CFPs ON GENOME EDITING OF CROPS FOR ENHANCED ATTRIBUTES

Letter of Intent (LoI) (Stage-1) deadline:
February 27, 2023 (by 15:00 hrs IST)

Invited Full Proposal (Stage-2) deadline:
May, 2023 (by 15:00 hrs IST)

जैव प्रौद्योगिकी विभाग
Department of Biotechnology
Ministry of Science & Technology
Government of India
सत्यमेव जयते

Azadi Ka Amrit Mahotsav

…….. Grant Call 2022-23

The Department of Biotechnology, Ministry of Science & Technology is pleased to announce

Call for Proposals for Financial Support on theme of

"Genome Editing of Crops for Enhanced Attributes"

under Plant Biotechnology area during FY 2022-23

Context

With a vision "to attain new heights in biotechnology research, shaping biotechnology into a premier precision tool of the future for creation of wealth and ensuring social justice - specially for the welfare of the poor" the Department of Biotechnology (DBT), since inception has been spearheading an enabling ecosystem by promoting biotechnology research, and improving capacity across the country.

Through various initiatives and policy frameworks towards promoting innovative research, empowering people, building world class infrastructure, supporting public-private partnership, international cooperation, the Department has greatly influenced the Indian agriculture, healthcare, environment and industry on one hand, while raising India's global standing and aspirations in the sphere of biotechnology on the other.

The Department stresses on generation of biotech products, processes and technologies for enhanced efficiency, productivity and cost-effectiveness in the areas of agriculture, food and nutritional security; affordable health care; environmental safety; biofuel & clean energy; bio-manufacturing; etc.

The Department's major emphasis has been on fostering cutting edge-research and innovation, with a strong focus on translational research. Achieving sustainable agriculture solutions through recent technological advances is paramount and the need of the hour. In an attempt to harness the potential of cutting edge tools of modern biotechnology such as "Genome Editing", DBT intends to fund innovative, interdisciplinary and collaborative research approaches for Agriculture Improvements.

This action anticipates to exploit the potential of existing tools of Genome Editing technology and accelerating the pace of its application in plant breeding innovations. The overarching aim is to strengthen the research, innovation and translation in Agriculture sector and contribute to the Government's National Mission for Sustainable Agriculture (NMSA) and UN's Sustainable Development Goals (SDGs).

This call is oriented to bring impactful biological solutions to tackle the impediments in ensuring better genetic gain, and achieving highly productive, nutritionally rich and climate resilient crop plants.

IMPORTANT INFORMATION

This call will follow a two-stage submission and evaluation procedure

Stage 1 [Letter of Intent (LoI)]:

> The 1st Stage would be inviting comprehensive LoIs from keenly interested and committed investigators. Each applicant would require to respond to various general, technical & qualitative questions in a diligent & coherent manner, within a restrictive space.

> Besides applicant's competence and interpersonal skills, his/her ability to understand & communicate the challenge, and to offer innovative approaches centric solution(s) in a given research & innovation (R&I) priority is the key.

> LoIs securing clear recommendations in peer review assessment would advance to Stage-2.

Stage 2 (Full Proposal):

> In Stage-2, applicants of recommended LoIs will be invited to submit interdisciplinary/transdisciplinary ambitious research & innovation (R&I) proposals. Procedure to be followed for preparation and submission of full R&I proposals will be informed separately through email only to applicants of successful LoIs. All submitted full proposals shall be evaluated through a structured peer review process.

> Full proposals securing clear recommendations will be considered further.

CONTENT

SECTION 1. CALL OVERVIEW & PRIORITIES

1.1. BACKGROUND & SCOPE

Crop improvement has been an ongoing process over the past thousands of years since the establishment of agrarian societies. Conventional plant breeding has largely depended on exploitation of existing variation either through selection of elite lines with the best phenotype or cross breeding wherein desired traits are transferred from one parent to another. However, since cross-breeding can only be used to introduce traits that are already present in the parental genomes, the low genetic variability in germplasms limits the use of this technique. Chemical/radiation-based Mutagenesis on the other hand creates random new variations in the cultivated gene pool but scouring these mutations for desirable traits is labour intensive and time consuming.

Global agriculture systems are under tremendous pressure due to rising population which is expected to touch 10 billion by 2050; and the situation is further exacerbated by decreasing arable land, monoculture and the looming threat of climate challenge. Trends show that crop yields are plateauing and the rate of genetic gain over the last several years has remained considerably slim. India has huge advantage owing to its rich biodiversity and varied agro-climatic zones suitable for a range of crops. Keeping in tune with the UN sustainable development goals, R&D endeavours in the agriculture sector of the country are focussed to make agriculture more climate resilient and sustainable.

Few major crops contribute significantly to the dietary requirement of the country's large population and also for export revenue. Rice and wheat alone contribute ~21% to the total Agricultural exports in the country, however this crop cycle is detrimentally affecting ground water resources, and sustaining rice cultivation in the long term would require continuous efforts to develop water use efficient dry DSR rice varieties. Similarly, Country relies heavily on imports for some of the crops viz. oilseeds and pulses. Owing to the changing dietary preferences of the urban population and management of life style diseases, nutritional security of the population is also under lens. Technological interventions must be utilized to develop improved crop varieties to address the agrarian and nutritional challenges. Besides food crops, horticultural crops (fruits/vegetables/flowers) are key drivers for economic development in the country. The diversification in the agricultural sector mainly of the horticulture sector has become a major source of positive growth and has a growing share in GDP. India can emerge as a leading producer and exporter of horticultural crops with sufficient emphasis on strengthening R&D and technological upgradation.

Conventional breeding may not be sufficient enough to bridge the gap between current vs. the expected levels in terms of food and nutritional security required to feed the global population in coming decades while minimizing climate degradation. Attention of the scientific community must shift to achieve increase genetic gain with minimum carbon footprint and environmental damage, through transformative technological interventions to improve priority traits in Cereals (wheat, rice and maize), Pulses (chickpea, pigeon pea, soybean, green gram and black gram), Oilseeds (rapeseed & mustard, groundnut, sesame and sunflower), Horticultural crops (banana, tomato and potato), floriculture (marigold, rose, lily, etc.,) and Cash crop (sugarcane) to ensure availability of equitable and quality produce to the population at large.

New Plant Breeding Technologies (NPBTs) provide a range of exciting, robust and highly controllable, biotechnological tools to generate new plant architectures. Genome Editing (GEd), an immensely promising new technology which can overcome the limitations associated with Genetic Engineering

(GE) approach is set to revolutionize global Agriculture sector. It offers multifaceted mechanisms for targeted & precise changes in the plant genome through targeted mutagenesis; gene knock-out & knock-in; stacking; and modulation of translation. This innovative technology is also amenable to multiplexing thus providing opportunity for improvement of complex traits viz. yield, input use efficiency, quality, climate resilience, photosynthetic efficiency at a rapid pace. Editing through SDN1 and SDN2 categories of nucleases either completely obliterate the need for integration or, provide an easy way out for segregation of foreign DNA, thus overcoming the biggest safety apprehension of transgenic plants. Several of such changes mimic randomly occurring spontaneous natural mutations but at predetermined precise locations. Several countries have accepted selective gene edited crops as non-GMOs on account of absence of any foreign DNA. Gene edited high GABA tomato (Japan), and high oleic acid soybean (USA) have already been commercialized in never previously achieved shortest possible time span.

