



Competitive Research Programme

Guidelines & Details for Principal Investigators

1. Objectives of the Call:

The Call of the Competitive Research Programme (CRP), under the following categories, is aimed at supporting high-quality, need-based and solution-oriented research that can contribute to national development, indigenous technology development, innovation and socio-economic impact:

- i. Triple Helix Projects (Industry Academia Linkages) and
- ii. Individual Research Projects (Individual researcher with viable high impact research)

2. Priority Areas of Research Projects

The Priority areas approved by different forums of the Government of Pakistan will be considered under this call. List of priority areas of research is attached at (Annexure-I).

3. Scope of the Projects:

Duration for the execution / completion of the project will be maximum upto 1-Year with the maximum funding limit up to Rs. 20.00 million for Triple Helix Projects and upto Rs. 10.00 million for Individual Research Grants.

Competitive Research Grants will be provided for:

- i. Development of new processes, products, applications and technologies through indigenous skills and expertise.
- ii. Indigenous technology development and innovative solutions to national and industrial needs.
- iii. Improvement/upgradation of existing products, processes, systems and technologies according to national and economic needs.
- iv. Value addition, technology transfer, commercialization and market-oriented development of research outcomes.
- v. Pilot-scale studies, prototypes, functional models and proof-of-concept development, where applicable.
- vi. Inventions, innovations and high-impact research with potential for practical application.
- vii. Creation and dissemination of new knowledge through quality publications and other appropriate research outputs.

4. Submission Details:

- i. The Principal Investigators will register on PSF Research Grants Management System (RGMS) with their credentials.
- ii. All proformas will be available online under the “Competitive Research Programme”.
- iii. The projects under Triple Helix Grants will require details of industrial partner onboard along-with its 5-15% contribution in the research. This category will follow with a Business Plan for research outcome as part of the project proposal.
- iv. Individual researchers will enter their projects in the Individual category.
- v. One scientist can submit only one research project either in Triple Helix or in Individual Category.
- vi. The Head of Organization must endorse the project proposal submitted to the Foundation for financial assistance. The online submission may be completed within deadline and the hard copy of the project proposal, duly endorsed by the Head of Organization along-with cover letter, with project number allotted by the RGMS on the top right corner of the envelope may be couriered to the below mentioned mailing address 14 days after the deadline.
- vii. The recommended project proposals may be revised in the light of recommendations of the Technical Committees and Project Award Committees. So, all researchers are advised to keep checking their email IDs regularly and the email ID of PSF RGMS should be marked as favorite to avoid emails going in spams.

The proformas of both categories can be accessed at (<https://rgms.psf.gov.pk/rgms/signup.aspx>). The portal will be closed at 23:59 PST on the last of the deadline as mentioned in the advertisement.

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Competitive Research Programme
Pakistan Science Foundation
1-Constitution Avenue, G-5/2
Islamabad.
051-9204033
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1. List of Priority Areas for Competitive Research Grants as per Approved PC-I

1. Agriculture and Food Security:

- i. Enhanced Productivity and Sustainability of Major Cropping System
- ii. Management of soils and water for sustainable crop production in salt affected drylands.
- iii. Climate change impact assessment, adaptation and mitigation for sustainable agriculture development
- iv. Control of diseases of fruits, vegetables and other crops
- v. Horticulture in arid and mountainous areas for promotion of vegetables of economic importance
- vi. Indigenous hybrid development in commercially important crops
- vii. Biosafety studies of GM crops/products
- viii. Developing high yielding, water efficient stress tolerant and crop varieties disease resistant
- ix. Value addition of fruits, vegetables and other food materials
- x. Management of postharvest losses and technologies for biodegradable food packaging
- xi. Fabrication/manufacturing of small and medium size agricultural implements
- xii. Precision agriculture

