Editorial Article

Strategic Research Investment for Sustainable Development in Low and Lower Middle-Income Countries

Inoka C. Perera, PhD
Professor
Synthetic Biology Laboratory
Department of Zoology and Environment Sciences
Faculty of Science
University of Colombo
Sri Lanka

Strategic research investment can profoundly change the development path of Low and Lower Middle-Income Countries (LMICs). This editorial examines successful development strategies, theoretical frameworks, and institutional models to create a guide for research investment in these nations. The insights reveal that smart research investments not only produce measurable economic benefits but also cultivate innovation capabilities necessary to avoid "middle-income traps". Countries that implement systematic research strategies, supported by robust policy frameworks, achieve progress in health, agriculture, and manufacturing. Conversely, nations that fail to develop and follow transformative policies and roadmaps risk prolonged technological reliance (Figure 1).

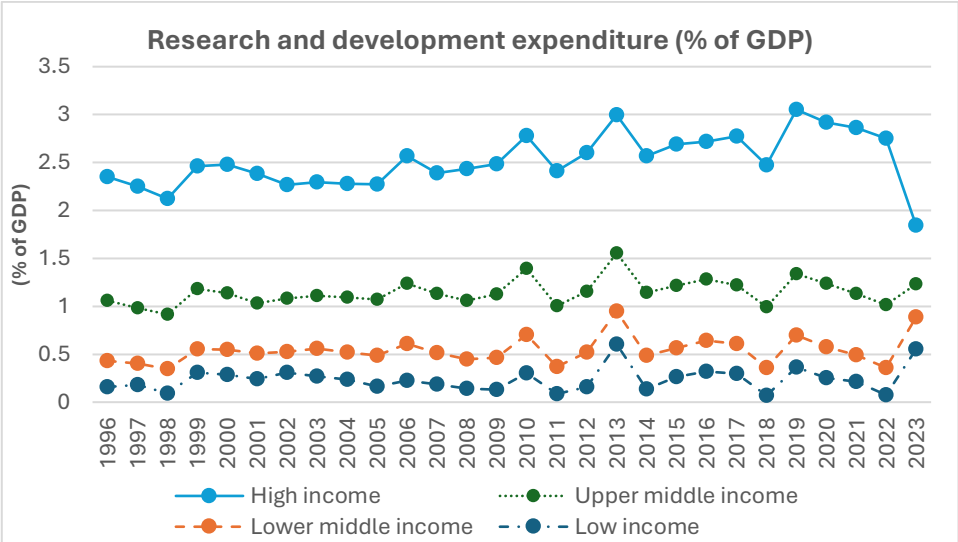

Figure 1: Research and Development Expenditure (% of GDP) by Income Group, 1996-2023, illustrating the persistent R&D investment gaps between high-income countries (maintaining 2.5-3.0% GDP), upper middle-income countries (gradual increase from 1.0% to 1.5%), lower middle-income countries (modest growth from 0.4% to 1.0%), and low-income countries (stagnant at 0.2-0.6%). Source of data: https://data.worldbank.org

Overly focusing on applied research to solve immediate problems can also create dangerous knowledge gaps that ultimately hinder long-term growth. Recent analyses of LMICs show that research strategies determine whether a nation achieves lasting prosperity or remains dependent on

*Correspondence: icperera@sci.cmb.ac.lk

external technological innovation. The evidence is clear! Countries that overlook strategic research investment, especially the balance between applied and fundamental research, face significant risks of delayed economic growth.

Challenges that LMICs face are interconnected in areas such as health systems, agricultural productivity, infrastructure development, education quality, climate adaptation, and poverty reduction. These issues demand both immediate solutions and the building of long-term systemic capacity. Current data highlights the scale of these challenges: 821 million people globally are undernourished, over 800 million lack electricity, and 736 million live on less than $1.90 a day.

However, the most compelling evidence comes from success stories that demonstrate how strategic research investment can transform entire economies. Rwanda, for instance, exemplifies this potential through systematic investment in health system research. Between 2005 and 2015, the country reduced maternal mortality by 60%, achieved 95% health insurance coverage, and built a strong primary healthcare system with over 45,000 community health workers. This success was a direct result of research implementation in community health programs, health financing studies that informed insurance design, and the systematic integration of evidence-based interventions.