Recognizing the potential of this powerful technology for the agriculture sector, Government of India has recently relaxed SDN1 & SDN2 mediated genome edited plants from an exhaustive biosafety and environmental safety assessment process defined in Rules, 1989 of Environment Protection (Act), 1986, which is reserved for genetically engineered organisms in the country. This relaxation has been the necessary first step, a unique opportunity, that is bound to propel research & innovation efforts to exploit this breakthrough technology for crop improvement.

R&D on genome editing will aid in basic research for gene discovery/functional genomics as well as product development thereby catering to agriculture growth.

We envisage to harness the potential of Genome Editing technology for crop improvement towards yield & quality enhancement, abiotic & biotic stress resistance, and input use efficiency.

1.2. STRATEGIC APPROACH

A major focus of this call would be towards tackling issues which are grappling the agriculture sector of the country to reach its full potential.

- Country has invested considerably in genome editing based research efforts in the recent past, several leads have shown promising results and have reached to an advanced stage. Such leads will be considered favourably under this call to handhold them to reach to a logical conclusion in terms of product development. This will enable the commercialization of the developed products within the next 2-5 years, and will ensure that the benefit of this transformative technology will reach the end users.

- Proposals targeting multiplex editing to develop climate-ready crops combining resistance to abiotic and biotic stresses with yield enhancement traits (such as improved photosynthesis; enhanced acquisition and use efficiency of water, nutrients and other natural resources) to produce more with less and fewer inputs in the coming decade will strengthen the agriculture sector in the country and making it economically more viable.

- The unavailability of functionally characterized trait linked genes is a major hindrance in exploiting genome editing tools for crop improvement. Emphasis is required on developing efficient regeneration/ transformation protocols for priority crops/genotypes; new gene discovery and foreign DNA free genome editing in all important major and minor crops.

- Being vegetatively propagated and due to higher ploidy levels, horticultural crops are relatively less amenable to gene editing. Tools need to be standardized to overcome the issues associated with application of gene editing in such crops.

- Developing novel and innovative tools by exploring the diversity of CRISPR-Cas effectors from the natural microbial population will be another important area of focus.

- Leads available after successful completion of these projects will be evaluated, and if desired, it would be pursued further.

Through this strategic approach we would like to address following objectives;

> To build capacity for development and use of innovative tools of Genome Editing

> To edit and stack, well characterized candidate genes for traits of economic and agronomic importance with established robust regeneration protocols and dense genomic resources

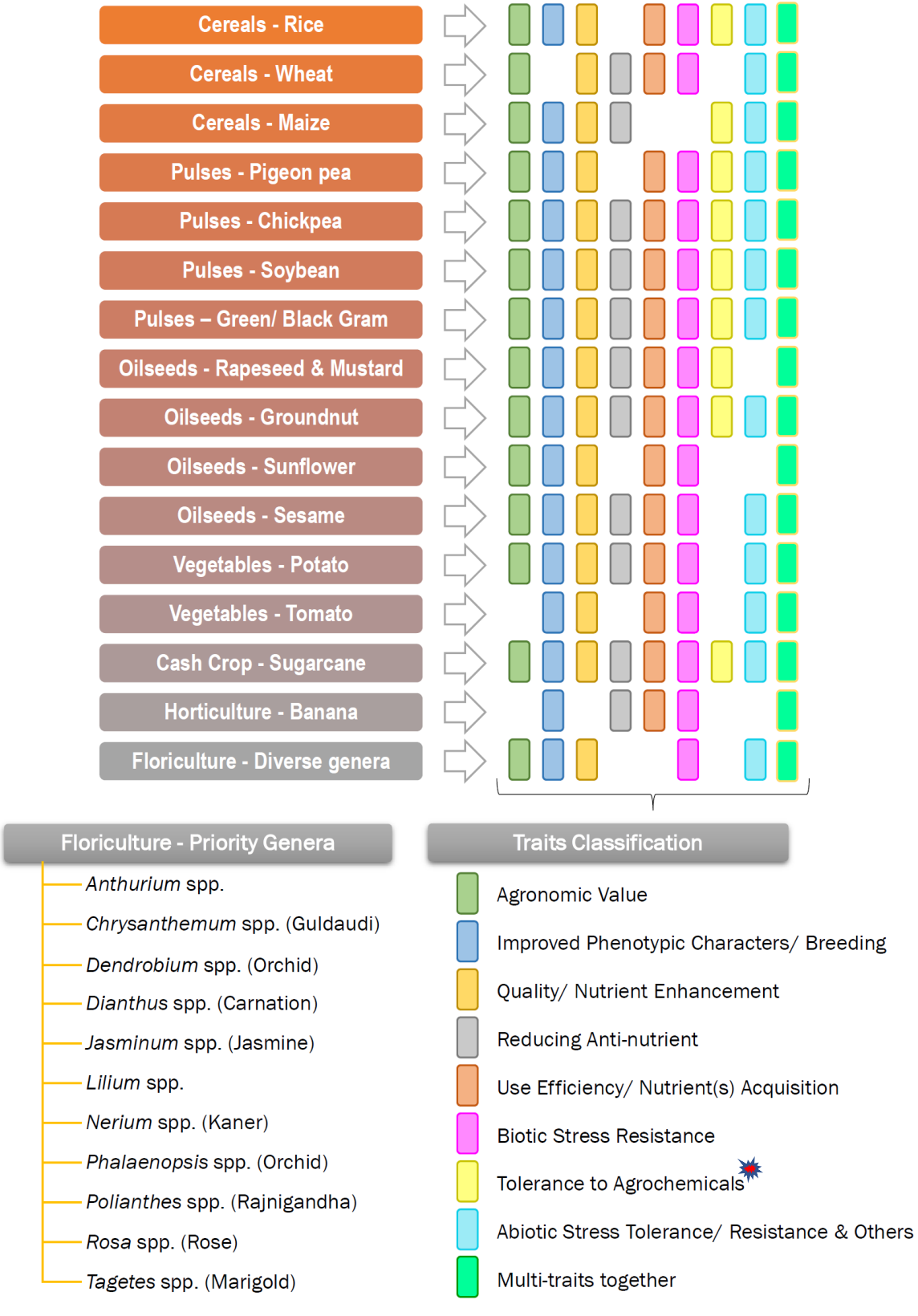
> To establish genome editing protocols in recalcitrant crops where high efficiency regeneration protocols are not available

> To establish genome editing protocols to develop foreign DNA free edited lines in vegetatively propagated crops

> To effectively engage with stakeholders/end-users towards dissemination of pertinent information about this breakthrough technology

We are looking for proposals, focusing on development of improved crop varieties suitable for sustainable agriculture, reduce import dependency and establish India as one of the drivers of genome edited crops. Please refer figure.1.

