NATIONAL EDUCATION POLICY 2020:
A SHOT IN THE ARM FOR R&D IN INDIA

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Dr. Rupamanjari Ghosh is the Vice Chancellor of Shiv Nadar University, Greater Noida. Dr. Ghosh joined the University in July, 2012, as the Founding Director of the School of Natural Sciences (SoNS) and Dean, Research and Graduate Studies. She has played a key role in shaping the vision and mission of the School. She also headed the first Faculty Development Center started in 2013. Prior to joining the University, Dr. Ghosh served as the Dean of School of Physical Sciences at Jawaharlal Nehru University, Delhi along with many other important academic and administrative positions. She has held several visiting faculty/scientist positions on invitation abroad and delivered numerous invited research seminars. Recipient of the Stree Shakti Science Samman for her 'original contribution to Science', she serves as an expert on the Department of Science and Technology (DST), Government of India Committees in Physical Sciences; and in many central and state universities and institutes. Dr. Ghosh received DAE (Department of Atomic Energy), Government of India, C V Raman Lecture Award (in Physics) in 2018. She also served as the Chief Advisor for the National Council of Educational Research and Training (NCERT) Science textbooks for Classes IX and X, developed afresh under the National Curriculum Framework - 2005.

She worked as a Rush Rhees Fellow at University of Rochester, NY, and selected for "outstanding scholarly ability and the promise of exceptional contributions to scholarship and teaching." Her pioneering work with Prof. L Mandel on two-photon interference (using the nonlinear optical process of spontaneous parametric down-conversion) has yielded new direction in quantum optics and quantum information in the creation and use of a source of entangled photon pairs, and of single photons, is at the forefront of research today. Her research interests include Experimental and Theoretical Quantum Optics' Laser Physics; Nonlinear Optics and Quantum Information. As a researcher, teacher, orator and an academic administrator par excellence, Dr. Ghosh is well known for her efforts to support the cause of gender justice and environment consciousness in the higher education system. Professor Ghosh Co-Chairs the FICCI Higher Education Committee. Currently, she is a member of the Council of the Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune.

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Rupamanjari Ghosh

The new National Education Policy 2020 touches on all the issues that were being discussed in this sector for years and provides a perspective on each issue. The emphasis on quality learning has generated a lot of aspiration on ground. The NEP–2020, in its current avatar, promises wholescale change within higher education in India by proposing multidisciplinary universities and more freedom. The importance of higher education as a key driver to accelerate invention/innovation in the long-term goal of becoming a global knowledge leader cannot be understated. Whatever measures we take to create the new education system at large, the intent and the spirit of NEP–2020 should not get lost even at every individual citizen level.

INTRODUCTION

India's new National Education Policy (NEP–2020) got Union Cabinet approval on 29 July 2020, thus replacing the last NEP that was adopted in 1986 and amended in 1992. The most powerful section of the NEP–2020 is its vision statement; it is a bold and courageous declaration, succinctly delivered through a few words: "This National Education Policy aims at building a global best education system rooted in Indian ethos, thereby **transforming India into a global knowledge superpower**" (*NEP–2020, p. 5*).

THE STRENGTH AND THE CHALLENGE

Following this vision, the proposals outlined in the NEP–2020, prepared under the able leadership of Dr Krishnaswamy Kasturirangan are wide-ranging and comprehensive. It touches on all the issues that were being discussed in this sector for years and provides a perspective on each issue. This is the strength of NEP–2020, and this has also led to a lot of scepticism in terms of its implementation. As always, the devil lies in the details and we need to focus on how to get the NEP–2020 translated to action on ground – true to the spirit of the reforms envisaged – to empower the students in the country, and to discover and fully develop their unique potentials. Only by leveraging this demographic dividend, the country can dream of becoming a 'knowledge superpower'.

