VIEWPOINT

ARTHUR D LITTLE
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TAILORED RDI STRATEGIES FOR RESOURCE-CONSTRAINED ECOSYSTEMS

A toolkit to build thriving RDI ecosystems in emerging economies

A thriving research, development, and innovation (RDI) ecosystem is essential to driving growth and improving living standards. Yet, governments in emerging economies often argue that when funds are limited, a "luxury" like RDI is not a priority. But in an increasingly competitive world, innovation is no longer a luxury — it is imperative for survival and growth. This Viewpoint explores ways emerging economies can maximize their RDI ecosystem potential with limited resources.

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RDI CHALLENGES IN EMERGING ECONOMIES

Emerging economies have unique and interconnected constraints that influence RDI ecosystems:

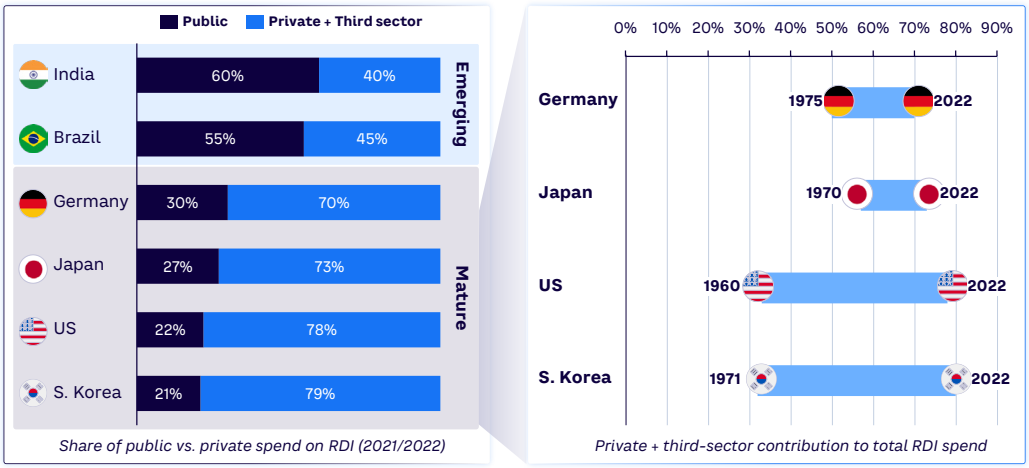
- **Constrained government budgets.** Unlike mature nations, which can allocate substantial resources to high-risk, high-reward innovation, emerging countries face higher budget limitations. For example, the US allocated more than US $18 billion to Operation Warp Speed to accelerate COVID-19 vaccine development — an investment amount beyond the reach of nearly all emerging economies. Indeed, such substantial and topical outlays illustrate clearly why replicating advanced nations' resource-intensive innovation models is impossible for budgetarily constrained countries.
- **Limited alternate sources of funding.** Emerging countries like India and Brazil get around 60% of their RDI funding from public sources (see Figure 1). Although this was historically the path to private sector investment attraction for most Organisation for Economic Co-operation and Development (OECD) countries (which relied heavily on government funding during their development phases to lay the groundwork before transitioning to private sector dominance), it remains a pressing challenge for emerging countries today. Governments in emerging economies have to be the majority contributor to the ecosystem to lay the necessary foundation despite an already constrained budget.
- **Limited absorptive and adaptive capacities.** Emerging economies typically have lower absorptive capacities (the ability to adopt, adapt, and benefit from external knowledge and technologies). For example, a World Bank report found that although numerous emerging markets have significant exposure to advanced technologies through foreign direct investment, trade, and international collaboration, limited local RDI and technical skills often result in a suboptimal application of these external innovations, diminishing their economic impact.

POSSIBLE SOLUTIONS

Mature nations pursue ambitious, resource-intensive targets. Emerging economies should not expect that model to work, given the above-mentioned challenges (and others).

The policy toolkit for governments includes steering mechanisms, financial incentives, setting up new institutions, and creating linkage programs, each with varying degrees of active government involvement. Below, we examine a few select solutions for emerging market governments to achieve their RDI objectives while operating within their constraints.

Figure 1. Public vs. private contribution in mature vs. emerging countries



Source: Arthur D. Little

Government as an enabler

As one of the largest drivers of economic activity and RDI funding, governments can play a central role in boosting the RDI ecosystem. As Mariana Mazzucato, founding director of the UCL Institute for Innovation & Public Purpose, lays out in The Entrepreneurial State, the role of government is not merely to correct market failure, but to act as a lead risk-taker and market shaper. Government can provide direction, set priorities, and foster an agile and dynamic RDI ecosystem, leaving private players to respond quickly to emerging opportunities.