2. Livestock:

- i. Development of Rapid Diagnostic Tests and improved vaccines for viral diseases of livestock and poultry.
- ii. Studies on climate change impact on livestock production in flood affected areas of Pakistan and identification of mitigation measures.
- iii. Development of improved biotechnology for improvement of reproduction efficiency in buffaloes & cattles
- iv. To develop efficient animal breeds for more milk, meat and eggs
- v. Development of Veterinary Diagnostics and Vaccines
- vi. Management of reproductive health in large and small animals
- vii. Exploitation of indigenous resources to improve livestock and poultry health
- viii. Development of techniques/assays to rule out adulteration in animal products including milk and meat
- ix. Enhancement in Fisheries production
- x. Commercial production of vaccines

3. Water and Soil:

- i. Management of Terrestrial and Marine Water Resources
- ii. Determining climatic, trans-boundary and water rights implications in the national water flow balance and future projections
- iii. Intra-andInter-Basin Storage/Transfer of water projects
- iv. Developing and Managing Groundwater Resources
- v. Flow measurement techniques at Barrages and Canal Head Works
- vi. Developing mechanisms to control groundwater abstractions

- vii. Exploring the potential of hill torrents and its effective utilization
- viii. Studies on seawater intrusion
- ix. Assessment and characterization of country-wide wastewater management and development of strategic national action plan for sustainable ecosystem
- x. Prospectus of artificial groundwater recharge through rainwater harvesting especially urban areas
- xi. Controlling waterlogging and salinity to maximize crop productivity of affected lands

4. Engineering& Manufacturing:

- i. Artificial intelligence, big data, cloud computing and robotics
- ii. Innovative design and manufacturing of high-precision and high-techequipment/ instruments
- iii. Nano materials and devices
- iv. Biomedical materials
- v. High performance structural materials
- vi. Advanced manufacturing
- vii. Capitalizing CPEC through engineering
- viii. Scalable nano-manufacturing for integrated systems
- ix. Indigenous development of equipment / machines
- x. Fabrication of Smart Materials, Meta-materials, Flexible electronic devices, Fiber Lasers, Optical Components, Biomaterials and Biosensors etc.

5. Energy:

- i. Photovoltaic
- ii. Fuel Cell Technology
- iii. Bioenergy, biofuels and solar energy using renewable resources
- iv. Energy materials
- v. Efficient utilization of energy and the environment
- vi. Alternative Fuels
- vii. Exploiting Wind Resources
- viii. Harnessing alternate energy resources for environment friendly and profitable agriculture.
- ix. Renewable Energy/alternative sources of energy using plant and algal sources

6. Information and Communication Technology (ICT):

- i. Artificial Intelligence
- ii. Computer Graphics, Vision, Animation, and Game Science
- iii. Computing for Development
- iv. Big Data Analytics
- v. Data warehousing and Data mining, Data Science
- vi. Data Management and Visualization
- vii. Human Computer Interaction
- viii. Machine Learning
- ix. Natural Language Processing
- x. Intelligent Robots
- xi. Un-manned autonomous vehicles
- xii. Information Security and Privacy
- xiii. Systems and Networking

- xiv. Wireless and Sensor Systems
- xv. Internet of Things (IOT)
- xvi. Cloud Computing
- xvii. Intelligent information systems
- xviii. Computer assisted surgical and medical analysis
- xix. Healthcare systems
- xx. Data Security: Secure routing, Test beds for security application, Operating systems security, Intrusion detection/prevention, Availability, Authentication, Botnets and worms
- xxi. Cryptography
- xxii. Network security
- xxiii. Developing Information Literacy Skills of Librarian & Researchers using ICT tools
- xxiv. Developing Smart Digital Repositories

7. Health Sciences:

- i. Precursors of Medicines
- ii. Medical Equipment
- iii. Pathogenesis and precise diagnosis and treatment of major chronic diseases
- iv. Infectious diseases and antibiotic resistance
- v. Stem cells and diseases
- vi. Tissue and organ damage, dysfunction and intervention
- vii. Protection of organs and replacement therapy
- viii. Interdisciplinary scientific research on diseases
- ix. Medical imaging and biomedical engineering
- x. Innovative medical technologies and personalized medicine
- xi. Standardization of herbal medicines.
- xii. Development of nutraceuticals and cosmetics based on medicinal plants of Pakistan.