Figure .1: Priority Crops Vs. Priority Trait Categories



✸ → **If the trait emphasizes "Tolerance to Herbicide Usage" (either for pre or post emergence), such herbicide shall have a novel chemistry. Herbicide(s) with already known chemistry shall not be considered for this round of competition.**

1.3. PREREQUISITES

- The product development should be attempted only in elite commercial cultivars/varieties with high consumer preference and export potential.

- This is a time-bound action; therefore, proposals should focus on clear and tangible deliverables with stringent monitoring criteria. Timelines to achieve tangible deliverables should be realistic but with a clear advantage over the conventional approaches.

- Secure appropriate license(s) (as applicable) well in-time

- The process of product development must comply with the existing regulatory framework for GEd crops. It is vital to note that clear understanding of regulatory data requirement & stewardship, reproducibility of data, and effective documentation & record keeping are prerequisites for each successful product development.

- The biosafety and environmental safety assessment parameters, trans-gene free status of the developed crop varieties and critical analysis of off-target effects (if any), should be the mainstay of every proposal.

- Networking is the key for each proposal. Active co-operation and collaboration between partnering institutions towards a common goal with distinct responsibilities is the primary expectation. Similarly, proposals should seek synergies and capitalize on the relevant expertise, and already generated background knowledge in the respective labs of partners.

- Better consumer engagements, capacity building of young researchers and establishment of infrastructure of international standards should become an inherent component of such proposals.

1.4. RESEARCH & INNOVATION (R&I) PRIORITIES

Consequently, to address some of the challenges before us in the agriculture sector, following priorities have been outlined for the present call for proposals:

1.4.1 R&I Priority-1: Product development through demonstrated leads available within the country, and are at the advanced stage(s) of development

Government has supported a large number of high-quality research ideas over the last 5 years. Some of these have led to significant advances in developing new tools of genome editing as well as identifying and deploying effective candidate genes in elite commercial cultivars/varieties for addressing challenges plaguing Indian Agriculture sector and are already ready for confined field testing and evaluation. Only those leads with a product ready for confined field testing or which has the potential to reach farmers field through commercialization in the next 2-4 years will be supported under the stated priority crops & traits.

1.4.2 R&I Priority-2: Deploying trait specific candidate gene(s) having well established proof-of-concept, into elite commercial cultivar(s)/variety(ies).

World-over, R&D studies have well established numerous candidate genes for genome editing which may immensely contribute towards trait improvement. Few of these candidates have already been field tested and deployed for commercial use, while a large number is yet to be field tested but have shown remarkable trait improvement under laboratory/contained studies. Such proven candidate gene(s) can be capitalized rapidly to introduce/improve desired traits in country's popular commercial cultivars/varieties to ensure that the socio-economic benefits of this breakthrough technology reach to masses. Proposals should aim to develop edited plants, validated in contained conditions and should be ready for confined field testing at the end of the proposal duration.

1.4.3 R&I Priority-3: Establishing proof-of-concept for novel candidate gene(s) for trait improvement, over and above the cultivar(s)/variety(ies) currently in use

Rich biodiversity of the country holds the key to unravel new genes for nutritional enhancement, yield gain and climate resilience. It is imperative to undertake trait phenotyping, genotyping/omics studies to identify novel gene(s) and their underlying molecular mechanism to combat the challenges in the agriculture sector. Proposals under this priority should delineate a clear hypothesis and should be oriented to generate a proof-of-concept for editing of candidate gene(s) in plant system(s) for early-stage validation.

1.4.4 R&I Priority-4: Developing novel indigenous tools (vectors, nucleases, etc.), methods, regeneration protocols for recalcitrant crops

Genome editing methods/tools developed worldwide are largely restricted for free commercial exploitation owing to distribution of intellectual property (IP) and freedom to operate. These issues though negotiable yet affect the pace of product development and deployment. Thus, development of indigenous novel tools (including discovery of novel & efficient Cas effectors) of genome editing will give the necessary impetus to the R&D efforts for deploying genome editing in transforming Agriculture. Further, several priority crops/elite genotypes lack established high frequency regeneration protocols which limit their amenability for gene editing. Therefore, R&D efforts to develop new tools of genome editing and better regeneration capacity in the recalcitrant crops should be innovative with a distinct advancement and advantage over the existing tools rather than small incremental changes in the already established protocols. Proposals under the aforesaid priority should be focused on developing novel and versatile indigenous tools (with much greater "precision")/ methods/ protocols at par or better than the existing ones with clear demonstration of their use.

1.4.5 R&I Priority-5: Capacity building through familiarization of R&D tools for Genome editing

Introduction of any new technology from lab to field and its reach to the end beneficiaries is affected by how it is perceived by the stakeholders at all levels. Outreach activities to familiarize them with the promising technology of gene editing till the grassroots levels, creating an optimistic public perception and mitigate concerns that such products of gene editing technology are not as safe as the conventionally bred crops are imperative to ensure that the environmental, health, and socio-economic benefits of this technology reach farmers and society at large. Science communication is thus required to forge deeper

partnerships to expand public understanding of this technology. Proposals inclined towards this priority should be directed towards different sections of the society and employ different tools/strategies to popularize and positively impact the public perception of products of Gene Editing.

SECTION 2. FUNDS AVAILABILITY

The Department envisages grants-in-aid support for up to fifteen (15) ambitious and focused, multi-institutional R&I projects of up to 3 years duration in stipulated R&I priorities, with a perceived budgetary requirement of INR 50.00 Cr for this round of competition. The budgetary requirement per project shall not exceed INR 4.30 Cr.

SECTION 3. WHAT IS NOT SUPPORTED?

- Applications which are not in the scope
- Editing approaches by nucleases other than SDN1 and SDN2 categories
- Applications considering crops other than the chosen priority crops
- Applications considering elementary exploration(s) that aim to demonstrate scientific principles/techniques, with no element of novelty and no plan to convert ideas into a possible commercially viable proposition
- Concerted action, in which each project participant performs a self-contained exploration under a particular theme without complementarities, synergies and extensive interactions with the other participants
- Applications do not fulfil eligibility criteria
- Applications without all the necessary information, or evidence to show the assessment criteria are met

SECTION 4. MODALITIES OF PARTICIPATION AND FUNDING

4.1. PARTICIPATION

4.1.1 Participants for STAGE-1 (Letter of Intent) and STAGE-2 (Full Proposal)

- All independent Indian legal entities/organizations are eligible for participating in this round of competition

- Each legal entity/organization must have adequate strength, competence, resources and facilities in relevant and distinct disciplines, and preferably be performing R&I activities as one of the key mandates

- Participation of business partner(s) and/or an urban, rural or other local government body(ies) who would be the end user of solution(s)/intervention(s) is encouraged

- The competition is open to all career groups (i.e., early, intermediate and senior).

- It is expected that each investigator should have adequate (***at least 4 years***), regular and full-time service tenure to accommodate key research, coordination, outreach and post-completion handholding (if any) responsibilities.

- Participation of early career scientists/faculties is encouraged

- Participation of female researchers are particularly welcome

- Submission of only ONE (1) LoI per applicant is permissible. Applicants who apply for more than one LoIs will forfeit any chance of further consideration and funding.