The Triple Helix model, first articulated in 1995 by Henry Etzkowitz and Loet Leydesdorff, suggests a dynamic interaction among government, academia, and industry. The model shows how innovation ecosystems work best when each actor concentrates on its core strength: government on legislation, public-good investment, and enabling infrastructure; academia on advancing research and intellectual property (IP); and the private sector on translating those discoveries into market-ready products.

Two mutually reinforcing strategies stand out:

1. **Demand-side interventions.** The government shifts from a focus on forcing innovation supply by funding specific research and/or setting research curricula to stimulate demand via public procurement of innovation (PPI) and pre-commercial procurement (PCP). Government acts as a first customer, providing a guaranteed market and clear commercialization pathway for innovative RDI solutions. In this way, it shifts from funding inputs to paying for results, encouraging innovation aligned with measurable outcomes.

   A powerful example is South Korea's strategy in the 1980s and 1990s. By strategically procuring locally mature technologies (e.g., mobile telecommunications devices from domestic firms like Samsung and LG), the South Korean government significantly reduced market uncertainty, allowing these firms to achieve economies of scale domestically before expanding internationally. The US government's historic procurement of semiconductors and computer technologies, initially driven by defense applications, similarly laid the foundation for Silicon Valley's global technology dominance.

   Beyond directly creating demand, governments can stimulate it by removing outdated regulatory barriers and establishing "innovation sandboxes" where new technologies can be safely tested under relaxed rules, as explored in the Arthur D. Little (ADL) report "Smart Regulation: The Gateway to Frontier Innovation." As innovations frequently outpace regulations, they risk getting bogged down in bureaucracy. Therefore, innovation sandboxes can significantly lower innovation barriers and stimulate private sector RDI.

2. **Co-funding and de-risking mechanisms for private investments.** In mature ecosystems, the private sector actively invests in high-risk, disruptive endeavors, driven by the potential for outsized returns. In emerging economies, private players experience amplified market frictions and uncertainties, coupled with lower competitive pressures and modest market demand for cutting-edge solutions, significantly reducing investment incentives.

   The solution for this underinvestment is not for the government to "do" RDI itself but to act as a lead risk-taker — a role championed by Mazzucato. As she argues, governments should shoulder the earliest, highest-risk investments to define and de-risk emerging markets rather than merely correcting failures. In practice, this means co-funding RDI through private capital allocators (venture capital, private equity, incubators, accelerators) and aligning those investments around clear, mission-oriented goals. Such targeted support reduces perceived risk for private investors in ventures with long payback periods or high uncertainty.

This catalyzes private sector participation while avoiding the market distortions that can arise from large, direct public sector execution (which could further dampen private sector interest).

Use existing resources

Inefficient use of resources, particularly research infrastructure, severely limits potential innovation outcomes. Emerging economies must:

- **Maximize shared access to existing research infrastructure.** In emerging economies, use of research infrastructure is often limited by restricted access, poor operational efficiency, or fragmented institutional management despite a larger fraction of this infrastructure being government-funded (and therefore a public resource). Governments can strengthen ecosystem linkages by introducing clear, open-access policies that reduce access barriers to public research facilities. ADL's Blueshift report "Eureka! On Steroids" shows that mutualizing compute and data platforms (e.g., shared supercomputing centers) can lower infrastructure costs by 30% to 40% while broadening RDI reach. Integrating dispersed labs into consolidated organizations (e.g., Germany's Fraunhofer Institutes) can further enhance operational efficiency, quality of research outputs, and resource sharing. These do not require substantial capital expenditure, but they can significantly benefit innovators who may otherwise not be able to access requisite resources. Government can also stimulate higher demand for infrastructure. For example, Business Finland launched a support program that offered subsidized access (via innovation vouchers) to RDI infrastructure to small and medium-sized enterprises and start-ups that would otherwise not have been able to afford it. This had the twin benefit of increasing use while encouraging entrepreneurship.
- **Encourage impactful funding through performance-based funding (PBF) models.** PBF models help governments route public funding to places where it will have the highest impact, extracting maximum output and impact from available funding. This is important because in emerging markets, public funding makes up a large portion of the overall RDI expenditure, and they generally have both lower funding volumes and lower relative RDI productivity due to greater market frictions. As described in the Viewpoint "Driving Research Excellence Through Performance-Based Funding," under PBF models, institutions receive funding contingent on demonstrable innovation outcomes such as industry collaboration, technology commercialization, and market impact. The performance is assessed through government-set, predefined metrics — sending a clear signal to innovators on the strategic direction required by the nation. Almost all top Global Innovation Index countries use tailored forms of PBF models. Additionally, emerging markets such as Chile, Malaysia, India, and South Africa have deployed PBF models, showcasing their potential to direct innovation activities without outright government control.

