National Research Foundation

Detailed Project Report

Developed by

The Prime Minister's Science, Technology and Innovation Advisory Council (PM-STIAC)

in Consultation with

The Ministry of Human Resource Development
Department of Higher Education

December 2019

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National Research Foundation (NRF)

1. Background:

1.1 **Origins.** The idea to set up a National Research Foundation (NRF) in India, as a body to catalyse, facilitate, coordinate, seed, grow, and mentor research in institutions around the country, has been in the minds of researchers in the nation for many decades. Such a National Research Foundation was one of the key recommendations of the Draft National Education Policy 2019, which was commissioned by the Ministry of Human Resource Development in 2017.

1.2 **The Importance of Research for Higher Education.** As noted in the Draft National Education Policy 2019, the very best higher education institutions (HEIs) in the world and throughout history have been those in which high-quality knowledge creation also takes place. Furthermore, the very best teachers in HEIs, for imparting the skills of creative thinking, innovation, and a research mindset, are naturally those scholars who themselves are deeply involved in the knowledge-creation process. Therefore, cultivating research in HEIs across the country is considered critical for the success and vibrancy of the nation's higher education system, and for India's higher education institutions to take their place among the very best in the world. Unfortunately, at the current time, less than 1% of the country's approximately 40,000 higher education institutions engage in research. Thus, the vast majority of the nation's faculty and students in higher education institutions are simply not involved with knowledge creation at all – a huge loss to India's research potential.

1.3 **The Importance of Research for Addressing Key Societal Challenges.** Some of the key societal challenges that India needs to address today, such as access for all its citizens to clean drinking water and sanitation, quality education and healthcare, social equity, improved transportation, sustainable infrastructure, elimination of poverty, air quality, clean energy, and reversing climate change and its negative impact, will require the implementation of approaches and solutions that are not only informed by top-notch science and technology but also rooted in a deep understanding of the social sciences and humanities and the various socio-cultural dimensions of the nation. Facing and addressing these challenges will therefore require high-quality interdisciplinary research across fields, which must be conducted in India and cannot simply be imported. The ability to conduct one's own research across disciplines will be critical for India to develop sustainable solutions to key societal challenges. It is also well-understood that the existence of a research culture across disciplines also enables a nation to much more easily import, adapt, and apply relevant research from abroad. For all this to

happen inclusively across India, the importance of having the flexibility of conducting research through all our languages, and not only in English, is necessary.

1.4 **The Importance of Research Across Disciplines for the Development of an Enlightened Knowledge Society.** In addition to their value in solutions to societal challenges, any country's identity, upliftment, social progress, spiritual/intellectual satisfaction, and creativity is also attained in a major way through its art, history, language, and culture. Arts and humanities bring people closer to one other, and encourage critical thinking, empathy, and creativity. Research in and advancement of the arts and humanities, along with innovations in the sciences and social sciences, are thus considered extremely important for the progress, humanity, and enlightened nature of a nation.

1.5 **The Importance of Research for Sustainable Development.** If India is to achieve sustainable development and be a world leader, it must be at the forefront of knowledge creation and Research & Innovation (R&I). Key sectors of the Indian economy, such as defence, healthcare, rapid modes of transportation, aviation, and the manufacturing of electronic and communication devices, are critically dependent upon import of primary and secondary goods from various parts of the world to cater to indigenous demand. A well-directed and coordinated effort on the research and innovation front will directly complement the Government of India's 'Make in India' initiative, create ample employment opportunities for our aspiring youth, and significantly enlarge India's footprints in the global research index, which will eventually have a ripple effect in all sectors of our economy.

1.6 **Summary.** In summary, there is no single factor more important to the intellectual, social, and economic progress of a nation, and to the enhanced well-being of its citizens, than the continuous creation and acquisition of new knowledge. A new National Research Foundation would aim to become a major driver of that process for India, helping to sustainably thrust forward the nation's economy, enhance its security, promote well-being and societal progress, and grow India's position as a global leader.

2. Current Status of R&I Investment:

2.1 **R&I Investment as a Percentage of GDP.** India's R&I investment as a percentage of GDP, vis-a-vis other countries of the world, is currently extremely low and in fact has shown a steady decline over the last decade, dropping from 0.84% in 2008 to around 0.69% in 2018. For the sake of comparison, in 2018, R&I investment as a proportion of GDP was 2.8% in the United States, 2.1% in China, 4.3% in Israel, and 4.2% in South Korea.

2.2 **Number of Researchers Supported by Current R&I Investment.** The small proportion of GDP that India invests in R&I annually is reflected in

the relatively small number of people that are supported to conduct research in India. The number of researchers per lakh of the population is only 15 in India, compared to 111 in China, 423 in the United States, and 825 in Israel, as per the Economic Survey of India, 2016-17. This extremely small number of researchers supported in India naturally results in severe underperformance in its research-output metrics.

3. India's Research Output:

3.1 **Number of Patents.** India lags behind other nations in the number of patents produced. According to the World Intellectual Property Organisation (WIPO) 2017 report, as many as 13,81,584 patent applications were made by China, and 6,06,956 by USA, but a mere 46,582 by India - of which approximately 68% were made by non-resident Indians.

3.2 **Number of Publications.** In terms of publications, India has been doing somewhat better, showing steady growth in its output and taking India's share of scientific publications from 3.1% in 2009 to 4.4% in 2013 to 4.8% in 2016. However, a 2018 compilation of Science and Engineering indicators by the U.S. National Science Foundation showed that both the USA (17.8%) and China (18.6%) published approximately four times as many articles as India in 2016.

3.3 **Quality of Research.** The quality of publications from India has also been substantially lower than global standards. Though in terms of the total number of publications India stands at the 5th position in the World, in terms of the citation impact, India is much lower at the 11th position. Only 15.8% of the total publications are in top 10 journals, compared with, e.g., 27.6% in China and 36.2% in the U.S. The overall quality of our R&I is currently not up to current global standards. Moreover, none of our institutions are amongst the top 100 R&I institutions of the world. The quality of the research workforce produced by our institutions is thus currently not amongst the best in the world, barring a few exceptions.

4. Other Impediments to Research:

4.1 **Lack of Integrated Planning and Coordination.** While each of our funding bodies has done an excellent job in nurturing components specific to them, the whole remains less than the sum of its parts, because of an absence of integrated planning and coordination, which is necessary today due to the multidisciplinary nature of modern scholarship and its applications to society. Thus India's R&I capabilities are not fully realised, and would likely not be realised within the existing structure simply by a mere increase in funding. Hence a key reason for the overall state of research in the country not being at par with the global best is the absence of an integrated and comprehensive approach towards seeding, funding, coordinating, and monitoring R&I initiatives in the country and

their linkages with Central and State governmental bodies and with industry and societal needs.

4.2 **Lack of Research Culture.** The lack of research culture and mindset, and the lack of research infrastructure in most educational institutions, further compounds the problem. The artificial separation between research and education that was created post-independence, with research being conducted at relatively well-funded standalone research institutions while universities were designated only for teaching and largely starved of research funds, has evidently hurt the country considerably - both in research and in teaching. The union of education and research must be restored.

4.3 **Lack of Emphasis on Creativity and Critical Thinking in Educational Institutions.** The lack of creativity and critical thinking in large sections of our students is yet another impediment. Marks-based assessment of students' potential promotes rote learning without analytical skills, communication skills, innovation, or creativity. Our curriculum does not give enough importance to soft skills and human-centric development, e.g., through the arts, humanities, and social sciences. To address this problem, there is a need to promote special programmes within our education system for developing cognitive, creative, and design-thinking skills amongst students – thereby making them more employable as well. These skills will not only empower students to identify and visualize key problems around them, but also encourage them to become involved in proposing constructive, out-of-the-box, and sustainable solutions.

5. Concept of a National Research Foundation:

5.1 **Need for a National Research Foundation (NRF).** Due to the various factors as described in the previous sections, as articulated also in the National Education Policy 2019, there is a pressing need to set up a professional and comprehensive research and education framework - a National Research Foundation (NRF) - that directs human and material resources towards carrying out well-coordinated research across disciplines and across all types of institutions.

5.2 **Call by the Honourable Prime Minister of India.** In his address to the Indian Science Congress on January 3, 2019, the **Honourable Prime Minister of India** emphasised the need for such a research structure, and called on PM-STIAC, in consultation with MHRD, to formulate such a framework:

"We must establish an expanded research ecosystem... Friends, our strengths in research and development are built on the backbone of our national labs, Central Universities, IITs, IISc, TIFR, and IISERs. However, over 95% of our students go to State Universities and colleges where research is still limited; a strong research ecosystem must be developed in these universities and colleges. I call upon the

NRF Science, Technology, and Innovation Advisory Council to discuss these issues in detail and formulate an action plan, in consultation with the Ministry of Human Resource Development, to boost research in our colleges and State Universities."

5.3 **Announcement by the Honourable President of India.** The need for such a research framework was re-emphasised by the **Honourable President of India** on 20/06/2019, in his address to the joint sitting of two Houses of Parliament, when he stated that:-

"Research is being encouraged in higher educational institutions. To further strengthen this effort, it is proposed to establish a 'National Research Foundation'. This proposed foundation will work as a bridge between different Departments of the Central Government, science laboratories, higher educational institutions and industrial institutions."

5.4 **Announcement by the Honourable Finance Minister.** On July 5, 2019, the **Honourable Finance Minister**, in her Budget Speech, 2019-20 announced that:-

"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."

5.5 **Meeting at NITI Aayog.** A meeting with representatives from Ministries, Departments, industry, and academia, to discuss a possible `National Research Foundation' and its structure, the spectrum of its operations, and its linkages with industry and academia, was held at NITI Aayog on August 20, 2019. A number of valuable suggestions emerged on the creation of a National Research Foundation for the development of research capacity in the over 40,000 higher education and research institutions in the nation.

5.6 **Proposal to set up a National Research Foundation.** It is in the above backdrop that the National Research Foundation (NRF) has been conceptualized and proposed to be set up, at the earliest, with the overarching goal of enabling a culture of research and innovation across disciplines to permeate through India's universities, colleges, research institutions, and R&D laboratories.

