

The Role of Physicists in Shaping the Future of Higher Education Reforms in Sri Lanka

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by

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1. Introduction

Sri Lanka stands today at a critical crossroads in shaping the future of its education system. Education has always been one of the strongest pillars of our nation's social progress and democratic development. The commitment to free education, introduced decades ago, opened the doors of opportunity to generations of Sri Lankans and played a transformative role in building our human capital.

Yet today, as the world undergoes profound technological, economic, and social transformations, our tertiary education system must evolve to meet new realities. The demands of the knowledge economy, rapid technological advancement, and the aspirations of our young people require us to rethink how we organize, expand, and strengthen higher education in Sri Lanka. The development of a '*National Policy on Higher Education*', therefore, represents not merely a sectoral reform but a national priority aimed at empowering our youth, strengthening innovation, and positioning Sri Lanka as a competitive knowledge hub in the region.

Several years ago, a bright student from a rural school in Sri Lanka achieved excellent results at the G.C.E. Advanced Level examination in the physical science stream. His teachers believed he had the potential to become a scientist. His family had only one dream: that he would enter a state university and pursue physics. However, despite qualifying for university admission, he could not secure a place due to the limited capacity of our university system. Eventually, he enrolled in a different program through an alternative pathway. Like many talented young Sri Lankans, he slowly lost his dream of becoming a physicist.

Now imagine this story repeated tens of thousands of times every year across our country. Every year, roughly 160,000 students qualify for university admission through the Advanced Level examination, yet only about 40,000 to 42,000 students are admitted to state universities. Behind these numbers are not just statistics. They represent dreams postponed, talent underutilized, and potential that the nation may never fully benefit from. Some of those students could have become physicists, engineers, entrepreneurs, innovators, or policymakers who might contribute to solving the challenges facing our society.

This reality compels us to ask an important question. Are we fully utilizing the intellectual potential of our nation? And more importantly, how should Sri Lanka reform its higher education system to unlock that potential? It is within this broader context that the role of physicists in shaping higher education reforms in Sri Lanka becomes particularly significant.

2. Industrial Revolutions and the Transformation of Knowledge

To understand the urgency of reforming higher education, it is useful to reflect on the broader historical forces that have shaped the evolution of knowledge, industry, and society. Over the past three centuries, the world has experienced a series of industrial revolutions that fundamentally transformed economies, technologies, and education systems.

The First Industrial Revolution, which began in the late 18th century, was driven by steam power and mechanization. It marked the transition from agrarian economies to industrial production. Scientific understanding of mechanics, thermodynamics, and materials played a critical role in enabling these transformations. The Second Industrial Revolution, emerging in the late 19th and early 20th centuries, introduced electricity, mass production, and modern manufacturing systems. Advances in electromagnetism, materials science, and engineering fields deeply rooted in physics enabled the development of electrical grids, communication systems, and industrial machinery that reshaped modern economies. The Third Industrial Revolution, often referred to as the digital revolution, began in the latter half of the 20th century. It was driven by semiconductors, computing technologies, and the internet. Quantum physics and solid-state physics laid the foundation for the invention of the transistor, integrated circuits, and the digital technologies that underpin today's information society. Today, we stand in the midst of the Fourth Industrial Revolution, characterized by artificial intelligence, quantum technologies, advanced materials, robotics, biotechnology, and data-driven innovation. The boundaries between physical, digital, and biological worlds are rapidly converging. In this new era, knowledge itself has become the most valuable economic resource. These technological transformations are not merely industrial developments; they are deeply connected to the evolution of universities and research institutions.

Each industrial revolution has required new forms of knowledge, new skills, and new models of education. Universities around the world have continually adapted their curricula, research priorities, and institutional structures to meet these changing demands. For Sri Lanka, this moment presents both a challenge and an opportunity. If our higher education system evolves in alignment with these global transformations, it can empower our youth to participate in the knowledge economy and drive national innovation. If it does not, we risk falling further behind in an increasingly competitive and technology-driven world. Physicists occupy a particularly important place in this transformation.