Together, these resource-optimization strategies enable emerging economies to substantially enhance RDI ecosystem effectiveness, converting existing infrastructure and funding into higher economic and societal returns.

Enhance private sector leadership

To drive innovation under resource constraints, emerging economies must forge robust linkages between private firms, academia, and government. Private firms are well-positioned to rapidly align innovation with market needs. Businesses can leverage strong ecosystem linkages to translate research outputs into commercial products and scale solutions, maximizing the economic impact of limited RDI investments.

For example:

- **Public-private partnerships.** Success in innovation ecosystems hinges on a strong private sector role, strategically funneled toward areas where public sector priorities align with the private sector. A great example is Egypt's Smart Village. The Ministry of Communications and Information Technology provided 20% of the initial capital (covering land, core infrastructure, and utilities), which catalyzed the private sector to fund the remaining 80%. Today, this is a high-tech business district that hosts more than 880 companies and accounts for 65% of Cairo's tech park capacity. Governments should establish partnerships with the private sector to develop and commercialize public research infrastructure. Even in the case of existing public infrastructure, partnerships with the private sector have the potential to better align incentives, unlocking the commercial potential of these facilities, improving their utilization, and providing supplemental funding streams (in addition to public funding). Inspiration for these can be taken from the success of examples in the US and UK, where partnership with the private sector led to much better utilization of public research infrastructure (see sidebar "US National Labs").
- **Industry-academic partnerships.** Emerging markets suffer disproportionately from the "valley of death" phenomenon since research in Technology Readiness Levels 4 to 7 is much more resource-intensive than early-stage research. Moreover, research and technology institutes in emerging markets are relatively less mature (and not as well-funded) compared to universities. The policy toolkit for governments must include a focus on intermediary institutions, crucial for translating research into commercially viable products. Initiatives like India's BIRAC Biotechnology Ignition Grant program, which awards proof-of-concept grants with IP and regulatory coaching, link teams to biotech mentors and investors via demo days. The program has supported more than 1,000 start-ups, filed 75 patents, and commercialized 164 products, with more than 90 start-ups raising more than $116 million in follow-on funding, effectively bridging the gap between academic research and market-ready start-ups.

US National Labs

The US leveraged its national labs under a government-owned, contractor-operated (GOCO) model. The government retains ownership of the laboratories and their high-tech infrastructure (e.g., supercomputers, particle accelerators, and advanced testing facilities) but entrusts their management and operations to private companies, academic institutions, or nonprofits. This approach allows labs to adapt to rapidly evolving technological challenges and attract top-tier talent by using competitive industry-standard practices. The GOCO structure also minimizes bureaucratic inefficiencies and fosters an entrepreneurial culture within the labs, facilitating quicker decision-making and strong alignment with national RDI priorities.

By combining government oversight with private sector efficiency, the model enhances collaboration across sectors, creating a dynamic ecosystem where public, private, and academic entities can coalesce around shared objectives in science, technology, and innovation. The labs have supported more than 11,000 collaborative agreements and 2,500 technology transfer licenses, generating breakthrough achievements in renewable energy and national security.
For example, advances in energy storage and quantum computing showcase the labs' capacity to maximize resources and talent in line with national priorities.

Such programs not only boost commercialization rates; they instill market-oriented mindsets within academic institutions. Coupled with support for technology-transfer offices, good research conducted by academia can be commercialized, thus realizing its economic potential.

