as the national body for standards, accreditation, and business excellence. It is also the safety and compliance monitoring authority for controlled goods and weights and measures.

#### Sectoral Focus

SPRING provides assistance to growth-oriented, local SMEs in all sectors. In recent years, there has been a special focus on nurturing innovative start-ups with programs designed for the needs of young firms and entrepreneurs. While the programs administered by SPRING are applicable to all sectors, there is currently a shift toward a more domain-focused approach in program implementation. This entails working with partners from the focal sector to identify specific problems and develop specific solutions beneficial to the whole sector. So far, SPRING has developed industry transformation maps (ITMs) for 23 sectors to identify key challenges and priorities. Currently, SPRING offers industry-specific programs in 14 industries including biomedical engineering, retail, education, clean technology, logistics, printing, and food manufacturing.

### Country Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP, PPP</td>
<td>US$ 527 billion</td>
<td>2017</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>US$ 57,714</td>
<td>2017</td>
</tr>
<tr>
<td>Gross Expenditures on R&amp;D (GERD)</td>
<td>2.2% (UNESCO, 2014)</td>
<td></td>
</tr>
<tr>
<td>Public R&amp;D spending</td>
<td>37.09 % of GERD (UNESCO, 2014)</td>
<td></td>
</tr>
<tr>
<td>Business R&amp;D spending</td>
<td>54.10% of GERD (UNESCO, 2014)</td>
<td></td>
</tr>
<tr>
<td>World Economic Forum (WEF) competitiveness rank</td>
<td>3/137 (2017–18)</td>
<td></td>
</tr>
</tbody>
</table>
Note: SPRING merged with International Enterprise (IE) Singapore to form Enterprise Singapore in 2018.
Source: SPRING
Business Model Evolution

SPRING’s operating model and structure are informed by the government’s strategic vision for innovation development, specifically, and economic development more generally. The vision for innovation is explained in the five-year national blueprint, which was previously known as the National Science and Technology Plan and has since 2010 been named the RIE (Research, Innovation, and Enterprise) plan. The evolution of SPRING’s model for implementing innovation promotion has been driven by these national plans, from the earlier approach of promoting the use of technology to improve productivity, to the more recent focus on helping enterprises to leverage innovation outcomes for competitiveness.

The RIE2020 framework announced in early 2016 outlined four key priorities for innovation and enterprise programs to build innovative enterprises that drive value creation and economic competitiveness. These priorities mark a broad shift in Singapore’s public policy approach to innovation and hence, the implementation strategies of agencies such as SPRING. These four shifts in strategy are:

(a) From start-up to scale up: prioritizing provision of targeted support to firms for scaling-up;
(b) From fragmented to integrated approach: prioritizing the fostering of stronger collaboration and cohesion among government agencies providing support to firms;

Figure 35. Organizational Structure of SPRING

Source: SPRING
(c) From generic to domain-focused: prioritizing initiatives that address domain-specific needs; and
(d) From technology push to industry pull: prioritizing increased alignment of research with industry.

It should be noted that SPRING’s strategic focus faces further realignment following the merger with International Enterprises (IE) Singapore, the country’s trade promotion agency, to form Enterprise Singapore in 2018. This follows from the recently released Committee for the Future Economy (CFE) recommendations, in a bid to enhance and streamline support for high-growth enterprises in scaling-up and internationalization. Enterprise Singapore will enable the growth of Singaporean companies through an integrated support network to build business capabilities and access overseas markets.

Organizational Structure

Organizational and Reporting Structure

SPRING is a statutory board under the MTI. Corporate governance is overseen by the Board of Directors, comprising 17 members from leading private sector companies and senior government officials. The organizational structure of SPRING as of October 2017 (see Figure 35) is the result of a recent restructuring effort, carried out in part as a response to key priorities outlined in the RIE2020 plan.

Human Resources and Skills

SPRING is committed to retaining and nurturing talent among its 500 staff members. The agency was recognized for its support in talent retention as a recipient of the silver HR Excellence award for Employee Engagement in 2017. Under its staff development agenda, deepening staff competencies in functional domains is complemented with on-demand learning available to staff. The provision of self-paced knowledge acquisition aims to promote a culture of continuous learning. Informal knowledge and networking opportunities are made available through events such as fireside chats with local entrepreneurs.