Many of the foundational technologies that define modern industry, from semiconductors and lasers to medical imaging and quantum computing, emerged from advances in physics. As such, physicists are uniquely positioned to guide the scientific, technological, and educational directions necessary for the future. Therefore, as Sri Lanka considers reforms to its higher education system, it is essential that we recognize the strategic importance of fundamental sciences, particularly physics, in shaping the technological and intellectual foundations of the nation.

3. Why Physicists Matter in Shaping Higher Education Reform

The historical trajectory of industrial revolutions reveals a clear pattern; transformative technological shifts are almost always rooted in advances in fundamental science. Among these sciences, physics has consistently served as the intellectual engine that powers technological progress. From the discovery of the laws of motion that enabled early mechanical engineering, to the understanding of electromagnetism that made modern electrical systems possible, and

from quantum mechanics that gave birth to the semiconductor industry, to modern advances in photonics, nanotechnology, and quantum computing, physics has repeatedly reshaped the technological landscape of the world.

However, the contribution of physicists extends far beyond the development of technology itself. Physicists are trained to think analytically, approach complex systems systematically, and develop solutions based on evidence and fundamental principles. These qualities are precisely what are required when societies attempt to reform complex systems such as higher education. Higher education reform is not merely about administrative restructuring or policy adjustments. It requires a deeper understanding of how knowledge is created, transmitted, and applied in a rapidly changing world. In this process, the intellectual traditions of physics, rigorous reasoning, interdisciplinary thinking, and innovation driven by curiosity can provide valuable guidance.

For Sri Lanka, the involvement of physicists in national conversations on higher education reform is therefore not incidental; it is essential. Physicists can contribute not only as scientists but also as educators, innovators, and policy thinkers who understand the deep relationship between scientific discovery, technological development, and societal progress. As Sri Lanka seeks to position itself within the knowledge-driven global economy, the voice of the scientific community, particularly physicists, must play a central role in shaping the vision, structure, and priorities of our higher education system.

4. The Historical Strength of Sri Lanka's Education System

Sri Lanka has long been admired for its commitment to free education. The education reforms introduced in the mid-20th century transformed access to schooling and created one of the most literate societies in Asia. Even today, Sri Lanka maintains a literacy rate above 92 percent, one of the highest in the region. This remarkable achievement enabled generations of students, from rural villages to urban centres, to enter universities and contribute to national development. However, while access to primary and secondary education expanded significantly, expansion in higher education capacity has been comparatively slower.

Today, Sri Lanka's tertiary education system consists of 17 state universities and several higher education institutes under the purview of the University Grants Commission, alongside five state-owned universities that operate outside the UGC framework. The system further includes the National Institute of Education, which is authorized by an Act of Parliament to award degrees, as well as a growing number of non-state higher education institutions granted degree-awarding status (32 institutions and 293 degree programs as of March 13, 2026), collectively contributing to the expansion and diversification of higher education opportunities in Sri Lanka.

Sri Lanka's current education pipeline clearly demonstrates the urgency of expanding and diversifying the tertiary education sector. In 2023, a total of 229,057 students sat for the G.C.E. Advanced Level examination, of whom 151,343 students (66%) qualified for university admission, while 77,714 students (34%) did not meet the required threshold. At an earlier stage of the pipeline, 311,321 students sat for the G.C.E. Ordinary Level examination in 2021, with 231,982 (75%) passing and 79,325 (25%) not qualifying for progression to Advanced Level studies. Despite this large and growing pool of students progressing through the education system, the state university sector collectively admits only about 40,000 to 45,000 students annually. Consequently, a significant number of qualified students seek alternative pathways

to higher education. Each year, it is estimated that nearly 25,000 to 30,000 Sri Lankan students leave the country to pursue higher education abroad, resulting in a considerable outflow of both financial resources and human capital. In addition, thousands of students enroll in non-state and transnational education programs within the country.

These trends clearly indicate that the demand for higher education in Sri Lanka far exceeds the capacity of the traditional university system, highlighting the need to expand and strengthen diverse tertiary education pathways, including technical and vocational education, non-state higher education institutions, and transnational education programs. This situation, therefore, presents both a critical challenge and a strategic opportunity for reform.

