Advancing Sri Lankan Research: The Emerging Role of Computational Science

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Introduction

In modern scientific research, computation has risen to the forefront as a powerful driver of discovery, alongside theory and experiment. Nowadays, computational research ranges from modeling protein dynamics and predicting climate patterns to analyzing large scale social data and optimizing engineering designs. While many countries have identified computational research as a key contributor to national development and invested heavily in computational infrastructure, others are still in the process of fully integrating computational research into their scientific and development strategies. For a country like Sri Lanka, rich in intellectual talent but constrained by limited resources, computational research is not merely an option; it is a strategic opportunity. Popularizing computational research among Sri Lankan researchers can accelerate innovation and open the access to high impact science. This article explores why computational research matters for Sri Lanka, the barriers that limit its widespread adoption, and the practical steps needed to start a strong, sustainable computational research culture in the country.

Why Computational Research Matters for Sri Lanka?

Traditional experimental research typically depends on costly laboratory infrastructure, including highly specialized instruments, recurring consumables, and continuous maintenance. In contrast, computational research primarily relies on advanced algorithms and access to reliable yet increasingly affordable computing resources (Figure 1), making it a more cost-effective and scalable approach for many scientific investigations. Therefore, computational research substantially lowers the entry barrier for scientists to internationally competitive research, particularly in institutions where funding is unavailable or extremely limited.

Figure 1: Affordable workstations in the Computational Biophysics Laboratory, Department of Chemistry, University of Sri Jayewardenepura.

Globally, funding agencies, journals, and industry increasingly value computational research approaches in many fields. Hybrid studies that integrate simulation, modeling, and data analytics with experiments are frequently appearing in the high impact journals like Nature and Science. Positively managing this trend, Sri Lankan researchers with strong computational skills can position themselves on the global stage more effectively by publishing in high impact journals and competing for global research funding.

One of the greatest advantages of computational research is the availability of powerful open source software. Sri Lankan researchers can benefit immensely from tools such as ORCA and GAMESS for quantum chemical calculations, GROMACS, LAMMPS, and NAMD for molecular simulations, R, Python and Octave for statistics and data analysis, rather than relying on expensive commercial products.

Sri Lanka has an excellent pool of researchers in universities and research institutes, many of whom possess strong experimental and theoretical backgrounds in physics, chemistry, biology and mathematics. Despite notable progress by individual researchers and small groups in modeling, data analytics,

and simulation-based research using open-source tools and international collaborations, computational research remains far from widely adopted in Sri Lanka.

Barriers to Popularization

The growth of computational research in Sri Lanka is restricted by several barriers. One of the main barriers is funding constraints. Many Sri Lankan research grants place strict caps on equipment budgets, often treating computational hardware as a secondary or non essential expense. As a result, researchers are forced to rely on entry level systems that significantly slow simulations and data analysis. Moreover, inadequate funding limits the training of local workforce in computational research. While Sri Lankan students excel in theory, structured training in scientific computing is often missing from undergraduate and postgraduate curricula. Without systematic training, advanced methods such as molecular dynamics, finite element modeling, or machine learning remain inaccessible. Another major challenge for computational research is that researchers in this field often work in isolation, with few opportunities for peer learning, knowledge sharing, and meaningful collaboration within the country. The absence of strong national networks or forums reduces knowledge sharing and slows collective progress. The decision-making body of many Sri Lankan institutes has a persistent misconception that computational research is merely supportive of experimental work. This perception undervalues in silico experiments that can generate independent hypotheses testing. In evaluation processes, such as thesis assessments, promotions, and grant reviews, computational work is usually scrutinized improperly by non specialist panels.

Strategies to Popularize Computational Research

To popularize computational research among Sri Lankan researchers, exposure must begin early. Universities should introduce compulsory courses in scientific programming (Python, R, MATLAB, C++) and embed these components into core science subjects. Postgraduate programs should recognize computational theses as standalone research contributions, not merely supplements to experiments. Sri Lanka needs to substantially improve access to computing resources, which at present remains severely limited. Funding agencies and research councils can play a pivotal role by recognizing computational hardware as a core research infrastructure and allocating enough funding to acquire enough computational power. If distributing limited funds across many computational proposals is challenging, institutions can develop shared departmental or inter university computing clusters. Government can contribute to the development of computational research by establishing national level supercomputing centers. Although the initial investment required for such an initiative is substantial, the benefits will be long-term and sustainable. In addition to the points above, international collaborations can immediately provide local researchers with access to advanced facilities that are currently unavailable in Sri Lanka, though the approach is not sustainable.

Conclusion

The future of Sri Lankan research does not lie solely in building more laboratories, but in empowering minds with the tools to model, simulate, and analyze the world digitally. By adopting computational research through education, infrastructure, policy reform, and community building, Sri Lanka can unlock a new era of scientific productivity and global engagement. Popularizing computational research is, ultimately, about believing that world class research can be done anywhere, provided curiosity is matched with capability. In that belief lies Sri Lanka's greatest research opportunity.