Timeline

<table>
<thead>
<tr>
<th>Major Internal Events</th>
<th>1972</th>
<th>National Productivity Board (NPB) established</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td></td>
<td>Singapore Institute for Standards and Industrial Research (SISIR) established</td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td>NPB and SISIR merge to form Productivity and Standards Board (PSB)</td>
</tr>
<tr>
<td>2002-2007</td>
<td></td>
<td>Transfer of selected functions to other government agencies</td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td>PSB renamed SPRING Singapore</td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td>Action Community for Entrepreneurship Ltd (ACE) formed, with SPRING acting as secretariat</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td>Launch of Startup SG</td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td>SPRING merges with International Enterprise Singapore (IE Singapore) to become Enterprise Singapore</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Major External Events</th>
<th>1985</th>
<th>Economic Committee recommends strengthening the base of local SMEs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1988</td>
<td>Beginning of 1988: Establishment of various venture capital firms in Singapore</td>
</tr>
<tr>
<td></td>
<td>1991</td>
<td>National Science and Technology Board (NSTB) established to drive R&amp;D in Singapore</td>
</tr>
<tr>
<td></td>
<td>1998</td>
<td>First 5-year National Science and Technology Plan (NSTP) revealed</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>Committee for Singapore’s competitiveness set up to review economic strategy</td>
</tr>
<tr>
<td></td>
<td>2001</td>
<td>T21 Master Plan launched to promote technology start-ups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technopreneurship Investment Fund (TiF) established</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development of One-North (Biopolis and Fusionopolis) to support technology, innovation, and enterprise</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NSTB renamed A*STAR</td>
</tr>
</tbody>
</table>

139
The Innovation and Capability Voucher (ICV) aims to encourage SMEs to take small steps in developing their business capabilities. SMEs can use the voucher, valued at US$ 4,000, to upgrade and strengthen their core business operations through pre-scowed consultancy in the areas of innovation, productivity, human resources, and financial management. Apart from consultancy, ICV also supports SMEs in the adoption and implementation of pre-scowed integrated solutions to improve business efficiency and productivity.

SMEs that are ready to embark on larger upgrading projects can tap into the Capability Development Grant, which supports up to 70% of qualifying project costs. This grant supports upgrading projects in 10 business areas, including product development, business model transformation, and intellectual property.

SPRING offers qualifying start-ups and entrepreneurs several early-stage innovation grants. Startup SG Founder supports first-time entrepreneurs with viable and diferentiated business ideas with up to US$ 22,000 in co-funding. In addition, there is also Startup SG Tech, which is a competitive grant to support technology-based, early-stage start-ups in the proof-of-concept (up to US$ 180,000) and proof-of-value (up to US$ 400,000) stages, which enables the commercialization of technology.

Indirect Financial Support

Startup SG Investor comprises SPRING’s investment facilitation support and is made up of two programs: The Angel Investment Tax Deduction (AITD) and the Section 13H/Fund Management Incentive/Pioneer Service Investment (S13H/FMI/PSI). The AITD program is for angel investors who can commit a minimum of US$ 72,000 to a qualifying start-up. Approved angel investors receive a tax deduction of 50% of their investment at the end of a two-year holding period. For each year of assessment, the eligible investments will be subject to a cap of US$ 400,000 and the corresponding maximum tax deduction is US$ 180,000. In addition to AITD, the S13H and the Fund Management Incentive (FMI) or Pioneer Service Incentive (PSI) for S13H-approved funds encourage the inflow of venture-capital funds into Singapore and incentivize investments in foreign technology companies planning to set up operations in Singapore. These two incentives are open to applications from venture capital and private equity funds that were incorporated in Singapore, as well as their associated fund management companies, if they have obtained the necessary approvals and licenses from the Monetary Authority of Singapore for the proposed investment activities.
Non-financial Support

To facilitate innovation and knowledge transfer between large organizations and SMEs, SPRING administers two major programs. PACT aims to foster mutually beneficial collaborations between large organizations and SMEs by implementing collaborative projects in the areas of knowledge transfer, capability upgrading, and co-development and testing of innovative solutions. In 2017, the program was updated to enable government agencies to promote SME development through procurement opportunities. The Gov-PACT program similarly aims to foster mutually beneficial collaborations between procuring government agencies and SMEs calling for open innovation calls, procuring via spiral contracting, and deploying innovative solutions.