6. Objectives of NRF:

6.1 **Primary Objectives of the National Research Foundation.** The NRF will explicitly aim to remove the various obstacles to research in the nation as discussed in **2-4**. The NRF will have the following key objectives:

(a) Fund competitive peer-reviewed grant proposals of all types, submitted in any of our official languages to individuals or groups of individuals, across all disciplines (including for interdisciplinary research) and across all types of institutions, in order to significantly strengthen India's research and innovation potential;

(b) Seed, grow, and facilitate research at academic institutions, particularly at universities and colleges where research capacity is currently in a nascent stage, through mentoring of such institutions by eminent research scholars, by hiring excellent young research students, postdocs, and faculty, and by funding, strengthening, and growing already-existing high-quality programmes at such institutions;

(c) Fund research infrastructure (e.g., computing facilities) at individual institutions as well as infrastructure such as laboratories and other research equipment that can be shared across multiple institutions;

(d) Increase India's role and participation in key areas of national and global importance, and in major national and international collaborations, through large-scale mission projects and megaprojects;

(e) Act as a liason and coordinator amongst researchers, relevant Central and State government bodies, and industry, so that researchers are constantly connected with each other and with potential collaborations (including with government and industry), and so that policymakers are constantly made aware of the latest research breakthroughs in the country – thus enabling breakthroughs to be brought into policy or implementation in an optimal fashion;

(f) Support the development of the next generation of researchers and the long-term development of global-quality R&I through innovative initiatives in education, including enhancing the cognitive and R&I skills of students and new researchers through various online and offline courses, workshops, conferences, and summer programmes on topics of current research interest;

(g) Recommend and support various activities and initiatives for increasing the participation of women and other underrepresented groups in research;

(h) Create a central clearinghouse for the collection, interpretation, and analysis of information and data surrounding all research being conducted in the country, which may be used by governmental bodies and industry to guide their policies and directions;

(i) Recognise outstanding research and progress achieved via NRF funding/mentoring across subjects and categories, through various prizes and special seminars recognising the work of the researchers;

(j) Serve as a high-level think tank for the coordination and short- and long-term planning of research in the country and for the recommendation of key policy initiatives to the Prime Minister and to Parliament regarding research, innovation, and education.

6.2 **Building on Existing Strengths.** Overall, the NRF will actively aim to build on existing national strengths in R&I, while also filling in gaps in the current research and education ecosystem, in order to take India's R&I achievements into a much higher orbit.

7. Scope and Structure of the NRF:

7.1 **Structure of the National Research Foundation (NRF).** The National Research Foundation (NRF) will be established initially as a Society under the Societies (Registration) Act, 1860, and will be governed by its Memorandum and Articles of Association (MoA), regulations and bye-laws framed thereunder. The Society will be registered in Delhi and will have a pan-India jurisdiction. Within three years – once the details of the methodology of the functioning of the NRF have stabilised – the NRF will, by an Act of Parliament, become an autonomous body of the Government of India. The NRF will have complete autonomy (with accountability and internal checks and balances) in its functioning, with a robust system of governance in accordance with the very best international practices, as described in **7.2-7.7** below.

7.2 **NRF Governing Board.** The NRF will be governed by an 18-member NRF Governing Board consisting of eminent researchers and professionals in their respective fields. Experts may be drawn from within the country and internationally, and iit is expected that about a third of the Board member are women. In particular, for each Directorate, the NRF Board will contain at least one member from a field represented by that Directorate, while additional members would ideally represent multidisciplinary interests across Directorates. Up to one third of the NRF Board would come from industry and the philanthropic sector. NRF Board members will typically serve six-year terms, with one third of its members rotating off the Board every two years; the next batch of Board members will be elected by the Board every two years. The Board will have a Chair who will be selected by the Board members from amongst themselves. The NRF Board will be the custodian of the vision of the NRF, and will meet at least four times a

year, to set and approve priorities and programmes and ensure oversight and course corrections as needed. The NRF Board, through its Offices, will maintain connections with government and with industry, and will ensure that the important research issues of the day are being addressed by the NRF, and that government and industry are aware of the most important research being supported by the NRF. Since the scope of the NRF is wide-ranging – impacting all ministries - the NRF Board, through its Chair and the NRF President, will report to the Prime Minister.

7.3 **President, Vice-President, and Chief Operating Officer.** A President of the NRF will be searched for and selected by the NRF Board, based on research credentials, integrity, and capacity for leadership and administration. Since the majority of the budget of the NRF would necessarily go for research and innovation in science and technology, the President of the NRF would generally be someone from the Natural Sciences or Engineering, but who also has strong interests across disciplines. The President will serve a six-year term at the rank of Secretary to the Government of India. A Vice-President and Chief Operation Officer (COO) will also be selected in the same way - with suitable input from the President so that the three may work in harmony; they will also serve six-year terms at the rank of Additional Secretaries to the Government of India. The President and Vice-President would serve as ex officio members of the NRF Board. They would be the primary individuals responsible for oversight of administration, management, development, budgeting, and short- and long-term planning of the NRF; meanwhile, the COO would be responsible for the oversight of, and be directly involved in, the day-to-day operational functions of the NRF. The President of the NRF will periodically meet with Secretaries of all Ministries and with Chief Secretaries of all States and Union Territories in conference in order to assess their research needs and programmes, and formulate potential collaborations. The President, Vice-President, and COO will help set the culture of the NRF, which will be one of excitement and encouragement for attaining high-quality research in India across institutions and across fields. There will be no age limit on the positions of President, Vice-President, and COO; the sole criteria for these positions will be quality and capability.

7.4 **Research Directorates.** The NRF will consist of ten major Directorates – Natural Sciences; Mathematical Sciences; Engineering; Environmental and Earth Sciences; Social Sciences; Arts and Humanities; Indian Languages and Knowledge Systems; Health; Agriculture; and Innovation and Entrepreneurship – with the provision to fuse or add additional Directorates whenever it may be determined to be beneficial by the Board of the NRF. Each Directorate will have a Chair and Vice-Chair, appointed by the NRF Board, who will oversee the missions of the Directorate, from the development of policy priorities and administrative and management guidelines, to guidelines for ethics within the disciplines of the Directorate. The Chair and Vice-Chair will be assisted by a highly-qualified staff.

7.5 **Divisions and Programmes under Each Directorate.** Under each Directorate would be a handful of Divisions (e.g., under the Mathematical Sciences Directorate, there may be a Mathematics Division, a Computer Science Division, a Statistics Division, and a Data Science Division). Each Division would have a chairperson, namely, the Lead Programme Officer. Each Division would run multiple Programmes of research that will each be overseen by a Programme Officer who is highly-qualified in the disciplines covered by the Programme. Some Programme Officers may oversee more than one Programme. The Programme Officers will be key persons within the NRF, who make the final recommendations regarding funding proposals and who monitor the awarded projects within the Programme. (See **8** for more details on the rigorous peer-review process overseen by the Programme Officers.) It is estimated that the initial number of Programmes may be around 100, but this would likely grow over time. The Directorate Chairs and Vice-Chairs, and the Programme Officers, may be long-term employees of the NRF on contracts that are renewed regularly subject to performance evaluations, or they may be shorter-term employees on loan for periods of up to four years from their home institutions. The Directorate as a whole will have a rotating staff of experts that include Advisors (who may serve as mentors for grant-writing), Programme Analysts, Programme Assistants, Programme Communications Specialists (to help write calls for proposals in each Programme), and IT staff.

7.6 **Administrative Structure.** Working in parallel and in collaboration with the Directorates will be a number of administrative Offices of the NRF, each with its own Chair, Vice-Chair, and staff. These offices will include: an Office of Budgeting, Accounting, and Grant Management (responsible for carefully revising, formulating, and implementing budgets, managing accounts, and administering grant funds); an Office of Data and Information Management (responsible for collecting names of research experts around the country and the world who may serve as Research Mentors / NRF Professors, Programme Officers, members of Subject Committees, peer reviewers, etc., for collecting and analysing relevant data and information regarding NRF research grants and projects and on Central and State government and industry research needs); an Office of Mentoring (responsible for running research and innovation mentoring programmes for school students – such as Dhruv – as well as mentoring for faculty and institutions aiming to apply for NRF grants); an Office of Diversity and Inclusion (responsible for monitoring and reporting that grants are well-distributed across different types of institutions and across geography, and across underrepresented groups); an Office of Legislative and Public Affairs (responsible for communicating NRF's mission and research results to academia, government, industry, media, and the general public); an Office of the Inspector General (responsible for promoting efficiency and effectiveness in running programs and for preventing and detecting fraud, waste, and abuse, through regular audits and direct reporting to the NRF Board twice a year); and an Office of Development (responsible for developing relationships with government, industry, and philanthropic bodies, and passing on relevant research

needs and funds to Directorates and Research Offices). There will also be two Research Offices that function very similarly to Directorates: an Office of Integrative Research (responsible for collecting, suggesting, catalysing, incubating, and overseeing initiatives, in collaboration across Directorates, that capitalise on new interdisciplinary research ideas and projects); and an Office of Missions and Megaprojects (responsible for soliciting, evaluating through peer review, arranging funding for, and overseeing the successful execution of outstanding proposals for large-scale transformational national and international missions and megaprojects). As with Directorates, Offices may be fused or additional Offices may be added whenever it may be determined to be beneficial by the Board of the NRF.

7.7 **Funding for the NRF.** The NRF will be given an annual grant that will eventually aim to reach at least 0.1% of GDP (in current terms, approximately Rs. 2 kharab or 20,000 crores) and will be conferred with the autonomy to set its own finances, governance, and statutes. Given the imperative to increase research and innovation activities widely and across the country, this initial grant will be increased progressively over the next decade as the country's capacity for quality research across fields is developed. Any unspent funds in the initial years will be held towards a corpus for the NRF which will be managed professionally for steady risk-free return.

7.8 **Funding Peer-Reviewed Research.** The NRF will competitively fund research in all disciplines across the academic landscape – from subjects such as Medicine, Physics, Sustainable Farming, Artificial Intelligence, and Nanoscience to Education, Sociology, Archaeology, Art History, and Literature. The NRF may on occasion identify areas of research that are of special importance to the country and prioritise funding to them, but it will consider and fund outstanding proposals and researchers in all areas.

7.9 **Seeding and Mentoring Research.** In addition to directly funding outstanding research proposals, the NRF will also help seed centres of research in select disciplines at various universities, through providing institutional funding, and bringing in research mentors as well as postdocs and doctoral students, to grow an ecosystem for research at institutions where it currently does not exist or is limited. These mentorship programmes will include ones which stimulate research and exploration in schools, particularly in resource- constrained contexts.

7.10 **Establishing Linkages Across Academia, Government, and Industry.** The NRF, through its President and its Governing Board, will also act as a liason between researchers, Central and State governmental bodies, and industry, helping to ensure that the most urgent national issues of the day (e.g., clean water, sanitation, clean energy) are well-studied by researchers, and that the latest research breakthroughs are implemented for the public good through policy in an efficient manner.