5. Global Transformation of Universities

Around the world, universities are undergoing significant transformation. Three major forces are reshaping higher education globally. First, the rise of the knowledge economy, where economic growth is increasingly driven by knowledge, research, and innovation. Second, the rapid advancement of digital technologies, including artificial intelligence, data science, and advanced computing. Third, the need for interdisciplinary solutions to complex global challenges, such as climate change, energy sustainability, global health, and technological disruption. Universities are no longer simply institutions that transmit knowledge.

They are increasingly expected to generate knowledge, innovate technologies, and contribute directly to economic and societal development. Countries that successfully align their higher education systems with these transformations become centres of innovation and economic growth. Sri Lanka cannot remain outside this global transformation. If we aspire to become a knowledge hub in the Indian Ocean region, our universities must evolve into research-driven, innovation-oriented institutions.

6. Structural Challenges in Sri Lanka's Higher Education System

While Sri Lanka's higher education system has many notable strengths and a proud legacy, it continues to face several structural challenges that must be addressed if the system is to support innovation-driven development and fully harness the nation's scientific and intellectual potential.

6.1 Limited Access

The most visible challenge is limited access to university education. When nearly three-quarters of qualified students cannot enter state universities, the system inevitably creates frustration and inequality in opportunity. Expanding access while maintaining quality is therefore a central challenge of higher education reform.

6.2 Disciplinary Imbalance

Another issue is the distribution of students across academic disciplines. In many countries, national development strategies emphasize STEM fields: science, technology, engineering, and mathematics. While Sri Lanka has produced outstanding graduates in many disciplines, there remains a need to strengthen scientific and technological capacity to support innovation-driven development. Within STEM itself, physics plays a foundational role. Physics is often described

as the fundamental science that underpins modern technology. The technologies that shape our modern world, such as semiconductors, lasers, telecommunications, renewable energy systems, satellite technology, and quantum computing, all trace their origins to fundamental discoveries in physics. Strengthening physics education and research, therefore, strengthens the entire technological ecosystem of a nation.

6.3 Research and Innovation Capacity

Another challenge relates to research intensity and innovation ecosystems. Modern universities are not only teaching institutions; they are also centres of discovery and innovation. Countries that invest in research universities often experience significant growth in technology development, industrial innovation, and high-value economic sectors. Sri Lanka's universities have produced important research contributions, yet there remains considerable room to strengthen research funding, industry collaboration, and technology commercialization.

7. Why Physicists Matter in Higher Education Reform

At this point, one might ask, why specifically emphasize the role of physicists in higher education reform? The answer lies in the intellectual culture of physics itself. Physics trains individuals to approach problems with precision, curiosity, and analytical rigor. Physicists are trained to understand complex systems, analyze patterns in data, and derive insights from empirical evidence. These skills are highly relevant not only in scientific research but also in policy design, institutional planning, and systemic reform. A few ways in which physicists can contribute are stated below:

7.1 Evidence-Based Policy Design

Physics is fundamentally an evidence-based discipline. Physicists rely on measurement, experimentation, quantitative analysis, etc. These same principles can strengthen policy decisions in higher education. Instead of relying solely on tradition or opinion, reforms should be guided by data on student outcomes, research productivity, graduate employability, and institutional performance. Physicists can contribute to designing analytical frameworks that support evidence-based decision-making in higher education governance.

7.2 Strengthening STEM Ecosystems

Physics forms the conceptual foundation for many STEM disciplines. A strong physics ecosystem strengthens engineering, computing, materials science, and emerging technologies. Advances in quantum physics are driving new developments in computing and secure communication. Research in materials physics is enabling breakthroughs in renewable energy technologies. Developments in medical physics are transforming diagnostics and cancer treatment. Thus, investing in physics education and research strengthens multiple sectors of the knowledge economy.

7.3 Interdisciplinary Leadership

Physicists often work at the interface of disciplines. In modern research environments, physicists collaborate with engineers, chemists, computer scientists, and biologists. Many of today's global challenges require interdisciplinary solutions. Universities, therefore, need academic leaders who are comfortable crossing disciplinary boundaries and integrating diverse

perspectives. Physicists can play an important role in designing interdisciplinary academic programs and research initiatives.

7.4 Innovation in Teaching and Learning

Physics education research has produced valuable insights into how students learn complex scientific concepts. Innovative approaches such as problem-based learning, inquiry-based laboratories, and computational simulations have improved student engagement and conceptual understanding. These pedagogical innovations can inform broader reforms in teaching and learning across universities.