The T-Up program seeks to strengthen the technology innovation capability of local companies through the provision of external experts. The program facilitates the transfer of research scientists, engineers, and technical experts from leading R&D institutions such as A*STAR's research institutes, universities, polytechnics, reputable overseas technological institutions, and the industry to local companies.

SPRING administers several national awards that recognize organizations for their performance in business excellence. These include the Singapore Quality Award, People Excellence Award, Innovation Excellence Award, and Service Excellence Award.

Spearheaded by SPRING and JTC Corporation, the JTC LaunchPad @ one-north officially opened in January 2015. This common space near R&D lab facilities and IHLs is home to about 500 start-ups and 35 incubators and investors. The clustering effect enables a better exchange of ideas and networks. In the future, three more blocks will be added to accommodate 250 more start-ups.

SPRING has set up eight Centers of Innovation and one Private Sector Translator to strengthen IP commercialization infrastructure. Technology Transfer Offices (TTOs) were also supported in universities, polytechnics, and hospitals.

Figure 36. Programs Administered by SPRING
SPRING has launched innovation clusters in several industry focus areas to strengthen collaboration, research, and innovation within certain industries. One such cluster exists for 3D-printing in the manufacturing sector. The National Additive Manufacturing Innovation Cluster funds projects that support technological and standards development and translational and industry outreach activities to encourage additive manufacturing adoption. Other innovation clusters are the Food Innovation Cluster which encourages development and commercialization of new products, and establishment of shared production and R&D facilities in the food and nutrition sector, and the Diagnostics Development (DxD) Hub which aims to accelerate the transformation of Intellectual property (IP) into clinically validated diagnostic devices that are ready for market adoption.

There are 12 SME Centers set up to provide face-to-face business diagnosis and advisory services to enterprises. Each SME Center is staffed by a team of business advisors who assist enterprises in areas ranging from legal and financial to technology innovation and overseas expansion. The SME Centers also organize capability workshops and an annual SME conference for local enterprises.

Productivity Centers are one-stop competency centers that help SMEs improve productivity in their businesses. Supported by SPRING, they provide sector-specific productivity expertise and assistance to SMEs by helping them diagnose areas for improvement and supporting the implementation of productivity solutions.

National Certification Programs administered by SPRING include the Singapore Quality Class and Singapore Quality Class with Niche. These have stringent assessment criteria that recognize organizations with excellent performance in business excellence (BE). This includes BE certifications and BE awards.

**Delivery Challenges**

**Institutional Reforms**

SPRING currently offers a variety of programs and support plans to SMEs, start-ups, and entrepreneurs. However, as a result of the four strategic shifts arising from the recently launched RIE2020 strategy, it is expected to move away from a program-centric approach and place greater emphasis on industry engagement and domain-specific strategies. In particular, this shift toward an industry domain-focused approach is expected to be implemented in line with the ITMs that will be developed under the Information Transformation Project (ITP) announced in the 2016 budget. Under the ITP, the government is setting up study teams comprising officers from various agencies, including SPRING, which will develop an ITM for each of the 23 industries that collectively make up 80% of Singapore’s economy. The ITMs will detail how each sector can be made future ready, with innovation identified as a crucial element.

**Budgetary, Capacity, and Political Issues**

The change in approach brought about by the four strategic shifts in RIE2020 raises several implementation challenges for SPRING:

(a) Lack of technologically sophisticated companies and low absorptive capacity. Even as priority shifts toward industry pull, it is acknowledged that there are few local companies that demand and can commercialize cutting-edge technologies.

(b) Need for translational research to raise technology readiness levels. Another impediment to an industry-pull strategy is that technologies from universities and research labs are often at a low technology readiness level. SPRING proposes to address this through customized solutions that depend on the specific translational issue, whether it be lack of space, equipment for testing, expertise, or engineering knowledge in the domain.

(c) Need for international networks to help companies scale up. Because the work done by SPRING is domestically oriented, it lacks connectivity to global markets and players such as venture capitalists. The merger with IE Singapore to form Enterprise Singapore will provide enterprises with a single platform to grow their business capabilities internationally.

(d) Standardizing SPRING programs with those by other government agencies. To present an integrated access point to enterprises, the various programs and their associated criteria, terms, and conditions need to be standardized and aligned.

(e) Specifying detailed industry needs. Matching the solution provider to the solution seeker is not always straightforward. The process may be facilitated by knowledge sharing events such as conferences or through targeted customer validation programs.