7.11 **Recognition and Promotion of Outstanding Research.** The NRF will recognise outstanding research progress (especially research funded by the NRF), through NRF Prizes for and through the organisation of national seminars on truly transformative research and the successful seeding/growth of research at higher educational institutions.

7.12 **Funding of Conferences, Seminars, Workshops, and Symposia.** Conferences and workshops in all disciplines and at all levels that further the research goals of the country will also be funded through proposals for the same. This includes outstanding workshops and summer intra- and inter-university experiences for students to be introduced to and be engaged in the research process. Funding to attend such conferences will be provided to those that need it, with a special focus on participation from women and other underrepresented groups.

7.13 **Public Disclosure.** All proposals funded, together with the amounts of annual funding and duration of funding, annual updates on progress, and final results achieved (all explained also in layperson terms) will be publicly displayed on the NRF website.

7.14 **Eligibility for receiving NRF funding.** Researchers from all public and private non-profit education and research institutions will be eligible to compete for funding from the NRF.

7.15 **Financial and Administrative Autonomy.** The NRF will be fully empowered administratively and financially so that it does not face hurdles in funding good projects. The support for good research and innovation will require, at its core, a high-quality internal management process that links to a high-quality peer-review system. The NRF President, reporting to the Board, will have full flexibility in staffing. This will be done in consonance with recruitment and remuneration rules which will be drafted and approved by the Board within three months of the formation of the NRF. Government support to the NRF will come as a block grant without delineating the sub-heads of research support into human resources, consumables, and capital. The heads will be delineated by the divisions within the NRF as appropriate to each field and specific project. The NRF Board will have full flexibility in determining if and how funds can move between heads. The NRF Board will also have flexibility in determining the remuneration structure for fellowships and projects, e.g., some areas, such as in clinical research and computer science may require structures of fellowship and salary support that are different and significantly higher than the norm. Detailed financial rules for the operation of the NRF and NRF grants will be periodically updated and, when approved by the NRF Board and reported to Cabinet will be deemed government approval. Wherever explicit flexibility has not been specified, GFR will be followed.

7.16 **Other funding agencies.** Institutions that currently fund research, such as DST, DAE, DBT, ICAR, ICMR, ICSSR, ICPR, CIIL, UGC, etc., as well as various private and philanthropic organisations, will continue to

independently fund research according to their priorities and needs. Many of the leading research-producing nations in the world have multiple public and private funding agencies, and India would benefit from the same. However, a centrally-established NRF that transparently seeds, funds, and coordinates research across institutions in the country - in all disciplines, in an integrated manner, with a special mandate to foster research and innovation in Universities and Colleges, including interdisciplinary research, not limited by any particular subject or geographic interests, all through a robust system of peer review - is distinct from the mandates of other organisations and will be critical in building quality research capacity in universities and colleges across the country.

7.17 **High-Level Research Coordination Board of the NRF.** The NRF will coordinate in a very systematic manner with other funding agencies through a High-Level Coordination Board headed by the PSA and consisting of Secretaries or representatives of Ministries that fund research, as well as Directors or representatives of other major funding bodies, some of which were mentioned in **7.16**, in order to ensure that there is synergy of purpose, a sharing of results and methodologies, beneficial collaboration and integration, and a lack of duplication of efforts. The Coordination Board will meet at least twice a year, with participation from representatives of the NRF, such as the President of the NRF and/or Chairs of the NRF Board, Directorates, and Offices.

7.18 **Real-time information and data collection.** The NRF's Office of Information and Data Management will dynamically, on a near-real-time basis, collect information on how the R&I ecosystem is supported by public, private, industry, philanthropic, and other sources. This office will provide this analysis publicly, to all stakeholders and to the Finance Ministry. For the first time, this will allow the annual allocation of financial support to each R&I funding agency to be based upon an assessment of inputs, outputs, outcomes, and impacts – with the goal of strengthening and improving the effectiveness and efficiency of all funding organisations.

8. Funding Research Proposals through Rigorous Peer Review:

8.1 **Calls for research proposals.** Each year, each Programme of the NRF will make public calls for research proposals of various types, according to a standard calender. Divisions, Directorates, and Research Offices may also choose to make public calls for proposals across Programmes, Divisions, or Directorates, respectively. Directorates may choose to emphasise certain subject areas within their disciplines according to national needs, but all proposals within the discipline of the Directorate will be considered. Interdisciplinary proposals, across two or more Directorates, would be especially welcomed and encouraged. Proposals truly involving multiple disciplines, and proposals on an especially large scale such as missions and megaprojects, will generally be handled by the Office of

Integrative Research and the Office of Missions and Megaprojects, respectively, in coordination with the relevant Directorates. The NRF will sppedily develop structures so that proposals can be submitted in any official language.

8.2 **Types of Proposals.** Proposals of various types will be allowed, including for: (i) research projects to be conducted by a single principal investigator (PI); (ii) collaborative grants for inter- and intra-institutional projects; (iii) initial capacity building by a mentor researcher and mentee institution; (iv) capacity building to push institutions that are already conducting research into a higher orbit; (v) well-envisioned consortia and conferences that are likely to move forward research in the country; (vi) development of courses, seminars, workshops, and summer programmes for students to gain experience in cognitive thinking and research; (vii) research facilities of national and international importance; and more rarely (viii) larger and longer-duration projects/facilities of national importance or inspiration. Proposals centred on science communication, citizen- science and outreach will also be considered. (Capacity building as in (iii), (iv), and (viii) will be elaborated on further in **9**.)

8.3 **Content of Proposals to Include Societal Impact.** In addition to describing the work to be carried out, with detailed resource and funding requirements, proposals will also describe any societal impact expected and sought, e.g., the training of students and postdocs, public outreach, cleaning of a river, elimination of a disease, increasing agricultural yields, taking strides towards gender and social equality, preservation of ancient manuscripts and artefacts, preservation of Indian languages, etc. Appreciating the importance of science- communication to the public at large, proposals can include requests for support for such effort.

8.4 **Duration of Funded Projects.** Research proposals would generally be for projects of three-year duration; however, for truly outstanding proposals of likely-high impact, proposals of five years or even longer in exceptional cases would be considered.

8.5 **Assessing and funding quality research proposals through a system of rigorous peer review.** All proposals received within each Programme will be handled by the respective Programme Officers, who will arrange for rigorous peer reviews of all serious proposals by Subject Committees consisting of experts, drawn nationally or internationally, in the Programme subject areas. Such reviews will be carried out by members of the Subject Committees themselves, or in instances where there is not sufficient expertise or capacity within the Subject Committee, by sending for outside peer reviews, national or international, as necessary. A key aspect of the peer-review process will be the absence of conflicts of interest: committee members will recuse themselves and leave the room during discussions of proposals of their colleagues from the same institution, of their collaborators, advisors/mentees, or family members, or from institutions that have funded or paid them in the recent past; committee members will not participate in the writing of the reviews in

such cases. All funding recommendations for proposals will be made by Subject Committees and Programme Officers based on the resulting peer reviews. Final decisions regarding the funding of proposals will be made by the Lead Programme Officers of each Division in accordance with the respective Programme Officer, Subject Committee, and peer review recommendations. Proposals recommended for funding will be submitted to the Office of Budgeting, Accounting, and Grant Management, whose financial experts will review the budget of each proposal and, if necessary, work with proposers and their institutions (in consultation with Programme Officers) to potentially revise the budget and financial requests to ensure efficiency in budget and grant management while not compromising on the goals of the project. A detailed agreement will then be sent to proposers to sign as per NRF rules and conditions relevant to the project. Regardless of whether an award is made, peer reviews will also be made available to the writers of each proposal, without revealing the names of the specific referees, in order to provide proposers with valuable feedback. For most proposals, the whole review process will aim to be completed in six months from the date of the submission of the proposal.

8.6 **Awards to be well-distributed across different types of institutions and across geography.** In choosing proposals to be awarded, it will be taken into account to be equitable and inclusive, ensuring that awards are distributed across different types of institutions and across the geography of India. This will be facilitated by the Office of Diversity and Inclusion through data collection, recruitment of proposals from outstanding candidates, and mentoring. In particular, special attempts will be made to award grants to outstanding proposals from investigators from underrepresented groups, including women, in order to truly ensure that research capacity is grown across India.

8.7 **Approach to funds disbursal.** Funds for successful proposals will be released annually, and in a timely manner, to the researchers' institutions, subject to receipt of annual detailed reports describing progress and spending. The Office of Budgeting, Accounting, and Grant Management will set up procedures for and work with institutions to ensure efficient financial administration of the grant. Suitable overhead expenses will be provided to the recipient institutions for administration of the grant.

8.8 **Oversight and coordination by Programme Officers.** Funded projects within each Programme will be overseen end-to-end, in terms of funding, advice, progress, and completion, by the corresponding Programme Officer, who will also serve as the point of contact for PIs, and will annually report to the Lead Programme Officer on the status of each funded proposal, who in turn will report to the Directorate Chair.

8.9 **Assessment and Accountability.** The NRF will not only revamp and energise the current funding and support mechanisms for research in the country, but will also shift the culture of research into one of

accountability and the responsible use of funds. Initial funding will be provided only if the proposal clears a specified, high, benchmark. Progress reports with transparent disclosures of the use of funds, and the results achieved, will be submitted by the writers and host institutions of funded proposals each year. The NRF will expect the host institutions to ensure fiduciary accountability for the research project, and will set up specific reporting mechanisms for the host institutions for this purpose; the NRF will also periodically conduct audits to ascertain appropriate responsible usage of funds. Assessment of outcomes of research annually will be carried out on quality metrics that will be pre-specified and agreed upon (suitably taking into account the risks inherent in research). NRF will attain further accountability by ensuring that only investigators who handle their initial funding well and with integrity will receive new funds in the future.

8.10 **Intellectual Property to belong to researchers.** In accordance with international best practice, all intellectual property rights, including publications and patents, of NRF-funded research will be retained solely by those carrying out the research, while giving the government (including any of its assigned agencies) the license to use, practice, or implement the research/invention (or any of its output) for the public good without payment of any royalty or charge. In cases where NRF funding is being provided by a public-sector, private, or philanthropic entity for a particular research project (see **11.3-11.7**), this entity would also receive, along with the government, the same royalty- and charge-free license to utilise the research and its output.