4.1.2 Composition of Consortium at STAGE-2 (Full Proposal)

- Participation of at least THREE (3) applicants (whose LoIs secured clear recommendation) representing distinct and independent legal entities/organizations (of which one must be the publicly funded university or research organisation) is obligatory for a particular 'consortium' to become eligible for participating in this round of competition.

- Similarly, considering the administrative, financial and coordination complexities associated with a large consortium, we do not foresee participation of more than FIVE (5) applicants representing distinct and independent legal entities/organizations in a particular consortium at any given time in this round of competition. This criterion shall be considered in conjunction with and in strict compliance to the preceding para.

- There is no upper limit on number of participants per proposal from individual legal entities/organizations; however, the proposal shall be evident in reflecting each investigator's critical techno-scientific competence, complementarity, interpersonal skills and synergistic contribution towards smooth execution of the project, and compliance with the eligible funding conditions.

- The collaboration, collectiveness and extensive interaction between all project partners must be an absolute necessity to achieve the aims of the project.

- We expect that each consortium would give enough thought on gender parity and bringing investigators from all career groups on board, and to take optimal advantage of interdisciplinary/transdisciplinary addressal of research & innovation (R&I) challenges put before them.

- Consortium partners are also encouraged to promote equal opportunity in the implementation of the action by ensuring a balanced participation at all levels of the R&I teams and in the management structure.

- Each project proposal must appoint the central contact point and represent the consortium towards the Department. This contact point shall be known as the **'Project Coordinator'**[1].

- Responsibilities (*non-exhaustive*) vested in Project Coordinator and participating investigators are highlighted in **Annexure-1.**

- Applicants of recommended LoIs must take leading role [i.e., either as Lead-Principal Investigator (Lead-PI/ Project Coordinator) or Principal Investigator (PI)] in the project. Besides taking this lead position in the proposal of interest, such applicants are also permitted to become partner in one more consortium, rather as Co-investigator (Co-I) ONLY, **without seeking any budgetary share** for such participation. Our understanding in respect of investigators designation and corresponding roles may be seen at **Annexure-2.**

- Lead PIs should demonstrate relevant scientific/technical strength and have a good track record as an independent PI in leading and coordinating research programmes, as well as achieving productive research outcomes (e.g., award of national and/or international competitive extramural funding, substantial publication record in the past 3 years)

- Investigators who are involved in the implementation of three (3) or more **extramural projects** (*from any funding agency*) as Principal Investigator (PI) or Co-Principal Investigator (Co-PI) with a defined budget share, **at the time of full proposal submission** are in-eligible to lead or serve the consortium as PI or Co-PI. However, such applicants are eligible to become partner in one of the consortia as Co-investigator (Co-I), **without seeking any budgetary share**.

- Similarly, investigators who are not inclined to participate directly to the Stage-1 (i.e., LoI stage) of competition are in-eligible to lead or serve the consortium as PI under this competition. However, such applicants are eligible to become partner in one of the consortia either as Co-PI or as Co-I with defined budgetary share. This criterion shall be considered in conjunction with and in strict compliance to the preceding para.

- DBT reserves the right to modify this prerequisite participation requirements without prior intimation.

- While conceiving and deliberating application, investigators are requested to be mindful and considerate enough about the disruptions that may arise due to his/her scheduled superannuation, or planed movement from one institution to another as a career progression opportunity during his/her active tenure of the project. We discourage such disruptions, that greatly impact smooth execution of collective actions.

[1] Project Coordinator: A project coordinator is the individual who leads a project. Most often, the project coordinator will organize the consortium, prepare the proposal and manage the project. The coordinator is the representative of the consortium for any communication with the Department of Biotechnology. It is advised to appoint project coordinator from among the participants, who is familiar with the GoI rules, requirements & procedures.

4.1.3 Academic Participants

(i) Institutions or Organizations set up as Autonomous bodies, under a specific statute

(ii) Government supported or recognized (Public or Private) Educational and other institutions

(iii) Government recognized Urban and Rural local self-government institutions/bodies

(iv) Government recognized Voluntary Organizations or Non-Government Organizations or Trusts or Research Foundations

(v) Government recognized Co-operative societies

4.1.4 Industry Participants

- The Indian Industry [Company, Limited Liability Partnership (LLP), Joint Ventures either in the form of Company/LLP] can be a partner in the consortium and are eligible for GIA support from DBT, which will be routed through public sector academic institution subject to fulfilment of mentioned DBT's technical, administrative and financial norms.

4.2. ELIGIBILITY FOR PARTICIPATION

The participating entities/organisations (*academia and industry*) have to be a legal entity as per Indian law.

4.2.1 Eligibility for Research or Educational Institutions

- Public universities or research organizations or educational and other institutions must have a well-established research support system; for basic, applied and entrepreneurship research.

Requirement of Supporting Documents Assuring Eligibility

- Proof of establishment under Indian statute (recognition documents), and • Valid DSIR-SIRO certificate/ DSIR in-house R&D recognition certificate (*as applicable*)

4.2.2 Eligibility for Voluntary Organizations, etc.

- The Indian Private R&D performing institutions (including private universities) and Not-for-profit, NGO(s)/ VO(s)/ Trust(s)/ Research foundations should have experience of at least 3 years in Socio-economic or scientific research, teaching, training and extension activities; and must follow research as one of the mandates.

Requirement of Supporting Documents Assuring Eligibility

- Proof of registration at 'NGO DARPAN' of NITI Aayog (http://ngodarpan.gov.in/), • Certificate of registration under Society Registration Act, • Organization's Memorandum of

Association, • Organization's Articles of Association, • Valid DSIR-SIRO certificate/ DSIR in-house R&D recognition certificate (*as applicable*), and • Duly audited account statements for the past three successive years

4.2.3 Eligibility for Urban and Rural Local Bodies or Co-operative Societies:

- Participation of such bodies/societies will be restricted to consultation and public extension activities. Such organizations should be associated with activities which promote the welfare schemes and programmes of the Government.

4.2.4 Eligibility for Industry Participants

(i) Should be an Indian Industry/Company registered under the Companies Act or Limited Liability Partnership Act, wherein 51% (or more) of the ownership/ shareholding/ partnership/ subscribership shall be held by resident Indian citizen(s); and

(ii) Industry partner(s) should have an adequate *in-house* facility to address the project implementation or incubated at any of the recognized Incubation Facility

(iii) Industry partner(s) must possess the operational and financial viability to carry-out the research & innovation tasks that they propose

(iv) Industry partner(s) should not have been pronounced as DEFAULTER entity by any creditor or is under any liquidation or IBC process

(v) They should neither have withdrawn any sanctioned project nor any of the earlier projects have been terminated due to breach of any of the funding conditions.

Requirement of Supporting Documents Assuring Eligibility

(i) Certificate of Incorporation issued under Companies Act, • Exemption Certificate (*as applicable*), • Firm's Memorandum of Association, • Firm's Articles of Association, and • Duly Audited Account Statements for the past three successive years

(ii) The industry partner(s) will provide a declaration clearly outlining their financial performance in last three years and ability to support the proposed research for the entire duration. The declaration will be duly forwarded by the chair of the governing board/board of directors and an independent auditor.