(f) Seeking solutions from outside the industry. A domain-focused approach should not restrict innovations to originating within the industry. One challenge faced by SPRING is encouraging enterprises to “innovate to survive.” If innovation is viewed as a necessity, enterprises would source solutions and best practices from across domains, and SPRING could facilitate this process.
To address the challenges posed by a domain-focused approach, SPRING will seek to assist enterprises with means other than structured programs. As an example, SPRING has dedicated resources to champion large locally based companies to work with start-ups and local SMEs. One of the roles played by SPRING in this context is that of a demand aggregator, in which it consolidates the technology or business problems faced by large companies and channels them to innovators in SMEs and start-ups to develop possible solutions.

Measurement, Learning, and Results

Organizational Monitoring and Evaluation

Program Evaluations

SPRING takes a holistic approach to evaluating the success of its programs. The evaluation considers several factors, such as the following:

- Have performance targets been met?
- What is the impact to the intended enterprise segment?
- How well has the program been run? (Process efficiency and service standards)
- What is the state of the policy landscape? Are the policy objectives still relevant?
- What is the stakeholder feedback?

Evaluation Methodologies

Like other government agencies in Singapore, SPRING normally adopts two sets of indicators to monitor the performance of its programs: (a) Key Performance Indicators (KPIs), which measure the extent to which preset performance targets are met (number of start-ups and jobs created, percentage of assisted start-ups receiving follow-on funding, and so on); and (b) tracking indicators, which monitor other relevant outputs that complement the achievement of the KPIs. The indicators are specific to each program, depending on the objectives and intended beneficiaries determined during the program design stage. Program participants/recipients are required to provide progress and final reports on the actual achieved versus target KPIs and tracking indicators, with explanations required for variations.

Recognizing that the impact of some of its programs takes time to materialize, SPRING normally tracks the post-program performance of beneficiary companies over a period of years. SPRING also periodically releases case studies of local enterprises that have achieved success with the help of one or more of SPRING’s assistance programs.

Impact Evaluations

Evidence of Results

SPRING's efforts to facilitate networks have benefited the business ecosystem in Singapore. SPRING works closely with trade associations and chambers (TACs) in Singapore to help SMEs enhance productivity, catalyze innovation, and explore new market opportunities. Working together with IE Singapore, SPRING has supported more than 40,000 SMEs through the Local Enterprise & Association Development Program (LEAD), a multi-agency effort to enhance industry and enterprise competitiveness through TACs. In the last 10 years, around 200 industry and internationalization projects were conducted through this initiative. From the program’s launch in 2005, to 2015, LEAD supported more than 30 TACs with over US$ 72 million in funding. This support has helped some 160 industry development and internationalization projects to build up important capabilities and capture new opportunities for growth, benefiting SMEs.

SPRING also creates impact by helping SMEs access international markets, through the use of quality assurance and standards. This involves active participation by SPRING in international and regional forums, along with the key technical committees of international standards organizations. Through agenda setting at such global platforms, SPRING also enhances Singapore’s standing as a trusted global hub for attracting talent and as a testing ground for innovative ideas.

Several independent, externally commissioned studies on SPRING’s impact on Singapore’s NIS have been performed. As an example, a 2016 study of the T-Up Component of the GET-Up program commissioned two rounds of external studies, seven years apart, to researchers at NUS. These evaluated its impact on the innovation performance of the participating local SMEs versus the performance of comparable non-participating enterprises. On a macro level, SPRING periodically releases statistical data on the growth of local SMEs and start-ups in Singapore.
The majority of the cases in this report reside in emerging innovation systems: lower-income economies, middle-income economies, or high-income economies that rank in the lower three quartiles of the GII. Singapore (high-income, GII 7) is an exception and SPRING Singapore is included for comparison purpose. Rwanda (low income, GII 99) is within the nascent innovation system category, but the RDB-ICT is also included in the sample to highlight the efforts of a post-conflict country in establishing the foundations of a private sector-led economy. In at least 10 cases, the World Bank had a role in designing or revamping, financing, and/or providing technical support either at inception or during the operations of these agencies. This selection bias limits the generalizability of the results of the analysis herein.