9. Building Research Capacity in Universities and Colleges:

9.1 **Approach to Building Capacity.** In addition to funding peer-reviewed research proposals from around the nation, an important mandate of the NRF will be to seed, grow, and facilitate research at institutions in India where currently research is very limited. A key aspect of NRF's approach to build research capacity will be to utilise and bring outstanding serving or retired researchers from research universities and institutions to help seed and mentor research at State Universities and other universities and colleges where research is currently only in a nascent stage; outstanding researchers selected by NRF for the purpose will also contribute to the mentoring process, helping new researchers and institutions with grant-writing and with the appropriate set-up of research infrastructure and grant administration. Growing outstanding research cells already existing at State Universities will also be a top priority of the NRF. Finally, providing doctoral and post-doctoral fellowships to outstanding young researchers to join and help lead research programmes around the country will round out NRF's three-pronged approach to building research capacity at universities and colleges.

9.2 **Encouraging proposals that help build research capacity at State Universities.** A number of specific types of proposals will be sought to

help build capacity at State Universities and other universities/colleges that currently have limited research capability. These will include:

(a) **Seeding research at State Universities through Research Mentors / NRF Professorships**: Serving or retiring faculty at research universities and institutions who are still active in research may choose to serve as Research Mentors (in the form of **'NRF Professorships'**) at Universities and Colleges where research is currently in a nascent stage, particularly State Universities. Such a potential Research Mentor would submit to the NRF, in conjunction with a faculty member or a department chair at the desired state institution as a co-PI, a detailed research project proposal that describes how existing and new faculty members at the State Institution, as well as new postdocs and students, could participate in this project to grow a research cell(s). The proposal would be accompanied by an appropriate commitment from a university authority to suitably host the mentor and the proposed research project. Successful grants, given for an initial (but renewable) 3-5 year period, will provide Mentors with salaries (over and above their pensions to bring them to up to their original salary level) as well as research funding for the project, including for infrastructure, postdocs, and graduate students. Research Mentors at the State University would work not only on the proposed research project, but would also teach at least one accessible course a year to connect to the university community, and would also advise the university and its departments on growing a culture of research to transform into a research- conducting institution. There will be no age limit for Research Mentors; they will be permitted to serve as Research Mentors and apply for funding for as long as they are active and add value to their institutions. The talents of outstanding retired research faculty in the country are currently severely underutilised (many often leave the country when close to retirement age); this initiative, and the establishment of prestigious NRF Professorships at State Universities and colleges, will provide an invaluable opportunity to employ their expertise to expand research culture across the country.

(b) **Growing existing research at State Universities:** Outstanding research project proposals will be sought from all institutions of higher education and research across the country. However, special consideration for funding will be given to research being conducted at State Universities and other such universities and colleges where research capacity is currently limited. In particular, grants to build infrastructure (especially infrastructure that could be shared across many research groups), to fund travel and collaboration, and to hire doctoral students and postdocs, in order to grow existing and promising research programmes or seed new outstanding research programmes at locations where merit and expertise have been established, will be prioritised for State Universities and other

such HEIs (The NRF Board will formulate an inclusive and broad definition of HEIs) .

(c) **NRF Doctoral and Postdoctoral Fellowships:** Bringing in young research talent will be key to developing research cultures at educational institutions. For this purpose, NRF will launch a large and prestigious system of doctoral and postdoctoral fellowships to be used particularly at State Universities. NRF will maintain a list of doctoral and postdoctoral positions and projects that arise from the successful proposals in (a) and (b) above and will make a public call for applications for these positions. Outstanding applicants may apply for one or more of these positions based on their areas of interest and expertise. PIs or co-PIs in (a) and (b) may be consulted on the suitability of potential NRF Doctoral and Postdoctoral Fellowship candidates for their respective projects. NRF fellows will have opportunities to attend training workshops that enhance their teaching, leadership and mentoring skills. NRF fellows will be eligible to competitively apply for enhancement to their fellowships that require them to teach or mentor- research in schools or colleges addition to their research and other institutional commitments.

9.3 **Mentoring for grant applications and outcomes.** The NRF will not only provide funds but, as part of capacity building, applicants from institutions where research is only in nascent stages, but who submit research proposals of the level that could potentially be funded by the NRF, will be assisted by one or more Programme Advisors at NRF - who will be specifically commissioned by NRF for this purpose - to help bring the writing of the research applications up to the quality levels sought by NRF, before the application is put through the official review process of Subject Committees. Researchers of the above type that then receive funding will similarly be mentored and supported as needed throughout the funding period, to conduct research, to optimally use funds, and to deliver on the desired outcomes. Mentoring will also be provided to institutions and institutional leaders who wish to gradually transform their HEIs into more research-oriented colleges and universities.

9.4 **Capacity building through large, long-term missions or megaprojects.** NRF will consider funding larger national and international projects, in particular those that help build research, teaching, and other capacities at universities or that have a direct impact on society or fundamental knowledge in other ways. Examples of larger research projects of this type could include: a) nationwide projects to clean rivers: universities located near rivers could discuss the latest research on cleaning rivers - in a teaching and/or a research context - and participate on a mass scale in the practical aspects of this research at their own local rivers (leading to both scientific advancement and lessons in social responsibility); b) projects to bring clean energy to villages: universities located across the country could discuss the best clean energy solutions for their areas, and help implement these in their localities; c) nationwide projects to eliminate

diseases such as malaria; c) novel methods to teach literacy, or to preserve local languages, arts, or culture, that could be researched, developed and implemented by universities in their local communities across the country; d) scientific megaprojects where many universities could participate in analysing and interpreting the large amounts of data produced. See **10** for more details.

9.5 **Focus on underrepresented groups.** A key aspect of increasing research capacity will involve the support of proposals and of activities to increase the participation of underrepresented groups, including women, in research. Innovative measures that further this goal, such as special research workshops and conferences for talented women students, or at institutions in rural areas / Aspirational Districts / Special Education Zones, will be supported.

9.6 **Funding international collaborations and attendance at international workshops.** International research collaborations and attendance at international workshops will be encouraged and supported by the NRF, especially in areas where India does not yet have enough research strength on its own. In particular, special efforts and special schemes will be launched to strengthen international collaboration that leverages the Indian diaspora, which is seen as an important asset for research, innovation, and entrepreneurship in the country. Funding will also be provided for national and international travel for researchers to gain research perspectives from abroad.

9.7 **Other Research-Capacity-Building Measures.** NRF may help address the issues of capacity building at universities and colleges across the country through the creation of new technological capabilities and research infrastructure that may be shared across universities in a given geographical region, upgradation of different technologies, boosting fundamental research in university settings, as well as facilitating exchanges of scholars. NRF will work alongside all other funding agencies for this purpose.

9.8 **Role of Academies:** Academics associated with the national science and engineering academies and learned societies in the humanities and social sciences can add considerable value to the efforts of NRF. NRF can commission the academies and learned societies to produce expert reports and provide valuable advice on various topics that will help direct government efforts particularly with regard to government policy issues on research and education. Academies can also contribute greatly to capacity building for teachers and for researchers: their members can be mentors to university departments and colleges as these institutions seek to improve the quality of their teaching and research. NRF will aim to facilitate such linkages, especially to State Universities.

10. Large Inter-disciplinary Projects, Missions, and Megaprojects

10.1 **Large Inter-disciplinary Projects, Missions, and Megaprojects to inspire and propel the country forward.** High-impact, large-scale, multi-PI, multi-institution and, in some cases, interdisciplinary or multi-nation projects will also be pursued by the NRF to inspire and propel the country forward. Such interdisciplinary or large-scale projects will primarily be coordinated by the Research Offices of the NRF: the Office of Integrative Research and the Office of Missions and Megaprojects. Their call will be to choose truly outstanding projects that aim to advance areas of national importance, inspire youth and the people of the country, and grow India's position as a global leader.

10.2 **Research Offices to function similarly to Directorates.** Like the Directorates of the NRF, the Research Offices of the NRF will make calls for proposals within identified thrust areas, yet accept all outstanding proposals in all areas within their mandates. They will similarly have a Chair, Vice-Chair, and a team of expert Programme Officers who, in collaboration with Directorates, will arrange for peer reviews and review committees of national and international expertise, in order to make informed funding recommendations to the Office Chair and thereby to the NRF President and Board. Research Offices will also work with and help Directorates to establish robust and reliable review committees when the scale of a proposal is beyond the purview of any individual Directorate. The Office of Integrative Research will primarily be involved in making calls for, handling reviews of, and funding outstanding interdisciplinary and multidisciplinary proposals; the Office of Missions and Megaprojects will oversee India's participation in large-scale missions and megaprojects. The two Offices may work together on some of the proposals and projects where relevant.

10.3 **National Mission Projects.** The NRF, through its Office of Missions and Megaprojects, will fund National Mission Projects (NMPs) that help create or grow world class research facilities and Centres of Excellence in major thrust areas of research that are considered important for India's future. Each NMP would aim to establish or continue to support and grow an existing global class research Centre of Excellence (CoE) for the given mission, run by top researchers in the field, who in turn would aim to establish and expand (including through mentoring) a network of participating researchers/students/institutions/labs across the region or the nation in order to promote a regional or national research ecosystem in the given field; the CoE may recommend funding to other institutions/researchers for the purpose through the NRF. Examples of missions that are considered important for India's future at the current time include: artificial intelligence, big data analytics, water bodies rejuvenation technologies, sustainable habitats, sustainable agriculture, eradication of disease, climate science, preservation of manuscripts and artefacts, preservation and promotion of Indian languages, etc.

10.4 **Megaprojects.** The Office of Missions and Megaprojects will also, from time to time, help fund participation in `moonshots' and `research megaprojects', i.e., large-scale research projects that may take years to

carry out, may be worked on by multiple institutions or countries, may be funded by multiple agencies, and have the potential to be truly transformational and inspirational in a field or impact a huge number of lives. Such projects enable a country to connect and contribute to research and build research capacity at the very highest global level with national and international collaboration. Examples of some international research megaprojects that India is currently participating in include the Large Hadron Collider (LHC), the Laser Interferometer Gravitational-Wave Observatory (LIGO), and the Square Kilometer Array (SKA). Proposals for other types of national and international research megaprojects, relating, e.g., to new and emerging technologies that have the potential to improve the human condition, will also be handled by the Office of Missions and Megaprojects.