4.3. FUNDING PROVISIONS

DBT will fund the partners/entities in a successful project of up to THREE (3) years duration. Budget should commensurate with the essentiality of participation, workload, and objectives of the project.

4.3.1 DBT's Contribution to Academic Participants

DBT will seek to support 100 per cent (%) approved budget costs (Grants-in-aid) to all the academic partners mentioned earlier.

- Academic partners are also encouraged to co-fund one or more components of research action within a particular R&I project.

- Grants-in-aid support to PRIVATE R&D performing institutions (including private universities) and Not-for-profit NGO(s)/ VO(s)/ Trust(s)/ Research foundations shall be up to **INR 49.00 lakhs**, and it should be in alignment with the justification offered for the proposed cost by such partner(s). There are no such Grants-in-aid limitations for PUBLIC institutions

- Eligible costs for funding are: Capital/non-recurring expenditure (i.e., equipments & accessories, demonstration plants, pilot plants, etc.) || Manpower || Consumables || Domestic Travel || Contingency || Overheads || Others [*Academia can factor in additional sub heads (in "OTHERS" category) such as outsourcing, Indian Patent(s) filing cost; cost to be incurred on training & awareness, workshops, publications, review meetings, etc. based on the requirement of the project*].

- We expect that host institutions should be well-equipped, and have all the essential infrastructure to accomplish proposed R&I action in-time. The "Capital (Non-recurring)" support for major equipment(s) may be offered in exceptional case(s) subject to submission of ideal reasoning. Applicants must be cognizant of the fact that the proposed budgetary requirement under "Capital (Non-recurring)" head **shall not exceed 20%** of overall budget proposed by the consortia/network as a whole.

- Proposed budgetary requirement under "Overhead Charges" for individual consortium partner shall be up to **INR 5.00 lakhs/year,** and it should be in alignment with the justification offered for the proposed cost by such partner(s).

- Project partner(s) proposing to host the collaborating investigator(s) and/or project staff(s) within the consortium, shall provide research facility and research resources to accomplish defined objectives. This should be factored-in in participants budget, appropriately.

- While considering eligible costs for funding, DBT norms notified from time to time for supporting extramural research project may be followed; however, recommendations of area specific Technical Expert Committee (TEC) (while evaluating new R&D proposals, and/or reviewing progress of ongoing R&D proposals) should prevail.

- The Project Coordinator must ensure that each participant follows budget format proposed by DBT with an explicit justification of proposed cost.

4.3.2 DBT's Contribution to Industry Participants

- Grants-in-aid support to the industry partner(s) will be in-harmony with matching grant basis (i.e., DBT will incur up to 50% of the total budget proposed by a particular industry partner). However, the budget requested should be in alignment with the justification offered for the proposed cost, and financial strength of that industry partner.

- SMEs or Start-ups can be funded up to INR 25.00 lakhs, in which 80% can be Grants-in-aid with the balance to come from SME/ Start-up.

- The cost breakup for the DBT component of the proposal is covered under GIA-General (Recurring), in which the cost for consumables should not exceed 65% of total cost proposed by a particular industry partner from DBT, and balance will cover travel and contingency costs distributed equally.

- Capital/Equipment, Manpower, Overhead and Other costs will not be admissible by DBT.

- Industry partners shall require to set aside a yearly share of their own contribution exclusively towards the project in a non-lien bank account, upfront. To meet the expenditure under above mentioned categories, money deposited in this account must be utilized.

- To secure release of grant-in-aid from DBT for each successive year, industry partners shall require to furnish details of expenditure incurred from their share of contribution by submitting duly authenticated UC/SoE

- Each industry partner must be assigned to one of the public sector academic partners. Project's '**Covering Letter**' shall offer an obvious clarity on this aspect also. DBT's contribution to Industry participant(s) shall be routed through such public sector academic institution, only as an **outsourcing component**.

4.3.3 Non-Admissible Cost

(i) Prosecution/litigation & Audit costs;

(ii) Regulatory approval fees;

(iii) Fines and Penalties;

(iv) Salary of investigators;

(v) Any kind of Insurance coverage;

(vi) Cost of office or laboratory space;

(vii) Capital expenditure for the purchase of assets such as office furniture; motor vehicles; office equipment viz. desktops, laptops, tablets, cell phones, scanners, printers, photocopy machines, etc., exclusively for office usage;

(viii) Capital expenditure towards renovation, refurbishment or extension of facilities such as buildings and laboratories;

(ix) Membership costs to any association(s)/organization(s);

(x) General journal subscription costs;

(xi) Expenditure toward rental and utilities;

(xii) International travel; and

(xiii) Mere attendance at conferences/ symposiums/ congresses/ meetings/ workshop

SECTION 5. HOW TO PREPARE APPLICATION FOR STAGE-1 & 2

5.1. PREPARATION OF APPLICATION FOR STAGE-1 [LETTER OF INTENT (LOI)]

- At Stage-1, prospective applicants would require to provide answers to general and techno-scientific questions in a diligent & coherent manner (*that to within a restrictive character limits*). List of these questions is placed at **Annexure-3.** Complete LoI submission proforma may be seen as a separate **PDF attachment** to this Call Announcement.

- Applicants must have an absolute clarity about the current strength and stage of his/her R&I exploration, and aspiration over a period of time. Our understanding about the Research Readiness Level is placed at **Annexure-4.**

- Submission of interactive (correlative) infographic (*Strictly NMT two PPT slides converted to a PDF file*) shall be an integral part of your LoI. We believe that depicting LoI's saliency this way shall become a vital trigger for your engagement with possible future consortium partners (collaborators) or *vice versa*. Stipulated format for this infographic is placed at **Annexure-5.**

- An open access link, which will redirect you to the relevant ready-to-fill electronic form is provided in the submission section**.** Please note that the said link shall remain open for viewing till the closer of LoI submission.

- We believe that data/information which are available in open-source or in public domain shall be adequate enough to establish soundness of your concept. Therefore, refrain from depicting/submitting privileged or Confidential Business Information (CBI) at this stage (i.e., at Stage-1).

- LoIs securing clear recommendations during the peer review assessment would advance to **Stage-2.**

5.2. PREPARATION OF APPLICATION FOR STAGE-2 (FULL PROPOSAL)

- In Stage-2, applicants of qualified LoIs only will be invited to submit R&I proposals.

- Procedure to be followed for preparation of full research & innovation (R&I) proposals will be informed separately through email to applicants of qualified LoIs.

- We expect that applicants of qualified LoIs would take the fullest advantage of our engagement through a virtual information sharing session. Besides, sharing further details on call specifications and clearing your doubts (if any); this would become a unique platform to

showcase your strength, competence, and inter-personal abilities before the prospective project partners.