We need to establish institutional mechanisms for time-bound implementation of NEP–2020 with fixed accountabilities—from resource mobilisation, legislative interventions, coordination between the centre, the states, different boards as well as regulatory bodies and funding agencies. This is a Herculean task, which the country needs and deserves—the NEP–2020 document recognises that its implementation will "require multiple initiatives and actions, which will have to be taken by multiple bodies in a synchronised and systematic manner". The emphasis on quality learning has generated a lot of aspiration on ground. Whatever measures we take to create the new education *system* at large, the intent and the spirit of NEP–2020 should not get lost even at every individual citizen level. "The aim

must be for India to have an education system by 2040 that is second to none, with equitable access to the highest-quality education for all learners regardless of social or economic background" (*NEP–2020, p. 3*) and needless to say the responsibility of ensuring equitable access to quality education for the deprived sections of our society rests primarily with the central and state governments.

The proposed measures in the NEP–2020 offers a pathway towards the stated ambitious goal of transforming India into a global knowledge superpower. One needs to elaborate on one important all-encompassing thread—the identification and prioritisation of "a robust ecosystem of research" in that regard (*NEP–2020, p. 44*). Indeed, it is an *ecosystem* that can provide the right environment *for ideas to connect*. The change has to be brought in from the school level to undergraduate education.

STRUCTURAL MATTERS

Changing the pattern and content of any undergraduate curriculum is an involved and serious process and needs a lot of thought and care and also some resources. Shiv Nadar University started this concept at the very beginning in 2011 with a well-rounded four-year undergraduate program (the so-called 'FYUP'), and we already know the advantages of such a *flexible, multidisciplinary, 'liberal studies' and research-based* curriculum, which cannot easily be squeezed into just 3 years. Other universities can adapt from the available successful models. Curriculum changes can be implemented successfully only when all the stakeholders see merit in it; otherwise, changes stay only on paper. For a degree program, we had long recognised that it is the total course credits to be earned that matters, and *not* the duration of the program, which may not be fixed as the duration depends on each learner's pace, preparedness, aptitude and choice.

The multiple exit/entry options and the credit bank proposed in NEP–2020 will discourage dropouts from higher education for lack of funds or other reasons. This will also allow students from various backgrounds to complete their education while they are earning or were forced to take a break for some reason. For this to work out,

the curriculum has to be *modular*. On the flip side, the teaching-learning process for these students may become more impersonal and transactional. *You gain some, you lose some!* While it is good to have this flexible option, not every student will opt for multiple exits, and the majority may still go for a continuous education of 3-4 years; their experiences may not be comparable.

NEP–2020 guides us about what will enter the *menu* of UGC's student-centric Choice Based Credit System. Real-life problems, for example, need real-life solutions that are not restricted to only one discipline. The students must have a multidisciplinary breadth, which would allow them to handle interdisciplinary areas of importance. The traditional boundaries of disciplines and education in silos have become irrelevant. But it must be emphasized that interdisciplinarity should not be at the cost of 'disciplinarity': students should be trained to go deep into at least one discipline. In today's gig economy, a specialist is again in demand, and businesses are looking at specialists to deliver data-driven results, for example. When the students go deep in one subject and learn '*how to think*' in a research or exploration-based setting, they will be able to *re-learn* a new stream which today's unknown future may demand of them. Students should develop the skill of *critical thinking* irrespective of the major fields they are pursuing, so that their future is be bright. Universities need to expose undergraduate students to research, providing them with training in research-oriented scientific thought to address societal and industrial needs. The critical stakeholder for this are the faculty, whose role ought to be that of guidance and mentorship. It will be important for the faculty to have avenues for recharging and stay life-long learners.

In the NEP–2020, there is a mention of removal of the often confusing varied nomenclatures used for Indian higher-education institutions, such as 'deemed to be university', 'affiliating university', 'affiliating technical university', 'unitary university' – these shall be replaced simply by 'university' on fulfilling certain norms. This is a much-needed change of nomenclature and should be applicable to the names of the prestigious Institutions of Eminence, currently being called 'deemed to be university'. This may need amendments to the

UGC Act and should be taken up at the earliest so that we can talk about the more substantive issues related to the schemes.