11. Creating Beneficial Linkages Among Government, Industry, and Researchers:

11.1 **The importance of linking researchers with government and industry.** At the current time, there is no direct link between research being conducted at institutions in the country and relevant government entities (both Central and State), which makes it much more difficult for breakthroughs in research and innovation to be implemented for the benefit of society. The NRF will help in playing this linking role, including connecting domain expertise with government policy making. The NRF will also help link both researchers and government with industry, in order to increase collaboration and synergy of purpose with respect to research, innovation, and implementation among all three parties. The NRF, through the President and the Director's Office, the Board, and the Office of Development, will stay in constant contact with relevant government entities and with industry for this purpose. The Board, in particular, will also contain representatives from industry. Similarly, the NRF will stay in close touch with agencies that support the entrepreneurial, start-up, and commercialisation ecosystem.

11.2 **Collaborations with Government and the Private Sector.** In addition to the annual grant to the NRF from the Government of India (GoI), NRF may also receive additional funds (as outlined below) from various ministries of the GoI and from State governments for funding research. Similarly, Public-Sector Units (PSUs), the private sector, and philanthropic organisations will also be encouraged to fund research of interest to them through the NRF. The infrastructure that will be created by the NRF for end-to-end management of the life-cycle of research projects, covering evaluation of proposals, disbursement of funds, mentoring for helping to achieve project goals, and regular monitoring and assessment of research outcomes, will be invaluable to ministries and other agencies that require research towards their own endeavours. Different models of collaboration between the NRF and ministries and other governmental entities, industry, and philanthropic organisations can be explored.

11.3 **Research requirements of ministries.** Many government ministries have research needs that are not being met at the present time. Several ministries have research cells that are largely not functional. NRF will offer its expertise to ministries for their research needs. Research of interest to ministries will be funded via the same mechanisms as set up by the NRF, namely, national calls for proposals, peer-review via empowered Subject Committees (a representative from the relevant ministry may also be included on the Committee for this purpose), allocation and disbursement of funds, mentoring, and monitoring of progress. It is likely that over time funding from ministries will grow into becoming say 2% or more of their budgets as they see value in their association with and the research work carried out through the NRF.

11.4 **Research requirements of State Governments.** The contribution to research spending by State governments has been negligible so far, just 7% of the budget for 2015-16, according to the DST. States may wish to fund areas of research of special interest to their geography through the NRF, e.g., for health and disease control, or for the promotion and preservation of State languages, literature, arts, culture, artifacts, manuscripts, heritage sites, etc. through suitable research (again, a representative from the State could be included on the relevant Subject Committees if so desired).

11.5 **Non-strategic aspects of strategic research establishments.** There are many areas of basic research that strategic departments would find useful to meet their varied requirements. These include basic research on materials, fluid dynamics, cryptography, coding theory, atmospheric sciences, electro-optics, lasers, nanoscience, scientific aspects of hydrogen as a fuel, photo-voltaic, machine learning, basic semi-conductor physics, quantum information and quantum computing, as well as various areas of study in the social sciences, humanities, and languages. One should see an expanded fundamental research activity coming out of the demands of the strategic departments which could also similarly be carried out through the NRF structure, in addition to research carried out directly by the strategic sector.

11.6 **Research requirements of other government entities.** Other government entities (including from States) may also wish to similarly have research carried out by the NRF for their research needs.

11.7 **Research requirements of industry and other organisations.** Public and private sector enterprises and organisations, including philanthropic organisations, will also be given the opportunity to similarly participate in NRF's research mechanisms. Providing funds for specific research needs through the NRF will have the advantage of helping enterprises and organisations identify academic groups in the country with the expertise they are looking for, through NRF's competitive calls for proposals. They will also benefit from the peer-review process of the NRF for allocation of projects to specific research groups, and be able to ensure that their

research projects receive adequate oversight. The process of funding research through the NRF will also help develop links between academia and the concerned public and private sector companies and organisations. Subject Committees of the NRF may each contain one representative from the respective organisations during deliberations of funding from these sources.

In any given year, no more than one third of NRF's total funding budget would come from public and private enterprises and other private organisations for specific research requests. All such research requests would be decided on a case-by-case basis by the Governing Board and Divisional Councils of the NRF, based on assessment of the potential for national benefit, funding offered, and NRF's ability, expertise in, and previous involvement with the general area.

General donations to NRF, even if they are for a given recognised subject, e.g., for Health, Agriculture, Literature, Physics, etc. (but not for a specific research project, need, or request) will have no restriction on amounts donated from any organisation.

It is suggested that all public and private sector enterprises will contribute a small percentage, say at least .1%, of their annual profits to research (such as donations for research to the NRF). This could be done within or outside CSR funds, and such contributions would come with suitable tax incentives.

A legislative route to make industry contributions to NRF research and donations to NRF projects eligible for weighted deductions (in the manner of Section 35 of IT Act) will be speedily initiated.

11.8 **NRF as a linking entity among researchers, government entities, and the private sector.** The NRF Board, through its Offices and Committees, will monitor the functioning of the NRF; in the process, it will receive recommendations from Subject Committees and Programme Officers on outstanding research progress occurring in the country, which the Board (through its President, Chair, and the Office of Development) may convey to relevant government and industry entities for possible implementation of such research by the government or public-private partnerships for national benefit. Conversely, suggestions and requests from government entities as well as industry regarding important directions for the country's research may help guide the NRF.

12. Recognising Outstanding Research Funded by NRF Through Awards and National Seminars:

12.1 **Recognition of truly outstanding research through awards and national seminars.** The NRF will institute a system of awards for truly successful research (by individuals as well as teams of researchers) taking place in the nation, and in particular funded by the NRF. The awards will

be given across divisions and subjects, and in a number of categories, e.g., for postdocs and young un-tenured faculty, for institutions (and the people involved) for successful efforts in seeding and growing research where it was previously limited, for initiatives in student education and research training, and for initiatives in promoting diversity and inclusion. The NRF will also organise national seminars and public lectures on outstanding research (including research in education) to encourage the award-winning researchers as well as other scholars and members of the public to get involved in the important issues that the research addresses.

13. Initial Setup:

13.1 **NRF Infrastructure.** A portion of the initial year's funding for the NRF will go to constructing/securing a suitable campus and building(s) that are conducive to outstanding performance with respect to NRF's various activities. The NRF will require suitable contiguous office space that houses, in one location, the President, Vice-President, COO, as well as the various Directorates and Offices of the NRF, in addition to spaces for hosting review panels and Board Meetings. The building should include spaces for services that uphold the workings of the NRF, such as administration, finance and IT. The NRF campus/infrastructure will also have a library, meeting rooms, breakout spaces, and an auditorium. The architecture of the NRF campus/infrastructure will naturally have an immeasurable effect on the work culture of the NRF.

13.2 **Allocations to Directorates:** The Directorates enumerated in **7.4** will be directly allocated 2/3 of the total research funds of the NRF, in the initially suggested ratios of 8 : 4 : 8 : 4 : 2 : 1 : 1 : 8 : 4 : 4. These suggested ratios are not meant in any way to be indicative of the relative importance of these fields, but rather of the actual costs of research and the current absorptive capacities in these research areas in the nation. The remaining 1/3 of the research funds of the NRF will be at the discretion of the President and the Board of the NRF, in consultation with the Office of Integrative Research and the Office of Missions and Megaprojects, to fund (in collaboration with relevant Directorates and other funding agencies) larger interdisciplinary projects, missions, and megaprojects, and to provide additional funds as needed to Directorates / Divisions / Programmes / Research Offices in cases of a larger-than-expected number of outstanding proposals within a Directorate or Research Office in a given year (thus providing an important flexibility to the initially suggested ratios). All unused funds will be carried over within each Directorate to the next year and not lost, in order to help ensure that funds are provided only to outstanding proposals. The total funds allotted to each Directorate and Research Office will be fine-tuned year-to-year by the Board of the NRF based on previous years' experiences with quality of proposals, quality of outcomes, ongoing projects, regular assessments of national research needs, and the development of absorptive capacity for research in the country within each area, as will be carefully monitored,

analysed, and documented on a regular basis by the Office of Data and Information Management.

13.3 **Society Founders and First Board.** The members of the PM-STIAC will be the founders of the Society. The first Board will be chosen at the time of the founding of the Society and will consist of some of the most accomplished and eminent researchers and professionals having a wide range of expertise across fields. The members of the first Board shall be recommended by the Office of the Principal Scientific Advisor - after wide consultations with academia, government, and industry - to the Prime Minister for approval.

13.4 **Personnel Matters.** All employees of the NRF will be on fixed-term contracts whose terms of renewal will be based upon performance reviews. In order to be able to draw the best people from academia and industry, detailed recruitment, promotion, and superannuation rules for the President, Vice-President, COO, Directorate and Office Chairs, Programme Officers, and high-quality senior Administrative Staff will be framed by the NRF and approved by the Board following the principles outlined in **7.15**. To this end, the Board will have a standing Recruitment, Promotion, and Compensation Subcommitttee which will continuously review and set the rules and regulations for personnel matters of the NRF.

14. Financial Implication:

14.1 **Infrastructure.** The infrastructure for the NRF will accommodate the Office of the President and up to 10 Directorates across research disciplines and 10 administrative Offices. Cabins for senior staff and their executive assistants, and shared seating areas for all other staff members, will be created and suitably grouped into Directorates, Divisions, and Offices. There shall also be breakout spaces where discussions among people from different Directorates and Offices can take place.

There shall also be adequate space devoted to other areas of shared use such as a library, cafeteria, tea and coffee areas, board room, lounge, auditorium, several meeting rooms and classrooms of different sizes, as well as spaces for IT services, housekeeping needs, and so on.

The quality of the spaces being created must be inspirational and of international quality so as to support the high aspirations that the country has from the NRF.

The infrastructure may be stand-alone, or it may be adjacent to an existing research campus in order to enable the sharing of some of the above-mentioned areas such as the cafeteria, etc. and to enable and foster a more vibrant research community.

Space required:

The Office of the President will include a main cabin of offices, a discussion room cum lounge, meeting room, lobby, pantry, and reception, and will initially house approximately 10 staff members including the President, Vice-President, and COO. It is estimated that the space required for the Office of the President will be approximately 600 Sqm.

The 10 Directorates will initially have an average of 4 divisions each; each Division would have a Chair, Vice-Chair, approximately four Programme Officers, including the Lead Programme Officer, and 4 technical staff, for a total of 40 staff members per Directorate on average. Each Directorate would also have one or more meeting rooms for discussions with grantees and for internal discussions. The estimated space required for each Directorate will on average be 800 Sqm.