SECTION 6. STATUTORY CONSIDERATIONS (IF APPLICABLE)

6.1. RESEARCH USING HAZARDOUS MICROORGANISMS, GENETICALLY ENGINEERED (GE) ORGANISMS & PRODUCTS THEREOF FOR R&D PURPOSE

Research using hazardous microorganisms, genetically engineered (GE) organisms & products thereof are governed under Rules, 1989 (Rules for the Manufacture, Use/Import/Export and Storage of Hazardous Micro Organisms/ Genetically Engineered Organisms or Cells) of Environment (Protection) Act, 1986, according to which, necessary intimation/ recommendation/ authorization from concerned Institutional Biosafety Committee (IBSC), Review Committee on Genetic Manipulation (RCGM) & Genetic Engineering Appraisal Committee (GEAC) is obligatory based on type & scale of research operations.

Further guidance on regulatory considerations can be obtained from:

- Handbook For Institutional Biosafety Committee (IBSC), 2020 (https://ibkp.dbtindia.gov.in/Content/FlashPDF/IBSC%20Handbook.pdf)

- Regulations and Guidelines on Biosafety of Recombinant DNA Research & Biocontainment, 2017 (http://dbtindia.gov.in/sites/default/files/uploadfiles/Regulations_%26_Guidelines_for_Reocminant_DNA_Research_and_Biocontainment%2C2017.pdf)

- Guidelines for the Safety Assessment of Genome Edited Plants, 2022 (https://ibkp.dbtindia.gov.in/Content/FlashPDF/Final11052022Annexure%20I,%20Genome_Edited_Plants_2022_Hyperlink.pdf)

- Standard Operating Procedure for Regulatory Review of Genome Edited Plants under SDN-1 and SDN-2 Categories, 2022 (https://ibkp.dbtindia.gov.in/Content/FlashPDF/Final%20SOPs%20on%20Genome%20Edited%20Plants_merged.pdf)

- Guidelines for Testing Crop Varieties under the All-India Coordinated Crop Improvement Projects (https://icar.org.in/files/TESTINGCROPVARIETIESFG-2016.pdf)

SECTION 7. PROCESS FOR SUBMISSION OF APPLICATION AT STAGE-1 & 2

7.1. SUBMISSION OF APPLICATION AT STAGE-1 [LETTER OF INTENT (LOI)]

- The proposal must be submitted electronically using the electronic submission system.

- Before attempting to fill the online form, all applicants should also check that they comply with the obligatory eligibility requirements and ensure all necessary information (*including documentary proofs)* are easily accessible to them, so that the same can be shared with DBT, whenever demanded to ascertain the eligibility.

- Open access link, which will redirect you to the relevant ready-to-fill electronic form is provided below**;**

  https://docs.google.com/forms/d/e/1FAIpQLSf9VVIyZRW2atyxps2LXgFc_K-VJm-9-RNKcE-E1MzEfkKP3Q/viewform?usp=pp_url

- Submission of duly filled LoI will be opened and accepted only between **February 21, 2023 (10:00 hours IST)** and **February 27, 2023 (till 15.00 hours IST)**. After this deadline, submission of LoIs to the call will not be permitted.

- Prospective applicants should carefully comprehend "Instructions to Follow" placed on the top of the electronic form, before attempting to fill the form.

7.2 SUBMISSION OF APPLICATION AT STAGE-2 (FULL PROPOSAL)

- Only the applicants of qualified LoIs will be invited to submit interdisciplinary/transdisciplinary & multi-institutional ambitious full R&I proposal in a network mode.

- The proposal must be submitted electronically. This task will be done by the designated Lead Principal Investigator (Lead PI)/ Project Coordinator. It is the responsibility of other partnering investigators to ensure that a Project Coordinator gets all the required, verified & valid information on time.

- Proposals submitted by means other than the above shall not be entertained.

- Procedure to be followed for submission of full R&I proposals will be informed separately through email to applicants of qualified LoIs.

- Submission of full proposal by invitation will be permissible only for limited time in the month of **April-May 2023.**

SECTION 8. ASSESSMENT CRITERIA AND REVIEW PROCESSES FOR STAGE-1 & 2

- Submitted applications (i.e., LoIs & Full Proposals) will be subjected to eligibility checks, internal screening, review by national and/or overseas subject experts as well as review by an evaluation panel(s).

- Incomplete applications (i.e., LoIs & Full Proposals), and those which do not fulfil eligibility criteria, and application(s) without all the necessary information, or evidence to show the assessment criteria are met, will not be considered for further processing.

- Should circumstances arise, the DBT reserves the right to modify the review process.

- **DBT considers following criteria are vital to judge the admissibility of any LoI (i.e., Stage-1);**

  > its appropriateness to the Scope and Objectives of the call

  > its ability to understand & communicate the challenge(s) with clarity

  > soundness of the concept

  > strength and track record of the applicant

  > desire to successfully accomplish proposed research & innovation action to a logical conclusion

  > extent that the proposed concept is beyond the State-of-the-art; and reliably demonstrates innovation, implementation & scaling potentials

  > extent to which the output of the concept would contribute to expected impacts

- LoIs securing clear recommendations during the peer review assessment would advance to **Stage-2**

- Procedure to be followed for assessment of full R&I proposals will be informed separately through email to applicants of qualified LoIs.

SECTION 9. CONFIDENTIALITY

During the tenure of the Project, DBT will undertake to maintain strict confidentiality and refrain from disclosure thereof, of all or any part of the information and data exchanged/generated from the Project for any purpose other than purposes in accordance to this CFPs.

Please note that all proposals, documents, communications and associated materials submitted (collectively, "Submission Materials") will become the property of DBT and will be shared with competent authorities, as deemed necessary. The proposals will be subject to confidential review by independent subject matter experts, in addition to in-house analysis and assessment.

SECTION 10. DISPUTE RESOLUTION

In the event of any dispute or difference between the Parties hereto upon or in relation to or in connection with this CFPs, such dispute or difference, shall be resolved amicably and in good faith by mutual consultation.

If such resolution is not possible, then the unresolved dispute or difference whatsoever arising between the Parties out of or relation to the construction, meaning, scope, operation or effect of this CFPs or the validity the breach thereof or in respect of any defined legal relationship associated therewith or derived therefrom dispute shall be referred to arbitration of the Sole Arbitrator to be appointed by the Secretary, Department of Biotechnology on the recommendation of the Secretary, Department of Legal Affairs ("Law Secretary"), Government of India.

The provisions of Arbitration and Conciliation Act, 1996 (No. 26 of 1996) shall be applicable to the arbitration under this clause. The provision of this Clause shall not become inoperative notwithstanding the Contract/grant expiring or ceasing to exist or being terminated or foreclosed. The venue of arbitration shall be New Delhi or any other place decided by the arbitrator and the arbitration proceedings shall be conducted in English Language. The arbitrator shall make a reasoned award (the "Award"), which shall be final and binding on the parties.

IMPORTANT INFORMATION

> This call for proposal adheres to the administrative guidelines for the "Competitive Research Grants System" issued vide DBT OM. BT/2022/CGS/1 dated 08.03.2022 and 28.03.2022

> Excerpts of General Financial Rules, 2017 (GFR-2017) issued by Department of Expenditure, Ministry of Finance, Government of India

"*the funds released to successful project(s) in one or more instalments shall be treated as Grants-in-aid in the books of account of the implementing agency. It may also be noted that the ownership in the physical and intellectual assets created or acquired out of such funds shall vest in the sponsor. While the Project or Scheme is ongoing, the recipients should not treat such assets as their own assets in their Books of Accounts but should disclose their holding and using such assists in the Notes to Accounts specifically."* [*https://doe.gov.in/sites/default/files/GFR2017_0.pdf*]

> While securing Intellectual property as an outcome of the project, DBT shall be made one of the co-applicants for any IP to be filed/granted. IP rights will rest with the originator, subject to the fulfillment of the condition mentioned in para above. The industry partner (*if any*) will have the first right of refusal for commercial exploitation of such IP generated as an outcome of the project.