ENGAGING THE BRIGHTEST AND BEST MINDS OF OUR GENERATION

Today in the higher education space, while it is fashionable to talk about 'liberal arts' on one hand, and 'disruptive technologies' of AI (Artificial Intelligence), ML (Machine Learning), VR (Virtual Reality) on the other, we must remember that Liberal Arts is incomplete without physical sciences, and the disruptive technologies alone will not be able to solve all societal problems. Science has shaped our world, and today the global pandemic has reinstated the importance of basic and applied scientific research, and also of stable research infrastructure and funding, for survival and sustenance.

"HEIs will focus on research and innovation by setting up start-up incubation centres; technology development centres; centres in frontier areas of research; greater industry-academic linkages; and interdisciplinary research including humanities and social sciences research. Given the scenario of epidemics and pandemics, it is critical that HEIs take the lead to undertake research in areas of infectious diseases, epidemiology, virology, diagnostics, instrumentation, vaccinology and other relevant areas. HEIs will develop specific hand holding mechanisms and competitions for promoting innovation among student communities. The NRF will function to help enable and support such a vibrant research and innovation culture across HEIs, research labs, and other research organizations." (*NEP–2020, p. 38*)

Research in Basic Science has been the foundation for transformational technology. In the history of science, all technological innovations – from life-saving vaccines to space satellites – can be traced back to the work of scientists motivated purely by a desire to understand the world. One key aspect of implementation of NEP–2020 should be outreach efforts heavily focused towards getting our young minds to understand the tremendous opportunities in the study of depths of science. What is encouraging to note is that the NEP–2020

unequivocally recognises the role of research towards alleviating the big problems of our modern world: climate change, population dynamics and management, the expansion of the digital marketplace, and the rise of machine learning and intelligence which may affect employment patterns of the future (*NEP–2020, p. 44*). Closer home, high-quality research could help find the solutions for the myriad problems that vex our country every day: access for citizens across social spheres to clean air, drinking water, adequate food, energy, quality healthcare, improved transportation and more.

University education should drive and not just respond to industry/ technology. I call for the brightest minds of our generation to engage their time and energies in social and technological developments of the physical kind and not just in improving social media or e-marketing algorithms. The vision for the future outlined in NEP–2020 resonates with the burning issues of the present time that will greataly impact the times to come: "research has never been more essential for the economic, intellectual, societal, environmental, and technological health and progress of a nation" (*NEP–2020, p. 45*).

While we celebrate the lofty and comprehensive goals of NEP–2020, we must also be cognizant of the fact we are at a preliminary stage of the entire process; execution still remains the most important part. If we, as a nation, are serious about the goal of transforming India into a global knowledge superpower, serious research, exploration and invention must be given the due priority it so urgently requires.

THE CURRENT SCENARIO OF RESEARCH IN INDIA: STRIKING BUT ISOLATED ACHIEVEMENTS

As a nation, we have some outstanding achievements which we can justifiably be proud of. As recently as September 2020, India jumped four places to rank among the top 50 countries in the Global Innovation Index 2020 for the first time in its history (*Times Now, 2020*). Our current rank is 48th, and the fact that we made this leap, amid the ravages of the coronavirus pandemic and the ensuing economic downturn, should not be understated. The Indian Space Research Organisation (ISRO) occupies a special place when we talk

about Indian scientific innovation and temper. These are only a few examples of the immense potential the country possesses, which needs to be unlocked to truly discover our worth.

The other point to be made about the examples used above is that these successes have come despite the country's record of historically low investments in Research & Development. According to the World Bank, India spent only 0.65percent of its GDP on research & development in 2018 (UNESCO Institute for Statistics, 2018). This percentage is the lowest when it comes to the BRICS countries as can be seen by the corresponding figures – Brazil (1.26percent in 2017), Russia (0.99percent in 2018), China (2.23percent in 2019) & South Africa (0.83percent in 2017) (UNESCO Institute for Statistics).