The 10 Offices will each have a Chair and Vice-Chair, along with about 15 technical staff, on average (some Offices would require a greater number of staff and consequently a greater amount of space, such as the Office of Budgeting, Accounting, and Grant Management), for a total of about 17 staff per Office on average. A number of the offices would require meeting rooms, particularly the Office of Budgeting, Account, and Grant Management, and the Office of Integrative Research, for discussions with Directorates, grantees, and internal discussions. The estimated space required for each Office will, on average, be 400 Sqm.

An auditorium of 200-person capacity would be approximately 300 Sqm, a library an additional 250 Sqm, an office of IT and computer facilities at 200 Sqm, a Board room, meeting halls, classrooms, and breakout spaces of around 1000 Sqm, and a common cafeteria and recreational/fitness facilities would require an additional 500 Sqm each. Utility services/substation and security would likely require an additional 1000 Sqm.

The initial built up area is thus expected to be 600 + (10 x 800) + (10 x 400) + 3750 = 16350 Sqm, plus additional areas for reception, corridors, lobby spaces, restrooms, staircases, lifts, service spaces @ 40% of 16350 Sqm, i.e., 6540 Sqm, for a total of about **22890 Sqm**. (See Annexure 1.)

Cost of construction

a. Basic cost of construction of the main building (22890 Sqm at Rs. 50046.12) = ₹114.56 cr.

b. Cost of furnishing at 20% of the basic cost of construction = ₹22.91 cr.

c. Improved specification and architectural features at 10% of the basic cost of construction = ₹11.46 cr.

d. Contingencies at 3% of the basic cost of constuction = ₹3.78 cr.

e. Escalation for 3 years at 7.5% of the costs of construction per annum = ₹29.21 cr.

f. Labour cess at 1% of the cost of construction = ₹1.59 cr.

g. Costs of other allied expenditures such as power supply, water supply, architectural services and project management = ₹22.68 cr.

h. Escalation for 3 years at 7.5% of allied expenditures per annum = ₹10.26 cr.

i. GST at 12% of total costs = ₹25.78 cr.

Total cost of construction of 22890 Sqm on an entirely new campus, including all external services, cafeteria, and other ancillary buildings : ₹242.23 Cr. (See Annexure 2.)

The above cost of construction does not include the cost of land. As the NRF would be a significant source of local employment and a prestigious institution for a State/UT to host, the aim would be to acquire land at minimal cost from a State/UT.

The above costing is based on the present cost index applicable to Delhi as per 2019 CPWD guidelines, and may vary depending on the actual location.

If the facility is constructed adjacent to an existing campus, where services can be shared, costs of construction may be reduced by about 10%, or about ₹17.5 crore, due to possible sharing of common facilities such as the cafeteria, water and electric supplies, etc.

Annual maintenance costs of the NRF infrastructure are estimated to be around 10% of construction costs, as per usual practice, or approximately ₹23.6 crore annually.

Extent of land required

A minimum of 5 acres of land will be required, as service facilities will need to be constructed away from the main building, including for fire tender movement and the provision of sufficient parking and greenery around the building.

Somewhat larger amounts of land would allow for a `campus' and a more robust research and education environment and also provide room for future expansion in accordance with the growth and success of the NRF.

It would be preferable to establish the facility adjacent to an existing research campus, as it will reduce maintenance / running costs, as well as help to develop a more vibrant research / education community.

Realisation in a phased manner

1st and 2nd year: Operation from leased premises of about 7650 Sqm at ₹2196 per Sqm per month. Leasing costs are thus estimated at ₹24.2 crores per year (depending on the city and location). About one half of the NRF staff envisaged in this document will be recruited by the end of the second year.

End of 2nd year: Completion of Phase I of construction, after which the aforementioned staff of the NRF may move into the NRF facility.

5th Year: Completion of Phase II of construction, by which time the full cohort of staff as envisaged in this document may be recruited and move into the NRF facility.

Future years: Further phase(s) of construction could be taken up in future years in accordance with the growth and success of the NRF.

Total costs for infrastructure

The total costs for infrastructure, including the leasing of temporary space and the construction of new space, is thus expected to be about ₹242.23+24.2+24.2+23.6+23.6 = ₹337.83 cr for the first five years.

14.2 **Salaries.** Salaries for the President, Vice-President, COO, Directorate and Office Chairs, Programme Officers, and high-quality Administrative Staff numbering about 532 people by the fifth year are estimated to be in total about ₹19.65 crores per year for the first two years, and about ₹39.3 crores per year for the remaining three years of the initial 5-year period, for a total of ₹157.2 crores over the first five years. These estimates arise taking into account that only about one half of the total NRF staff envisaged in this document will be recruited by the end of the second year. The remaining staff as described in this document will be recruited by the end of the fourth year. See Annexure 3.

14.3 **Funding for research.** All remaining (i.e., over 98% of) funds of the NRF will be used to support research in accordance with the robust procedures of merit-peer-review and equity described in this document.

Seeding Research at State Universities through NRF Professorships

One of the foremost aims of the NRF will be to seed research at Universities and Colleges where research is currently nonexistent or in nascent stages, particularly State Universities, where 90% of the country's faculty and students work and study.

To this end, the NRF will aim to fund 100 prestigious NRF Professorships at such Universities and Colleges each year across the country and across disciplines. These 5-year renewable positions will be occupied by the highest-quality researchers, who will move to their chosen Universities/Colleges to launch new high-quality research cells. To enable this, these Professorships will come with a seed 5-year grant (of about 5 crores on average) and include positions for postdoctoral and doctoral fellows. The average estimated cost for each NRF Professorship, including the seed grant and associated research positions, will be approximate ₹8.44 cr, for a total cost of about ₹4220 cr over five years. See Annexure 4.

Centers of Excellence

Each year, proposals will be invited for establishing Centres of Excellence at higher education institutions in areas of critical national importance, such as Machine Learning, Environmental Science, Preservation of Indian Languages, Museum Administration, etc. Many of these Centres will aim to work in an interdisciplinary manner. It is estimated that 20 such Centres of Excellence, along with associated research funding, will be established by the NRF over the period of five years, at an average cost of ₹300 cr each, for a total cost of ₹6000 cr.

National Mission Projects

Two nationwide multi-institution 'National Mission Projects' of critical national importance or inspiration (including participation in international magaprojects such as LIGO) will be funded every year, on average, with an expected cost of ₹1000 cr per Mission over 5 years. The total cost is thus expected to be ₹10,000 cr over 5 years.

Doctoral and Postdoctoral Fellowships

The NRF will initially select and fund 500 Doctoral and 500 Postdoctoral Fellowships each year to outstanding candidates across fields (and thus about 50 Doctoral and 50 Postdoctoral Fellowships per Directorate), and increase to 1000 Doctoral and 1000 Postdoctoral Fellowships each year (i.e., about 100 Doctoral and 100 Postdoctoral Fellowships per Directorate on average). Fellowships will come with associated contingencies, such as basic conference travel funding, 10% grant overhead for the institutions they join, etc. The total cost per year of the NRF Doctoral and Postdoctoral Fellowships Programme will be ₹39.56 lakhs x 4500 + ₹37.48 lakhs x 4500 over the first five years, or about ₹3467cr. See Annexure 5.

Funding of Grants

A major goal of the NRF will be to fund good people with good ideas, across fields, wherever they may be located. Proposals of all kinds to this end will be invited by the NRF from individuals and groups of individuals

across institutions. The aim will be to increase, over time, the resource absorption capacity for high-quality research in the nation.

The NRF will aim to select and fund 320 high-quality 3-year projects per Directorate (about 20 projects per Programme Officer), thus eventually building to about 960 Active Projects per year per Directorate (thus about 60 active projects handled by each Programme Officer at any given time). Each project is expected to cost 1.67 crore on average. Naturally, applied science, engineering, and health projects will require more funding on average than projects in the humanities and theoretical sciences. Many of these projects would be interdisciplinary, and suitably shared across Directorates, as coordinated by the Office of Integrated Research. It is understood that there may well be a larger number of projects than estimated, many of which would, however, require far smaller amounts of grant money.

The total cost for the first five years towards high-quality grant funding will thus be about 10 x 320 x ₹1.67 cr x 5 = ₹26,720 cr. See Annexure 6.

Total funds required

The total funding required for the NRF over the first five years will be Rs. ₹26720+3465+10000+6000+3925+157.2+337.8 = ₹50905 cr over 5 years. See Annexure 7.

14.4 **Further funding.** Through its Office of Development, the NRF will aim to raise additional resources and develop partnerships with industry and philanthropy. Additional projects may thus be suggested and funded by the private sector through the NRF, making use of NRF's extensive experience with calls for proposals, peer-reviews, and funding and auditing mechanisms. The aim will be to have 20% of all funding to be coming from private sources within five years, and up to over 30% by the end of ten years. The Office of Development, together with the President and NRF Board Members, will continuously work to secure private funding to enhance NRF's research footprint on the nation.

It is important to reiterate three points here. First, the NRF will support quality research. For quality research proposals to be submitted, and for the associated mentorship programmes to succeed, the budget will need to be fully supported as will the quality and number of staff in the NRF. Second, raising outside resources and developing partnerships with industry will be a major task in itself and will require dedicated staff. Finally, foundational research support from government is necessary and will always be needed in a knowledge-driven economy and society.

14.5 **Administrative costs.** In the current model, the total administrative cost (including infrastructure and salaries) will be less than 1% of the total budget of the NRF. In accordance with national and international best practices, even if administrative costs increase in the future, it will nevertheless be aimed at all times that the cost of administering NRF

research funding will remain no more than 2% of the total budget of the NRF, in order to ensure always that the vast majority of NRF funds go towards advancing and supporting outstanding research in the country.