> While publishing outcome of the project, investigators shall explicitly acknowledge the funding contribution made by Department of Biotechnology, Government of India

> All valuable data arises out of the project should be shared with Indian Biological Data Centre (IBDC), Faridabad for long term deposition, storage, annotation and sharing. **[***https://ibdc.rcb.res.in*]

> Should circumstances arise, the DBT reserves the right to modify qualifying pre-requisite(s), documentary requirement(s), and process(es) without prior intimation.

SECTION 11. POINT OF CONTACT

Inquiries should preferably be made by email, except when urgent

To,
Dr. Sumita Kumari
Scientist- 'C',
New and Emerging Technologies in Plant Biotechnology
Department of Biotechnology
Email: plant-biotech@dbt.nic.in
Tele: +91-11-24360718 || +91-11-24369611

SECTION 12. SUGGESTIVE TIMELINES

Important Events/ Milestones	Important Months	Remarks
Launch of Call for Proposal	February 2023	
[STAGE-1: Letter of Intent (LoI)] For all Applicants & Interested Investigators		
Opening of LoIs Submission	February 2023	
Closure of LoIs Submission	February 2023	Applicants to apply via stipulated google forms only
Eligibility Checks, Review and Shortlisting	March 2023	
Notification to shortlisted LoIs	March 2023	Applicants of shortlisted LoIs will receive a communication from DBT for further course of action
[STAGE-2: Full Proposal] For Shortlisted Applicants Only		
Information Sharing Web-Session	April 2023	
Opening of Full Proposal Submission	April 2023	
Closure of Full Proposal Submission	May 2023	
Eligibility Checks, Internal Screening, Peer Review, and Evaluation by Experts Panel	May-July 2023	
Notifying selected Proposals	August 2023	Applicants will be informed of their *in-principle* approval and will work with DBT's grants team on the required submissions and processes
Funding Decision, Letter of Award, Signing of MoAs and Commencement of project	Sept. -2023	

ANNEXURE-1

ROLES AND RESPONSIBILITIES VESTED WITH PROJECT PARTICIPANTS

Responsibilities vested in Lead-Principal Investigator/Project Coordinator and Coordinating Institutions

> In particular, the COORDINATING INSTITUTION shall be responsible for overall Project Coordination, management, compliance, monitoring and future prospects as mentioned below;

Overall:

a). Must assume responsibility for the entire R&I action for the full duration of its implementation

b). Must act as the leader of the project

Coordination and Management:

a). To act as the intermediary between the consortium partners and the DBT.

b). If deemed necessary, to consult independent experts for the improvement and/or course corrections of the performance within the Project

c). To designate a Deputy Project Coordinator [*only for proposal(s) where number of participating legal entities are more than five in number*]

d). To coordinate the flow of results derived from the involved consortium partners and be responsible for the exchange of any relevant information prompt and effective way

e). To oversee Project's research outputs and to advise the consortium partners on IP strategy, technology transfer, business development, etc. (*wherever relevant*)

Adherence to the Compliance:

a). To ensure up-to-date information about the consortium partners

b). To monitor compliance by the consortium partners with their obligations

c). To inform the involved consortium partners and the DBT on any event that might substantially affect the project, including any change of investigators.

d). To collect, review, verify consistency and submit reports (technical, scientific and financial), other deliverables (including financial statements and related certifications) and specific requested documents to the DBT and other competent authorities (if demanded)

Financial management:

a). To administer the financial contribution by DBT and fulfilling the financial tasks described within the Sanctioned order(s) released by the DBT from time to time.

b). To notify the project partner concerned promptly of the date and amount transferred to its registered bank account, giving the relevant references.

Roles vested in each Project Partner, and Partnering Institution

> All the involved consortium partners shall be responsible for contribution towards effective coordination, management, compliance and monitoring of the project as mentioned below;

a). To maintain a separate audit head of account for the grants received from DBT for the project.

b). To designate Co-principal investigator(s) and/or Co-investigator(s)

c). To recruit all scientific and non-scientific staffs as sanctioned by DBT.

d). To undertake that the manpower, both scientific and non-scientific, recruited shall be purely on contractual terms & conditions such that the contract for engagement of the manpower shall run concurrently with the said project period only.

e). To make sure the availability of existing facilities and resources, and also to agree upon appropriate arrangements for optimal performance of the work in compliance with proposed deliverables and milestones.

f). To allow investigators authorized by DBT to work with the research & development team of the institution/organization in all stages of project progression.

g). To freely exchange materials and reagents necessary for timely and successful achievement of the objective of the project

h). To set-up, if necessary, among themselves specific contracts in accordance with the provisions of GoI norms. Such contract(s), may inter-alia, specify the exchange of information and/or material in accordance with laws and regulations of the respective countries to such exchange. Copies of such contracts shall be made available to the DBT.

i). To agree among themselves on the ownership, protection, protection period and cost of the know how (IP) generated, in accordance to DBT guidelines.

j). To assure a free mutual flow of information relevant for the project, in relation, but not limited to, policies, legislation, ongoing and future research programmes, scientific and practical results, commercialization, and publications.

k). Regardless of authorship, each involved consortium partner agrees to give his/her partners the opportunity to review drafts of any abstracts, manuscripts, or oral disclosures generated as direct result of this collaboration at least 30 days prior to presentation, release or transmitted to

any third party. In the event that patentable subject matter is identified, such disclosure will be delayed up to an additional 60 days to afford the appropriate involved consortium partner the opportunity to file IP application(s).

l). To publish research articles and scientific papers in connection with the project, either jointly or individually depending on the nature of the research being reported, provided that such publication does not affect the protection of IP. In such case, the involved consortium partner(s) shall inform the respective authority of DBT on their publications and provide corresponding copies.

m). To manage the assigned resources in alignment with proposed deliverable and milestones.

n). To be responsible for consensus-building, communication and coordination with administrative and other offices within the research institution.

o). Each involved consortium partner shall be responsible for the scientific, administrative, financial management, and internal controlling of his/her contribution in compliance with defined objectives (work packages), tasks assigned, milestones and deliverables, as highlighted in proposed deliverable and milestones.

p). To inform Lead PI (Project Coordinator) of any event liable to substantially affect the project.

q). To ensure effective utilization of the grants given by DBT for the purpose for which it was granted and to ensure timely progress of project work.

r). To prepare and timely submit annual finance & audit reports, all periodic reports and other documents, in stipulated DBT format to Lead PI (Project Coordinator) for further verification, compilation, compliance and onward submission to DBT for release budget year after year.

s). To liable for an appropriate scientific approach and due diligence with respect to the implementation of the project, and to avoid making any warranty with regard to the facts or rights in connection with this project.