Would an increased investment result in better invention/ innovation? For example, if we increase R&D Spend-to-GDP ratio from 0.7percent to 0.9percent, would we see a dramatic change in outcomes? And, here is the answer to that question which was published a few years ago: "fundamental research is a long-term investment, the returns of which may not be immediate. This is not a luxury at the cost of the public – if fundamental research is abandoned by the State, it will irreversibly cause a collapse of all applied research in the long run, and the nation cannot ever dream of becoming self-reliant in today's 'knowledge society'.... Unlike a factory product, the value of research to society can only be judged in retrospect, which has always been a necessary gamble, and it has paid off everywhere in the world!"(*Ghosh, 2005*).

Education should *accelerate invention*, while *innovation* will continue to show up from unexpected quarters as well. Innovation, as we understand today in terms of commercialisation of technology, can happen without systematic education, but inventions, on the other hand, are primarily products of education (applied research). Both need investment. The country should continue to generate new knowledge through basic/fundamental research, and create robust industry-academia partnerships to translate the generated knowledge into applications. Strong R&D initiatives in the Indian industry are an essential element for success in this program.

WATCH THE DRAGON

China's investment numbers tell an insightful story. The country's spend on R&D rose to 2.23percent of GDP in 2019, an increase of 0.09 percentage points from the previous year. Its total expenditure in monetary terms was 2.21 trillion Chinese Yuan ($322 billion), which was a rise of 12.5percent over its previous year. China has continuously seen double-digit percentage increases in R&D expenditure with a stated goal of increasing R&D expenditure to 2.5percent of GDP by 2020, outlined in its most recent Five-Year Plan (*Normile, 2020*).

The results are showing, and these investments are now paying off. China has rapidly become a major player in fast-growing high-tech sectors such as nuclear energy, new energy vehicles, Artificial Intelligence and advanced manufacturing (*Nadir, et al., 2019*). According to a McKinsey report of 2017, one in three of the world's 262 unicorns was Chinese (*Woetzel, et al., 2017*). The country accounts for the largest share of industrial robots at 140,500, which is more than the combined total of the next four countries on the list (Japan – 49,900 units, United States – 33,300 units, South Korea – 27,900 units, & Germany – 20,500 units) (*Liv, 2020*).

In India, though there have been select remarkable successes, the entire research ecosystem – for basic and applied research – has not progressed uniformly. India must pave its own path, but there is much to be learned from China and other countries which show a clear correlation between increased R&D expenditure and technological innovation. The countries with the highest spends on R&D (South Korea, Japan, Denmark, Finland, Sweden, Austria, Switzerland, Germany & United States) are all highly advanced, industrialised nations at the forefront of technological know-how and excellence (*UNESCO Institute for Statistics*). It is, therefore, not a coincidence that most of these nations also rank within the top 20 of the Global Innovation Index 2020 (*Dutta, Lanvin, & Wunsch-Vincent, 2020*).

ANALYSING THE NATIONAL RESEARCH FOUNDATION'S (NRF) ROLE IN THE TRANSFORMATION

Recognising the pressing need to set up a professional and comprehensive research education framework, the Ministry of Education (formerly the Ministry of Human Resource Development) proposed the establishment of a National Research Foundation (NRF) with the objective of directing human and material resources towards carrying out a well-coordinated research across disciplines. *(The Prime Minister's Science, Technology and Innovation Advisory Council (PM-STIAC)*; *Ministry of Human Resource Development, 2019, pp. 6-7)*

In her budget speech on 5 July 2019, the Finance Minister, Nirmala Sitharaman announced the establishment of the NRF with the following points: "We propose to establish a National Research Foundation (NRF) to fund, coordinate, and promote research in the country. NRF will assimilate the research grants being given by various Ministries independent of each other. NRF will ensure that the overall research eco-system in the country is strengthened with focus on identified thrust areas relevant to our national priorities and towards basic science without duplication of effort and expenditure. We would work out a very progressive and research-oriented structure for NRF. The funds available with all Ministries will be integrated in NRF. This would be adequately supplemented with additional funds." (*Sitharaman, 2019, p. 14*)