Annexure 1:

Planned area statement

Sl No.	Space type	No.	Proposed area	Total Area in Sqm
1	President office complex	1	600	600

2	Directorates	10	800	8000
3	Offices	10	400	4000
4	Auditorium - 200 capacity	1	300	300
5	Library	1	250	250
6	IT office & computer facilities	1	200	200
7	Meeting rooms, lecture rooms, and board room	1	1000	1000
8	Health & wellness Centre	1	500	500
9	Dining & faculty Lounge	1	500	500
10	Utility services, substation, and security	1	1000	1000
	Total carpet area :-			**16350**
11	Additional areas for reception, corridors, lobby spaces, restrooms, staircases, lifts, service spaces @ 40%	40%		6540
	Total area :-			**22890**

Annexure 2:

Costs of construction of NRF infrastructure

A. Abstract of Block Estimate - Plinth Area Rates 2019 (CPWD)

Sl No.	Description of Items		Rate/ sqm	Amount in Rs. Cr
1	Civil works		32737.21	
2	Services		7267.50	
3	Lifts		225.00	
4	RCC Water Tank		816.67	
5	Development Work		2433.96	
6	Misc. works		927.08	
7	SPECIALISED E & M WORKS.		5638.71	
	Total		50046.12	114.56
8	Improved specifications and architectural features	10%	5004.61	11.46
	Total (Basic cost of construction)		55050.73	**126.02**
9	Contingencies @ 3%		3%	3.78
10	Escalation for 3 Yrs @ 7.5%/annum		22.5%	29.21
11	Labour cess @ 1%		1%	1.59
12	GST @ 12%		12%	19.08
	Total (Net cost of construction):-			**179.68**

B. Allied expenditures (Bulk Services)

Sl No.	Details	Amount in Rs. Cr
1	Power supply.- Rs 75.00 lakhs for about 2 kms distance.	0.75
2	Water supply.- Rs.125.00 lakhs for about 2 kms distance.	1.25

3	Vehicle for pre-project activities till commission.- Rs. 30.00 lakhs: for 5 years.	0.30
4	Expenditure for pre-project activities such as geo-technical investigation, borewell construction for water, site office, etc.,- Rs 15.00 lakhs	0.15
5	Quality check/lab charges during construction stages.- Rs.5.00 lakhs	0.05
6	Hiring of staff for construction supervision & office support.- Rs 220.00 lakhs	2.20
7	Site & support office infrastructure tillcommission of the campus.- Rs 25.00 lakhs	0.25
8	Software related to planning & estimate, billing, execution, project monitoring etc., for effective project management.- Rs 15.00 lakhs	0.15
9	Cost of furnishing @ 20% of basic cost of construction.	22.91
10	Deposits to statutory departments.- Rs 60.00 lakhs.	0.60
11	Evaluation of consultants & contracting agencies.- Rs 30.00 lakhs. (Depends on number participating firms.)	0.30
12	Material inspections & pre-dispatch inspections.- Rs 15.00 lakhs.	0.15
13	Travel & air fare of top management.- Rs 15.00 lakhs.	0.15
14	Consultancy services (Architectural, Structural, MEP, Landscape, AV system, Networking etc.) - 5% of basic cost of construction.	6.30
15	Construction & project management - 8% of basic construction cost (if outsourced to external firm).	10.08
	TOTAL	**45.59**
16	Escalation for 3 Yrs @ 7.5%/annum	10.26
17	GST @ 12%	6.70
	TOTAL	62.55
	TOTAL of A + B	**242.23**

Annexure 3:

Salaries

A. Salaries for posts in Office of the President

Office/Post/Designations for each Directorate	Number of Posts	Pay Scale	Level in 7CPC	Gross Pay at Stage-S	Total / Annum
1. President, NRF	1	Apex	80,000	2,25,000/-	
Executive Secretary	1	PB 4- GP 8900	13A	1,47,600/	
Section Officer	1	PB 3- GP 5400	10	63,100/-	
Office Assistant I	2	PB 2- GP 4600	7	50,500/-	
Office Assistant III	2	PB 1- GP 2400	4	28,700/-	
MTS	2	PB 1- GP 1900	2	21,100	
SCD	1	PB 1- GP 1900	2	21,100	
2. Vice-President, NRF	1	(HAG+)	L-15	2,05,100/-	
Asst. Executive Secretary	1	PB 3 - GP 6600	11	76,200/-	
Section Officer	1	PB 3 - GP 5400	10	63,100/-	
Office Assistant I	1	PB 2 - GP 4600	7	50,500/-	
Office Assistant III	1	PB 1- GP 2400	4	28,700/-	
MTS	1	PB 1- GP 1900	2	21,100	
SCD	1	PB 1-GP 1900	2	21,100	
3. CEO, NRF	1	(HAG+)	L-15	2,05,100/-	
Asst. Executive Secretary	1	PB 3 - GP 6600	11	76,200/-	
Section Officer	1	PB 3 - GP 5400	10	63,100/-	
Office Assistant I	1	PB 2- GP 4600	7	50,500/-	
Office Assistant III	1	PB 1- GP 2400	4	28,700/-	
MTS	1	PB 1- GP 1900	2	21,100	
SCD	1	PB 1- GP 1900	2	21,100	
Total	**24**				**1.9 Cr**

B. Salaries for posts in each Directorate

Office/Post/Designations for each Directorate	Number of Posts	Pay Scale	Level in 7CPC	Gross Pay at Stage-S	Total / Annum
Chair	1	PB 4 - GP 10000	14	1,62,300/-	
Vice Chair	1	PB 4- GP 8900	13A	1,47,600/-	

Lead Programme Officers	4	PB 3 - GP 7600	12	88,700/-	
Programme Officers	12	PB 3 - GP 6600	11	76,200/-	
Office Assistant I	6	PB 2- GP 4600	7	50,500/-	
Tech. Assistant D	8	PB 2 - GP 4200	6	39,900/-	
MTS	6	PB 1- GP 1900	2	21,100/-	
Total	38				2.79 cr
Total for 10 Directorates	**380**				**27.9 cr**

C. Salaries for posts in each Office

Office/Post/Designations for each Office	Number of Posts	Pay Scale	Level in 7CPC	Gross Pay at Stage-S	Total / Annum
Chair	1	PB 4 - GP 10000	14	1,62,300/-	
Vice Chair	1	PB 4- GP 8900	13A	1,47,600/-	
Programme Managers	4	PB 3 - GP 6600	11	76,200/-	
Office Assistant I	3	PB 2- GP 4600	7	50,500/-	
Tech. Assistant D	4	PB 2 - GP 4200	6	39,900/-	
MTS	3	PB 1- GP 1900	2	21,100/-	
Total	16				1.19 cr
Total for 8 Offices	**128**				**9.5 cr**

Annexure 4:

NRF Professorships

Year	Average Stipend for NRF Professor (over 5 years)	Seed Grant + 10% overhead	Total cost for 2 postdoctoral + 2 doctoral fellows*	Total cost per Professor-ship	Number of Professor-ships	Total
2020-21	90,00,000	5.5 cr	2,04,08,960	8,44,08,960	100	844.09 cr
2021-22	90,00,000	5.5 cr	2,04,08,960	8,44,08,960	100	844.09 cr
2022-23	90,00,000	5.5 cr	2,04,08,960	8,44,08,960	100	844.09 cr
2023-24	90,00,000	5.5 cr	2,04,08,960	8,44,08,960	100	844.09 cr
2024-25	90,00,000	5.5 cr	2,04,08,960	8,44,08,960	100	844.09 cr
Total					500	**4220.45 cr**

Annexure 5:

Doctoral and Postdoctoral Fellowships

A. Doctoral Fellowship Commitments

Year	Doctoral Fellowship Stipend (over 5 years)	HRA @ 24%	Annual Contingency Grant (x 5 years) +10% ovhd	Total cost per fellow	Number of fellows	Total
2020-21	18,60,000	4,46,400	16,50,000	39,56,400	500	197.82 cr
2021-22	18,60,000	4,46,400	16,50,000	39,56,400	1000	395.64 cr
2022-23	18,60,000	4,46,400	16,50,000	39,56,400	1000	395.64 cr
2023-24	18,60,000	4,46,400	16,50,000	39,56,400	1000	395.64 cr
2024-25	18,60,000	4,46,400	16,50,000	39,56,400	1000	395.64 cr
Total					4500	**1780.38 cr**

B. Postdoctoral Fellowship Commitments

Year	Doctoral Fellowship Stipend (over 3 years)	HRA @ 24%	Annual Contingency Grant (x 5 years) + 10% ovhd	Total cost per fellow	Number Of fellows	Total
2020-21	16,92,000	4,06,080	16,50,000	37,48,100	500	187.40 cr
2021-22	16,92,000	4,06,080	16,50,000	37,48,100	1000	374.81 cr
2022-23	16,92,000	4,06,080	16,50,000	37,48,100	1000	374.81 cr
2023-24	16,92,000	4,06,080	16,50,000	37,48,100	1000	374.81 cr
2024-25	16,92,000	4,06,080	16,50,000	37,48,100	1000	374.81 cr
Total					4500	**1686.64 cr**

Annexure 6:

Funding of Grants

Year	Average grant per project	Number of projects annually	Annual Total
2020-21	1.67 cr	3200	5344 cr
2021-22	1.67 cr	3200	5344 cr
2022-23	1.67 cr	3200	5344 cr
2023-24	1.67 cr	3200	5344 cr
2024-25	1.67 cr	3200	5344 cr
Total		16000	**26720 cr**

Annexure 7:

Total costs over 5 years (in Rs. Cr.)

Year	Infra-Structure	Grants	Salaries	NRF Professorships	Doctoral and Post-doctoral Fellowships	COEs and Research Infra-structure	Missions and Mega-projects	Total
2020-21	60.56	5344	19.65	844.1	385.2	1200	2000	9853.5
2021-22	84.76	5344	19.65	844.1	770.4	1200	2000	10262.9
2022-23	84.76	5344	39.3	844.1	770.4	1200	2000	10282.6
2023-24	84.16	5344	39.3	844.1	770.4	1200	2000	10282.0
2024-25	23.6	5344	39.3	844.1	770.4	1200	2000	10221.4
Total	337.8	26720	157.2	4220.5	3467	6000	10000	**50902.5**

NB:

1. No projects are being approved beyond the first 5 years. Funds will be used and will taper off beyond 5 years since the scheme for funding provides for instalments for 3 to 5 years from the year of award.

2. Estimates for salaries may be expected to increase at 10% a year from the first- year projections.

3. Costs do not include power and water, travel, advertising and publicity, international collaborations and meetings-related expenses, etc.

Annexure 8:

Justifications for NRF Costs

(with Comparisons to Costs of Other Successful Global Research Funding Agencies)

U.S. National Science Foundation (NSF): The U.S. NSF is considered by scientifc organisations worldwide as the gold standard for funding high-quality research, with rigorous peer review panels, procedures for ensuring the absence of conflicts of interest, and an outstanding system of grants management, budgeting, and accounting for efficient use of funds.

The NRF is thus modeled in large part on the U.S. NSF and similar such research organisations in other parts of the world - such as the European German Research Foundation (DFG), The UK Research and Innovation (UKRI), Japan Science and Technology Agency, the Swiss National Science Foundation, the Norwegian Research Council, the National Research Foundation (South Korea), and the Singapore National Science Foundation - while taking into account the Indian context.