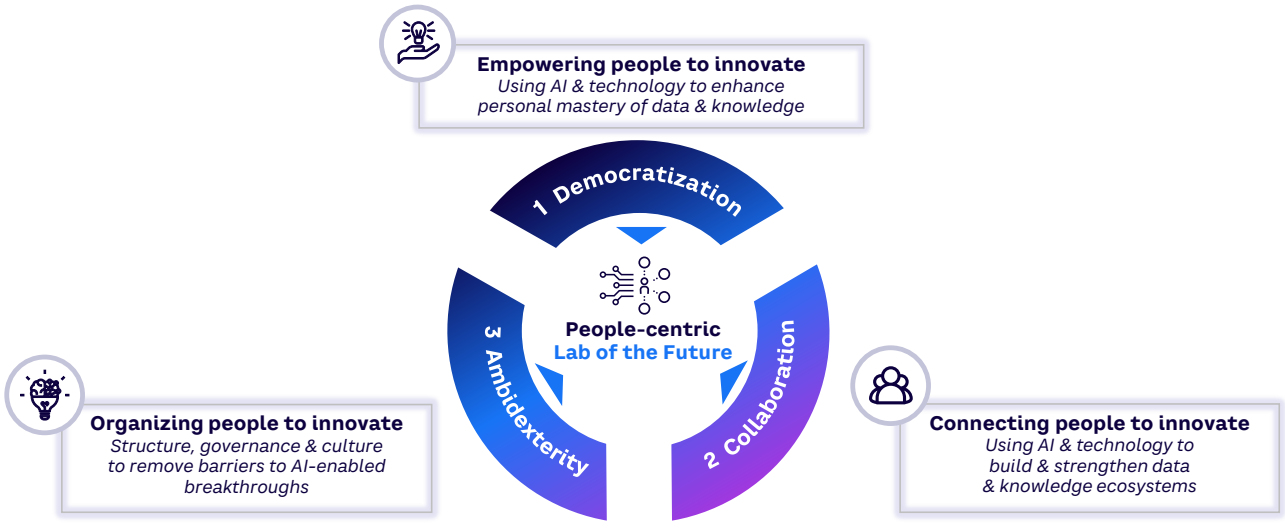
LEAPFROGGING WITH AI

As governments in emerging markets work toward a strong foundation for their RDI infrastructure, the advent of AI presents a golden opportunity for them to jump ahead in their RDI journey. As per ADL's Lab of the Future concept (see Figure 2), AI will be critical to enhancing innovation efficiency and effectiveness.

However, governments must take the right steps to ensure AI's benefits can be leveraged by their RDI ecosystem. This includes democratizing AI-enabled research and leveraging AI to supercharge ecosystem networks (including industry and academia partnerships), as described in "Eureka! On Steroids." Resource-effective initiatives include:

- **Establishing subsidized access to AI resources.** Tools such as Atomwise (for in-silico screening) and DeepMind (for modeling) enable AI-driven simulation and virtual experimentation that replicate high-end labs in software. Combined with enforcement of open data mandates for improved localized AI model development, this approach can help emerging economies slash infrastructure costs, lower entry barriers, and boost RDI productivity.
- **Supporting/building AI enhancements for RDI linkage platforms.** Support/encourage AI enhancement into platforms that connect various innovation ecosystem stakeholders. Use of AI can improve network building — better matching innovation demand with existing research expertise and infrastructure within the country. For example, the Halo platform indexes publications, patents, and expertise against corporate problem statements, cutting search friction, catalyzing targeted collaborations, and efficiently leveraging existing RDI infrastructure.

Figure 2. ADL's AI-enabled Lab of the Future



Source: Arthur D. Little

CONCLUSION

A ROADMAP TO RDI SUCCESS

EMULATING POLICIES OR TARGETS FROM MATURE NATIONS IS UNLIKELY TO PROVIDE POSITIVE OUTCOMES

Policymakers in emerging markets must craft a custom approach to their RDI ecosystems — emulating policies or targets from mature nations is unlikely to provide positive outcomes. We recommend the following steps to assess solutions and design a roadmap:

1. **Build a comprehensive view of the ecosystem's** dynamics, challenges, and stakeholder needs (including the broader economy).
2. **Consider the ecosystem's limitations and existing capabilities** (financial and otherwise).
3. **Assess the feasibility of implementing the portfolio of solutions** in the current ecosystem and the solutions' effectiveness in yielding desired results.

With these three items accomplished, policymakers can successfully craft a roadmap that supports local needs and national ambitions.

Arthur D. Little has been at the forefront of innovation since 1886. We are an acknowledged thought leader in linking strategy, innovation and transformation in technology-intensive and converging industries. We navigate our clients through changing business ecosystems to uncover new growth opportunities. We enable our clients to build innovation capabilities and transform their organizations.

Our consultants have strong practical industry experience combined with excellent knowledge of key trends and dynamics. ADL is present in the most important business centers around the world. We are proud to serve most of the Fortune 1000 companies, in addition to other leading firms and public sector organizations.

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