Similarly, Bangladesh utilized agricultural research to become the world's third-largest rice producer, despite high population density and climate vulnerabilities. Vietnam's manufacturing research enabled its transition from an agricultural economy to a major global manufacturing hub. These transformations share common traits; strong political dedication to research-based solutions, significant investment in institutional capacity, systematic integration of research with policy implementation, and a sustained commitment spanning decades, not just electoral cycles.

The evidence shows that research investment yields measurable economic returns. Analysis by the UNDP suggests that appropriate research and innovation policies could accelerate LMIC GDP growth by $19.2 trillion by 2030, helping to achieve the desired development goals 2-3 years faster than otherwise possible.

The Power of Fundamental Research

Fundamental research builds three crucial capacities which are deemed essential for sustainable development such as scientific infrastructure, human capital, and innovation networks. The ripple effects from fundamental research are particularly significant in the context of LMIC, suggesting that these investments in LMICs generate higher returns than in developed countries. The Consultative Group on International Agricultural Research (CGIAR) provides definitive proof; 50 years of fundamental agricultural research have generated $47 billion in annual economic welfare gains across 221 million hectares, with technologies adopted in 92 countries.

A Strategic Funding Framework

Analyzing successful development paths reveals clear patterns for optimizing research funding. A strategic framework must consider the development stage, existing research capacity, urgent developmental needs, and long-term competitiveness objectives. Countries in the early stages of development should allocate 75-80% of their research funding to applied research and 20-25% to fundamental research. As countries approach advanced middle-income status, these ratios should evolve toward 55-60% for applied research and 40-45% for fundamental research.

South Korea exemplifies this strategic evolution in research investment. Starting with government funding making up 53.5% of total R&D in 1981, this figure decreased to 24.3% by 2005 as private sector involvement grew. Korea consistently focused on applied industrial technology while gradually building fundamental research capacity. The country's R&D intensity increased from 0.4% to 4.24% of GDP, enabling its transition from technology adoption to innovation leadership. Samsung's journey from a noodle manufacturer to a global smartphone innovator illustrates this strategic progression.

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China's approach initially emphasized experimental development, accounting for 83% of total R&D spending, compared to 64% in the US, with basic research comprising only 6%. This focus on applied research facilitated rapid industrialization and technology absorption, though China is now increasingly investing in fundamental research as it approaches technological frontiers. Brazil's experience offers cautionary lessons; R&D spending remained low at 1.26% of GDP with limited private sector engagement, demonstrating that macroeconomic stability and private sector involvement are crucial for sustained growth in research investment.

The proposed framework includes specific metrics for measuring success and mechanisms for adapting to changing priorities. Target R&D intensity should progress from 1.0-1.5% of GDP for early-stage countries to 3.5-4.0% for advanced economies. Researcher density should increase from 500-1,000 per million population to 4,000-6,000 per million.

The Indispensable Nature of Fundamental Research

Despite immediate development pressures, the evidence for sustained fundamental research investment in LMICs is compelling. The World Bank's identification of innovation as essential for avoiding the middle-income trap, which affects over 100 countries, certainly makes fundamental research investment an economic necessity, not an option. Countries that bypass systematic investment in research capacity building face severe limitations on long-term competitiveness and technological independence. Risk analysis reveals that nations focusing exclusively on applied research encounter development traps that constrain long-term growth.

The 34 countries that successfully escaped middle-income status since 1990 share common characteristics: substantial public investments in research infrastructure, strong university-industry linkages, merit-based talent systems, and long-term research strategies rather than a short-term applied focus.

Conclusion

The potential for transformation is substantial. Quantified evidence from successful cases demonstrates that strategic research investment not only generates immediate development benefits but also creates the innovation capacity essential for sustained prosperity. The choice for LMIC leaders is clear: Invest systematically in research capacity building now or accept prolonged technological dependence and economic stagnation! Although compelling evidence provides the roadmap, successful implementation requires strong political will and institutional commitment to pursue research-driven sustainable development strategies that secure long-term national competitiveness in an increasingly knowledge-driven global economy.

**Correspondence: icperera@sci.cmb.ac.lk*