Some relevant details on the U.S. National Science Foundation:

The NSF is one of 28 significant research funding agencies in the U.S.; it is the U.S. funding agency that is the most comprehensive - across disciplines and with respect to coordination with higher education institutions, other funding agencies, government bodies, and industry. The budget of the U.S. NSF is about $7.8 billion per year, or about ₹5.5 kharab annually. The NSF funds about 11,000 proposals a year. The average grant is about $178,000 per year, with a typical duration of 3 years (although some proposals are longer), yielding an average of about ₹3.8 cr total per grant. (Funding for megaprojects, etc., are not considered in this average.)

The NSF is in a prominent location in the greater Washington, D.C. area (Alexandria, VA), across the street from a metro station for easy access, and has about 70K Sqm of built space over 19 stories, on 2.03 acres.

The NSF has 1,700 employees of which 509 are Program Officers. Thus each program officer on average handles about 22 new funded proposals a year, and about 70 total proposals at any one time. Most NSF program officers interviewed said that they found this number a bit too many, and would prefer fewer proposals to oversee so that they could more closely monitor, evaluate, and provide support to each one while keeping up their own research work.

The other concern expressed within the NSF was the overemphasis on science and engineering, thereby precluding the funding of important interdisciplinary and multidisciplinary research across the arts, humanities, sciences, engineering, and social sciences. Environmental science did not have an

obvious place in the NSF, also considered a deficiency in its setup given the unfortunate current environmental direction of the planet.

Recommendations for the NRF:

At the current time, despite India's population being triple that of the United States, the research capacity in India is about one-tenth of that of the U.S. One of the aims for research in India will be to move from 1/10 capacity to about 1/4th to 1/3rd capacity over the next 5 years. In particular, a guiding principle for the NRF will be to emulate the NSF - in its aspects relating to efficient budgeting, eliminating conflicts of interest, etc. – but at the same time improve the NSF (e.g., by including subjects that the NSF did not include, providing greater mentoring and handholding to seed and grow research across the country, etc.). The guiding aim will be for the NRF to function at between ¼ and 1/3 of the level of the NSF in terms of its infrastructure, the number of proposals funded, the number of programme officers, the total number of employees, etc.

Due to lesser labour costs in India, the total administrative and research budget of the NRF to achieve the above should come in under 1/5 of the total budget of the NSF during its first five years.

Directorates:

The overarching goal of the NRF is to increase research capacity across all fields across institutions in India, and to ensure that this research is multidisciplinary, curiosity-driven, has positive societal impact, and includes environmental science, Indian knowledge, as well as innovation & entrepreneurship. The NRF will thus have 10 Directorates across disciplines – Natural Sciences, Mathematical Sciences, Engineering, Arts & Humanities, Social Sciences, Earth and Environmental Sciences, Indian Languages and Knowledge Systems, Health, Agriculture, and Innovation & Entrepreneurship.

Programme Officers:

Over the first five years, each Directorate will have on average 4 subject Divisions, and 4 Programme Officers in each subject Division, for a total of 16 Programme Officers per Directorate, and thus a total of 160 Programme Officers across the NRF. Note that this number (160) is indeed between ¼ and 1/3 of the number (509) of such Officers at the NSF.

Each Directorate will have about 16 additional support staff as well. Administrative Offices will have about 20 staff each on average. The total number of employees at the NRF will thus be around 520, which again is between ¼ and 1/3 of the total number (1700) of employees at the NSF.

Number of Funded Proposals:

Each Programme Officer will aim to handle 20 or so newly funded proposals a year – handholding, monitoring, and supporting them – or about 60 funded proposals at any one time. The number of funded proposals per Programme Officer is thus approximately at NSF levels, but just slightly lower given the novelty of the job in India and the nascent stage of research at most Indian universities and colleges, meaning that each proposal will likely require considerably more time from each Programme Officer compared to those nations where research infrastructure is significantly higher at the current time.

The expectation is thus to fund about 3200 three-year proposals a year across disciplines. This number (3200) too is between ¼ and 1/3 of the number that NSF currently funds (11000).

Infrastructure:

To handle this number of employees, NRF should also initially aim to be about 1/3 the size of NSF headquarters. The proposed 22785 Sqm (Annexure 1) is indeed about 1/3 of the size of NSF's 70K Sqm.

Specific initiatives:

The types of proposals suggested are very similar in scope and design to those funded by the NSF. However, the initiative of NRF Professorships to seed research at State Universities is tailored to the Indian context.

Individual grants to outstanding proposals:

At the current time, the most prestigious science and engineering grants of the government (from SERB, etc.) are three-year grants of about ₹2 cr – 5cr each. Grants for the social sciences tend to be smaller (due to the significantly lower costs of research equipment needed) while for the humanities and arts, grants tend to be much smaller still (for similar reasons). However, the costs of research postdocs and Ph.D. students are the same regardless of field. It is thus expected that the most prestigious grants in any subject (especially those that include also a research postdoc and a Ph.D. student, for example) would still require ₹1cr over three years.

Since the NRF will aim to fund the most impactful research, and encourage more students and postdocs working in research, it is expected that most funding granted will range between ₹1cr and ₹2cr. In fact, since most NRF grants will be in the sciences, health, engineering, and technology, it is estimated that the average grant size will be about ₹1.67cr, i.e., somewhat closer to ₹2cr than to ₹1cr.

Of course, it will depend on the proposals received as to what the average will really turn out to be. There may well be many smaller high-quality proposals – perhaps not requiring students and postdocs - that will be worth funding. There may be a few revolutionary proposals requiring significantly more funding. The overall goal will be to fund good people with good ideas.

The total NRF cost of funding outstanding research proposals across disciplines at institutions across the country is thus expected to be 3200 x ₹1.67cr, i.e., ₹5344cr, per year, or ₹26720cr over five years (Annexure 6).

The costs required will be constantly reviewed by Programme Officers and the Office of Grants Management, Budgeting, and Accounting, and the Office of the Inspector General, to ensure efficient and honest usage of funds.

Research Mentors / NRF Professorships:

To grow research capacity in the country, as mentioned above Research Mentors will be recruited to State Universities and other universities where research is currently nascent. This will be a prestigious programme, with 100 high-profile researchers a year being given such NRF Professorships during the first five years). These Professorships (the exact costs will depend on the subject) will come with one time research grants of up to ₹5cr for setting up of research lab infrastructure, an Honorarium of approximately ₹1 lakh PM for Retired Faculty (to bridge the gap between pension and full salary) or Full Salary at Scientist H level for Currently Serving Faculty (approximately ₹2 lakh PM), 2 three-year Postdoctoral fellows (₹47000 PM + HRA 24% + Research Contingency Grant of ₹5 lakhs per annum), 2 five-year Junior Research Fellows / Ph.D. Students (₹31000PM + HRA 24% + Research Contingency Grant of ₹3 lakhs per annum), Contingency Grant of ₹10 lakhs per annum, and overheads of 10% on all grants. Awards are initially for a 5-year term, renewable for further terms upon success of the NRF Professorship and upon demonstrated research growth at the institution. Grant amounts here are Modelled on the Swarna Jayanti Fellowship and NRDMS Chair Professorship Scheme of DST.

The total expected cost for the NRF Professorships / Mentoring Programme over 5 years is thus as in Annexure 4.

NRF Doctoral and Postdoctoral Fellowships:

The NSF awards a total of 2,000 graduate and 2,000 postdoctoral fellowships every year. It is proposed that the NRF fund about ¼ of these numbers in its initial year and then scale up to funding about ½ of these numbers rapidly (across all fields), and thereby to scale up the research culture of the country and of the next generation as soon as possible. The total expected cost for the

NRF Doctoral and Postdoctoral Fellowship Programme (across all disciplines) is thus expected to be as in Annexure 5.

National Mission Projects and Megaprojects:

Participation in National Mission Projects and megaprojects can boost national and international collaborations in important areas across fields. Examples that India has participated in include LIGO (which resulted in Indian institutions' citation in the Nobel Prize for discovery of gravitational waves) and SKA, which had Indian contributions of ₹3000cr and ₹500cr, respectively, and dramatically boosted Indian science. Besides physics, national and international missions in other subjects would also similarly boost research (e.g., missions to clean rivers, reduce pollution, build a jet engine, build a network of supercomputers, preserve Indian languages and Indian manuscripts, etc). The average cost per mission may be estimated at ₹1000cr in view of previous missions; the total cost for 10 missions may be estimated at ₹10000cr.

Centres of Excellence:

To develop expertise in certain research areas that are so far underdeveloped in India, it is envisioned to develop Centres of Excellence in given such areas (through competitive calls for proposals) at, say, 20 institutions around the country over 5 years. Such areas may include artificial intelligence, clean energy, water conservation, preservation of ancient Indian manuscripts, preservation of Indian languages, climate/monsoon studies, etc. The aim would be to develop a cutting-edge Centre that conducts the highest-quality global-class research in the subject. A modest estimate of ₹300 cr to set up each Centre, on average, gives an estimate of ₹6000 cr total to develop such Centres.

Total budget:

The total budget for the NRF is thus estimated to be about ₹5 kharab over 5 years, less than 1/5 of the corresponding figure of ₹27.85 kharab for the NSF.

Some relevant details on the ERC:

It is also worth comparing the proposed NRF with the European Research Council. Note that the ERC is only a part of the EU Framework for Research and Innovation - the ERC represents 17% of the EU Horizon 2020 Research and Innovation budget.

The very basic principle of the ERC is to follow strictly a bottom-up approach where there is no hard separation of disciplines and/or topics used to determine priorities or shares. Domains of knowledge are divided roughly into 27 disciplines (compared with 10 Directorates and about 40 Divisions for the proposed NRF).

The budget for the ERC is about ₹1.73 kharab per year, or about ₹8.7 kharab over 5 years. It funds about 1200 grants annually, each ranging from ₹5cr to over ₹10 cr in size. The ERC office space consists of the top six floors of the Berlaymont building in Brussels, and occupies about 80,000 Sqm (compared to the requested 22,890 Sqm requested for NRF office space). The ERC has approximately 800 employees (compared to the 532 requested for the NRF).

Summary:

The above justifications for NRF funding, infrastracture, and human resources use estimates based on global norms that have been adjusted to the Indian context. As the above comparisons make clear, the request for NRF funding and infrastructure is minimal - far smaller than the NSF (and the ERC) - given what the NRF aims to deliver.