ANNEXURE-2

INVESTIGATORS CLASSIFICATION AND CORRESPONDING ROLES ARE

> The **Lead Principal Investigator (Lead-PI)/ Project Coordinator** role will be to engage and coordinate research activities carried by the research team as a whole from start to finish. He/ She will be responsible for all progress reporting of the project, on behalf of the research team.

> The **Principal Investigators (PIs) or Co-Principal Investigators (Co-PIs)** within a particular consortium will be the representative leading the research, and fulfil their duties at the Partner Institution. They tend to work in partnership in management, development and/or execution of the project. They are individually responsible and accountable for performance of the extramural project as well as management of sponsored funds.

> The **Co-Investigators (Co-Is)** will be the key personnel leading and managing a particular aspect of the collaborative effort, making a significant contribution to a project.

All investigators are obligated to ensure the project is conducted in compliance with applicable laws and regulations, and institutional policy governing the conduct of extramural research

ANNEXURE-3

TENTATIVE LIST OF QUESTIONS TO BE ANSWERED WHILE SUBMISSION OF LETTER OF INTENT (LOI)

[*These questions must be read in conjunction with footnotes (Description) made available*]

1. Your Name

2. Full name of institution/organization you officially work for, with Name of the State/UT it belongs

3. Reiterate your working email through which we can contact you

4. What is your current designation within the institution/organization you work in?

5. Are you a REGULAR employee of this institution/organization?

6. Your Date of Superannuation

7. Whether this CONCEPT (or a very similar one) of yours been submitted in past two (2) years to any of the National or International funding agency?

8. If Answer to the question 7 (mentioned above) is YES, please let us know the outcome of that submission?

9. How many extramural research projects are currently being carried-out by you as the PRINCIPAL INVESTIGATOR/ CO-PRINCIPAL INVESTIGATOR?

10. How many of these extramural research projects (as opted in Para 9 above) are driven through formal International Cooperation?

11. How many of these extramural research projects (as opted in Para 9 above) are of multi-institutional (wherein ≥3 independent legal entities are partnering) network in nature?

12. LoI's Unique Acronym

13. Select the priority research & innovation (R&I) action you are applying for

14. Why have you opted for the stated priority? How do you relate with this? Suggest your out-of-the-box thought

15. Summarize the CONCEPT behind this application in absolute "Laymen" term

16. Briefly describe your proposed R&I concept

17. Briefly describe work done by YOU in the most relevant research field

18. Tell us the CURRENT STAGE of your proposed R&I intervention/ solution/ technology on a scale of Readiness Level (RL)

19. Provide adequate reasoning to the assessment made above on current state of readiness level of your intervention/ solution/ technology

20. Tell us at what STAGE YOUR R&I intervention/ solution/ technology WOULD BE, on completion of proposed R&I action under consideration on a scale of Readiness Level (RL)?

21. Provide adequate reasoning to the assessment made above on stage of your intervention/ solution/ technology WOULD BE on a scale of readiness level on completion

22. Briefly describe your COMPETENCE and INTERPERSONAL SKILLS

23. Provide [UP TO FIVE (5)] LoI valid Digital Object identifier (DOI) of your most relevant publications (concerning the chosen priority) in last three (3) years

24. What R&I outcome/impact do you envisage through this LoI?

25. Communicate your LoI through Infographics/SmartArt

26. Kindly let us know the bare minimum budgetary requirement to passionately accomplish this ambitious goal within the chosen priority in-time?

27. Any other information you would like us to know, which may facilitate evaluation of your submission to a greater extent

ANNEXURE-4

READINESS LEVELS (RL-0 TO RL-9)

RL-0: IDEA || Need Assessment

- GAP analysis, Identify S&T needs
- Investigate the value proposition. Establish technical objectives and milestones

RL-1: IDEA || Basic Research (Discovery Science)

- Research hypothesis formulated. Scientific findings and knowledge base are reviewed and assessed as a foundation for characterizing new solution(s)
- Problem solving core principles (needs) are explored and observed, but have no experimental proof available

RL-2: IDEA || Basic Research (Discovery Science)

- Generating research ideas and plan addressing the challenge
- Hypothesis (Proof-of-Principle) are formed and preliminary studies are set to define parameters, to identify candidate concepts and to confirm basic principles
- Concept and/or application formulated with characteristics description and analytical tools for simulation

RL-3: IDEA || Basic Research (Science of Proof-of-Concept)

- Science known to the extant that models and simulations are possible. Risk areas and mitigation strategies identified
- Technical feasibility demonstration (Validation of Proof-of-Concept)
- Testing the hypothesis and critical data collection through active research and development with analytical and laboratory studies

RL-4: PROTOTYPE || Innovation & Transition (Early Technology Development)

- Lab-Scale (Small Scale) development and testing of prototype component or process on core mechanism and function
- Basic technological components are integrated to establish that they will work together. This is relatively 'low fidelity' stage compared to eventual system

RL-5: PROTOTYPE || Innovation & Transition (Early Technology Development)

- Pre-Pilot Scale Demonstration
- Basic technological components integrated with reasonably realistic supporting elements
- Rough working prototype (performant prototype) thoroughly tested in intended/ representative environment, which conforms to eventual environment and interfaces

RL-6: VALIDATION || Innovation & Transition (Advanced Technology Development)

- Represents a major step forward in a technology's demonstration readiness
- Pilot Scale production and viability Demonstration (Reliable Prototype)
- System/subsystem model or prototype demonstration in relevant end-to-end environment (i.e. prototyping implementation on full-scale realistic problems)

RL-7: VALIDATION || Innovation & Transition (Product Development)

- Operational Prototype (Prototype near, or at, planned operational system)
- Pre-Production Prototype (well integrated with collateral and ancillary systems) operating in operational environment at pre-commercial scale with most functions available for demonstration and test

RL-8: PRODUCTION || Innovation & Transition (Product Development)

- Commercial Demonstration
- Technology has been proven to work in its final form and under expected conditions. In almost all cases, this readiness level represents the end of true system development
- First of a kind commercial system (all technical processes, design and system to support commercial activity in ready state). All functionality tested in simulated and operational scenarios. Verification and Validation (V&V) completed

RL-9: PRODUCTION || Innovation & Transition (Product Development)

- Capability (actual system) validated on full range of parts and full range of expected mission conditions over long period. All documentation completed
- Commercial Deployment (Technology on 'general availability' for all consumer)

ANNEXURE-5

DEPICTION OF LOI THROUGH INFOGRAPHIC

SLIDE-1

A. General Information::	
1. LoI's Unique Acronym:	
2. Your Name:	
3. Current Position:	
4. Working Email:	
5. Your Cell number: (*Optional requirement*)	
6. Full Name of Institution & State/UT:	
7. Partners likely to join during full proposal formulation:	
8. Priority you are proposing to work on:	
9. 'Laymen Summary' of the LoI:	

SLIDE-2

B. We are looking for interactive (correlative) infographic which can comprehensively accommodate following verticals of LoI under consideration

**The above SmartArt illustration is for reference purpose only. It shall not be mistaken as the format for submission of infographic*