7.5 Systems Thinking in Institutional Reform

Perhaps most importantly, physics cultivates systems thinking. Physicists study systems where multiple variables interact in dynamic ways. Universities themselves are complex systems, involving governance structures, funding models, research ecosystems, and student experiences. Reforming such systems requires holistic thinking and careful analysis of interactions between different components. Physicists are uniquely trained to think in these terms.

8. The Way Forward for Sri Lanka

If Sri Lanka is to build a higher education system capable of meeting the challenges of the 21st century, several strategic priorities must guide reform. First, expand access to higher education through a diversified ecosystem of public universities, non-state institutions, private institutions, and international collaborations. Second, strengthen research universities that can drive innovation and knowledge creation. Third, promote STEM education and interdisciplinary learning aligned with the needs of the modern economy. Fourth, encourage stronger university–industry partnerships that translate research into real-world impact. Finally, empower academics and scientists to play a greater role in policy dialogue, institutional leadership, and national development strategies. Higher education reform should not be viewed merely as an administrative exercise. It is fundamentally about shaping a nation's intellectual future.

9. The Responsibility of the Physics Community

Physics teaches us that within every complex system there exists a critical threshold, a moment when gradual change leads to sudden transformation. In physics, we call this a phase transition. Water slowly heats, degree by degree, until suddenly it becomes steam. For a long time, change may appear slow and incremental. But when the right conditions emerge, a new state becomes possible. I believe Sri Lanka's higher education system may be approaching such a moment. As members of the physics community represented by the Institute of Physics, Sri Lanka, we have a collective responsibility that goes beyond our laboratories and classrooms. We must contribute to national dialogue on science education, advocate for evidence-based policy, inspire the next generation of scientists, and help shape institutions that nurture discovery and innovation.

There is a well-known saying that "*Mathematics is the queen of the sciences.*" And as history reminds us, even the most powerful king cannot rule wisely without a queen beside him. If we imagine physicists as the king in the great kingdom of knowledge, driven by curiosity to

understand the universe, we must also recognize that no king rules alone. Our queens are many: mathematicians, chemists, biologists, engineers, data scientists, medical scientists, environmental scientists, economists, sociologists, psychologists, policy analysts, and educationalists. Without this court of knowledge, even the most brilliant king would struggle to govern. The message is clear: the future of higher education cannot be shaped by any single discipline, but through a vibrant multidisciplinary collaboration where diverse fields work together to create new knowledge and new possibilities.

10. A Call for Scientific Leadership in Educational Transformation

At this pivotal moment in history, higher education systems across the world are being reshaped by rapid technological change, new forms of knowledge production, and evolving societal needs. Sri Lanka is no exception. The challenge before us is not simply to reform universities, but to reimagine them as dynamic institutions that drive innovation, nurture creativity, and empower future generations.

In this transformation, the role of physicists and the broader scientific community becomes critically important. Physicists have long been explorers of the fundamental laws of nature, but in today's world, they must also become architects of the intellectual and technological future of our society. By contributing to policy dialogue, curriculum innovation, interdisciplinary collaboration, and national research priorities, physicists can help guide Sri Lanka toward a higher education system that is resilient, forward-looking, and globally competitive.

If the industrial revolutions of the past were powered by scientific discovery, the revolutions of the future will depend on how effectively nations mobilize their knowledge communities. The question before us, therefore, is not whether change will come but whether we are prepared to shape that change.

11. A Call to Collective Responsibility

We have a proud tradition of education. We have talented students. We have dedicated academics. What we need now is vision, courage, and collaborative leadership to guide the next phase of transformation. If we succeed, the reforms we discuss today will not simply expand universities. They will expand opportunities for an entire generation. And perhaps somewhere in a classroom in Sri Lanka today, there is a young student who dreams of becoming a scientist. Our responsibility is to ensure that the system we build does not limit that dream but enables it.

As physicists, educators, and scholars, we carry both the responsibility and the opportunity to ensure that Sri Lanka's higher education system evolves in ways that serve not only our universities but the broader aspirations of our nation.

Let us work together to build a higher education system where no dream is limited by opportunity, and where the curiosity of every young mind can illuminate the future of our nation.

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