Each case study followed a standardized structured outline and the contents of all case studies have been discussed and validated with the respective agency management. The outline was structured to gather information on the specific roles, evolution, capabilities, organizational structures, budgets, and instruments, and where possible the M&E frameworks and impact.

It is important to note that these cases are not meant to evaluate successes or the impact of these agencies or their programs. They are strictly descriptive and designed to share insights with policy makers and practitioners interested in designing and/or reforming innovation support institutions and researchers keen on furthering the knowledge base in this field. The authors relied on the willingness of institutions to share information and their interest in being featured in this report.

The cases in this report were selected from the sample of innovation agencies, or agencies that seek to provide direct support to firms for innovation presented in Table 17. The country classifications follow the methodology adopted in this report, which is based on income classification and rank on the GII.

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<tr>
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<tbody>
<tr>
<td>Argentina</td>
<td>Upper-middle-income</td>
<td>76</td>
<td>Fontar</td>
<td>1996</td>
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<tr>
<td>Armenia</td>
<td>Lower-middle-income</td>
<td>59</td>
<td>Enterprise Incubator Foundation (EIF)</td>
<td>2002</td>
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<tr>
<td>Botswana</td>
<td>Upper-middle-income</td>
<td>89</td>
<td>Botswana Innovation Hub</td>
<td>2008</td>
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<tr>
<td>Brazil</td>
<td>Upper-middle-income</td>
<td>69</td>
<td>Finep</td>
<td>1967</td>
</tr>
<tr>
<td>Chile</td>
<td>High-income</td>
<td>46</td>
<td>National Innovation Council for Competitiveness</td>
<td>2005</td>
</tr>
<tr>
<td>China</td>
<td>Upper-middle-income</td>
<td>22</td>
<td>Ministry of Science and Technology</td>
<td>1998</td>
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<td>Colombia</td>
<td>Upper-middle-income</td>
<td>65</td>
<td>iNNPulsia</td>
<td>2012</td>
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<tr>
<td>Croatia</td>
<td>Upper-middle-income</td>
<td>41</td>
<td>HAMAG-BICRO; The Business Innovation Croatian Agency</td>
<td>2014; 1998</td>
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<td>24</td>
<td>The Technology Agency of the Czech Republic</td>
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<td>Denmark</td>
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<td>6</td>
<td>Danish Agency for Science, Technology, and Innovation</td>
<td>2006</td>
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<td>Finland</td>
<td>High-income</td>
<td>8</td>
<td>Tekes and Sitra</td>
<td>1983</td>
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<tr>
<td>Georgia</td>
<td>Lower-middle-income</td>
<td>68</td>
<td>Georgia Innovation and Technology Agency (GITA)</td>
<td>2014</td>
</tr>
<tr>
<td>Hungary</td>
<td>High-income</td>
<td>32</td>
<td>National Innovation Office</td>
<td>2010</td>
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<td>Iceland</td>
<td>High-income</td>
<td>13</td>
<td>Innovation Center Iceland</td>
<td>2007</td>
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<tr>
<td>India</td>
<td>Lower-middle-income</td>
<td>60</td>
<td>Biotechnology Industry Research Assistance Council (BIRAC); National Innovation Foundation</td>
<td>2012; 2000</td>
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<td>Indonesia</td>
<td>Lower-middle-income</td>
<td>87</td>
<td>Agency for Assessment and Application of Technology (BPPT)</td>
<td>1974</td>
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<tr>
<td>Ireland</td>
<td>High-income</td>
<td>10</td>
<td>Department of Business, Enterprise and Innovation (formerly, Forfas)</td>
<td>1994</td>
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<tr>
<td>Israel</td>
<td>High-income</td>
<td>17</td>
<td>Israel Innovation Authority (formerly, Office of the Chief Scientist and Matimop)</td>
<td>1969</td>
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<td>Japan</td>
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<td>New Energy and Industrial Technology Development Organization (NEDO)</td>
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<td>Kafalat</td>
<td>1999</td>
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<td>Lithuania</td>
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<td>40</td>
<td>Agency for Science, Innovation, and Technology</td>
<td>2010</td>
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<td>78</td>
<td>National Agency for Technological Development</td>
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<td>Kenya</td>
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<td>80</td>
<td>Kenya National Innovation Agency</td>
<td>2013</td>
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<td>11</td>