The stated objectives of the NRF are lofty, and if properly implemented are well-positioned to transform India into a global education superpower. In terms of the funding, it is proposed that the NRF be given an annual grant that will eventually reach 0.1percent of the GDP (approximately INR 20,000 crores in current terms) with the autonomy to make its own financial decisions. *(The Prime Minister's Science, Technology and Innovation Advisory Council (PM-STIAC); Ministry of Human Resource Development, 2019, p. 12)*

The initial grant is planned to be increased progressively over the next few years. According to NEP–2020, the NRF will competitively fund research in all disciplines across the academic landscape:

Science, Technology, Social Sciences, and Arts & Humanities. *(NEP–2020, p. 45)*

However, this is not enough. The quality of research of a country is inextricably linked to its higher education system. The NEP–2020, in its current avatar, promises wholescale change within higher education in India by proposing multidisciplinary universities and more freedom. It does not, however, answer an important question: how does higher education fund better research?

THE NEED FOR REFORM IN HIGHER EDUCATION

To answer that, as an immediate first step, at least INR 5,000 crores from the INR 20,000 crores earmarked for the NRF must be released on competitive merit for research to public and private higher education institutions. This funding must be non-lapsable and aimed towards enabling an environment of competitive and outstanding research. We must implement a forward-looking *'common norm for public and private HEIs'*—every institution should be held accountable, in a progressive and fair way. The schemes will be as good as the people—competence of people who sit in judgement should be unquestionable.

The importance of higher education as a key driver to accelerate invention/innovation in the long-term goal of becoming a global knowledge leader cannot be understated. The major reforms in higher education advocated by the NEP–2020 – holistic and multidisciplinary education, flexibility of education choices and program durations, etc. – must be aligned to an agile Higher Education framework. In its implementation, the government must not shy away from taking bold steps to promote private philanthropy to meet the Gross Enrolment Ratio (GER) for higher education. At present, Indian universities face various regulations and challenges in creatively endowing their investments. In contrast, premier educational institutions in the United States can maintain, and use large endowment funds to support their research aspirations.

Removing the shackles that have held back higher education organizations from investing their time and skills in research is key to restoring India's rightful place in the world. An immediate outlay from the proposed NRF to higher education institutions will kickstart this process and reinforce the message that the government is committed to its ambitious goal of transforming education. With a commensurate increase in outlays, we could enable our young talent right from the undergraduate levels to develop scientific thoughts in our institutions, aimed at finding innovative solutions to meet India's and the world's most pressing societal and industrial needs.

We need competent leadership; not just resources. How do we create a system where transformational and innovative leadership is encouraged with the pursuit of creating an equitable, fair world? We need to make sure that our elite institutions do not stay elitist. Our country's research quality and academic standards need to improve by collaboration and meaningful accreditation because only when the research median is high, we will be able to sustain the fragile peaks of excellence on it. There are no short-cuts to excellence, and we need to start now.

More than ever, the unprecedented coronavirus pandemic of 2020 has demonstrated the importance of becoming a nation capable of providing quick and effective solutions to world-changing crises. COVID-19 is not the first and it will not be the last pandemic that affects us, and it is likely that we will encounter more such events in the near future, which will reshape our world. The new normal will keep shifting and we, as a nation, can only be prepared to adapt and create solutions to meet ever-changing needs by cultivating a generation of visionaries, thinkers and academics who can change the world before it changes them. Our leading universities ought to be in the driver's seat of the 'robust ecosystem of research' with academia-industry-government, national-international partnerships, and maintain *quality*. Let's make a beginning now.

It is an opportune moment as there has been a serious buy-in of the NEP–2020 by almost all the stakeholders—at the individual institution as well as the faculty and student level. The implementation has to have the depth and breadth for the intellectual strength of our

country to emerge, with a leadership and vision that is '*glocal*': global in its outlook but deeply rooted in its local context.

(The author is the Vice-Chancellor of Shiv Nadar University, and Co-Chair, FICCI Higher Education Committee.)

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