<td>Korea Industrial Technology Foundation</td>
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<td>Malaysia</td>
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<td>37</td>
<td>Malaysian Technology Development Corporation (MTDC); AIM</td>
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<td>Mexico</td>
<td>Upper-middle-income</td>
<td>58</td>
<td>Inadem</td>
<td>2013</td>
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<td>Netherlands</td>
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<td>3</td>
<td>Senter Novem</td>
<td>2004</td>
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<td>New Zealand</td>
<td>High-income</td>
<td>21</td>
<td>Ministry of Business, Innovation, and Employment</td>
<td>2012</td>
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<tr>
<td>--------------------</td>
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<tr>
<td>Norway</td>
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<td>19</td>
<td>Innovation Norway</td>
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<td>Peru</td>
<td>Upper-middle-income</td>
<td>70</td>
<td>National Council for Science, Technology, and Technological Innovation (CONCYTEC)</td>
<td>2004</td>
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<td>Poland</td>
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<td>38</td>
<td>NCBR</td>
<td>2007</td>
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<td>Portugal</td>
<td>High-income</td>
<td>31</td>
<td>Portuguese Agency for Competitiveness and Innovation</td>
<td>1975</td>
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<td>Romania</td>
<td>Upper-middle-income</td>
<td>42</td>
<td>Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI)</td>
<td>2010</td>
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<td>Russian Federation</td>
<td>Upper-middle-income</td>
<td>45</td>
<td>Skolkovo Foundation</td>
<td>2010</td>
</tr>
<tr>
<td>Rwanda</td>
<td>Low-income</td>
<td>99</td>
<td>Rwanda Development Board-Information and Communication Technology Department (RDB-ICT)</td>
<td>2008</td>
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<tr>
<td>Serbia</td>
<td>Upper-middle-income</td>
<td>62</td>
<td>Innovation Fund (IF)</td>
<td>2011</td>
</tr>
<tr>
<td>Singapore</td>
<td>High-income</td>
<td>7</td>
<td>Standards, Productivity and Innovation Board (SPRING)</td>
<td>1996</td>
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<tr>
<td>Slovak Republic</td>
<td>High-income</td>
<td>34</td>
<td>Slovak Innovation and Energy Agency</td>
<td>2007</td>
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<tr>
<td>Slovenia</td>
<td>High-income</td>
<td>32</td>
<td>SPIRIT Slovenia – Public Agency of the Republic of Slovenia for the Promotion of Entrepreneurship, Innovation, Development, Investment and Tourism</td>
<td>2013</td>
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<tr>
<td>South Africa</td>
<td>Upper-middle-income</td>
<td>57</td>
<td>National Advisory Council on Innovation</td>
<td>2006</td>
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<tr>
<td>Spain</td>
<td>High-income</td>
<td>28</td>
<td>Ministry of Science and Innovation – Centre for the Development of Industrial Technology (CDTI)</td>
<td>1977</td>
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<tr>
<td>Sri Lanka</td>
<td>Lower-middle-income</td>
<td>90</td>
<td>Information and Communication Technology Agency of Sri Lanka (ICTA)</td>
<td>2003</td>
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<tr>
<td>Sweden</td>
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<td>2</td>
<td>VINNOVA</td>
<td>2001</td>
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<td>Taiwan, China</td>
<td>High-income</td>
<td>-</td>
<td>Industrial Technology Research Institute (ITRI)</td>
<td>1973</td>
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<td>Thailand</td>
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<td>51</td>
<td>National Innovation Agency</td>
<td>2003</td>
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<tr>
<td>Turkey</td>
<td>Upper-middle-income</td>
<td>43</td>
<td>Technology Development Foundation of Turkey (TTGV)</td>
<td>1991</td>
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<td>High-income</td>
<td>5</td>
<td>Department of Business, Innovation, and Skills</td>
<td>2009</td>
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<td>Uruguay</td>
<td>High-income</td>
<td>67</td>
<td>National Research and Innovation Agency (Agencia Nacional de Investigación e Innovación−ANII)</td>
<td>2008</td>
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<tr>
<td>Vietnam</td>
<td>Lower-middle-income</td>
<td>47</td>
<td>Innovation Partnership Program</td>
<td>2014</td>
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</table>

Note: Agencies highlighted in dark blue signify mature innovation systems: fall within (a) the top quartile of the GII 2017 ranking (Rank 1–32 of 127 countries) and (b) the high-income category. Several of these were already covered by the NESTA report.

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