8. Biotechnology, Biochemistry& Molecular Biology:

- i. Cellular and Biochemical Engineering
- ii. Plant Biotechnology for improved varieties of cotton, sugar Cane, Potato, maize etc.
- iii. Molecular Virology: Recombinant Vaccine development against Viruses
- iv. Stem Cells as regenerative medicine
- v. Biopharmaceuticals: Recombinant human Proteins
- vi. Biocomposites, biodegradable plastics and plasma coating materials for personal care, health care and other diverse industrial applications
- vii. Environmental biotechnology for bioremediation of toxic industrial effluents and for solid wastes management
- viii. Industrial/ fermentation biotechnology for producing effective and efficient biochemicals and biocatalysts to replace the use of textile chemicals in industrial processes
- ix. Nano-biotechnology, nanomaterials and other advanced materials for industrial applications
- x. Development and applications of Bioinformatic tools

9. Earth Sciences, Environment& Climate Change:

- i. Climate change, Environmental pollution and its impacts
- ii. Water cycle and eco-hydrological processes
- iii. Early warning systems and control of geological disasters
- iv. Marine ecological system security and deep-sea biological resources
- v. Resources, environment and ecology along the “One Belt and One Road” regions

- vi. Innovations in Biological Imaging and Visualization (IBIV)
- vii. Advancing Digitization of Biodiversity Collections (ADBC)
- viii. Effect of climatic changes on animal biodiversity
- ix. Methods and technologies of pollutants control of water body environment, polluting process and renovating technology of soils
- x. Climate change and its effect on Agriculture, environment, and livelihood
- xi. Generation and maintenance of geotechnical data of different basins of Pakistan facilitating the exploration of oil & gas in Pakistan.
- xii. Improvement of existing methods and technologies for reclamation of lubricating oils for provision of quality lubricating oils for their use in industry and transport.
- xiii. Development of chemical marker system for checking adulteration of petroleum fuels for provision of quality fuels to industry and the public.
- xiv. Inter-fuel substitution and carbon free fuels
- xv. Value addition of indigenous coal

10. Chemistry and Physics

- i. Chemical Catalysis and Chemical Synthesis
- ii. Macromolecular, Supramolecular and Nanochemistry
- iii. Optics and Photonics
- iv. Solid State and Materials Chemistry
- v. To develop functional materials and functional system of polymers
- vi. To develop soft-substances used in the field of new energy, information technology, biomedicine and environmental sciences.
- vii. To develop technologies for treating solid waste substances use of nano-materials in pollution controlling process.
- viii. Process and mechanism of surface and interface chemistry
- ix. New system of materials chemistry related to energy and resources
- x. Natural products chemistry and drug discovery
- xi. Physics of Living Systems
- xii. Acquire accelerator technology with emphasis on RF power systems, accelerating cavities, magnets, cryogenics and beam dynamics.
- xiii. Build small scale accelerators in Pakistan for medical applications
- xiv. Development of detector technology based on gaseous, multi-proportional wire-chambers, and semiconductor based which have applications in mining, medical imaging and for security purposes.
- xv. Research on detectors combined with material science which may lead to novel materials.
- xvi. Mathematical modeling and computational sciences for applications in all fields of science.
- xvii. Research in astrophysics and cosmology
- xviii. Experimental high energy physics.

11. Science, Technology, Engineering & Mathematics (STEM) Education

12. Space Sciences

13. Other Emerging Areas in Research:

- i. Gene therapy for treatment and life-long protection from diseases.
- ii. Improved electricity storage for improved and efficient electricity sector in both renewables and fossil fuels electricity production
- iii. Use of nanofiber for next generation battery development
- iv. 'Instantly rechargeable' batteries for the future electric and hybrid automobiles.

- v. More efficient catalysts for water splitting to produce hydrogen, a promising source of clean energy.
- vi. Carbon Capture and Storage (CCS) technology.
- vii. To recover 100 percent of the water from highly concentrated salt solutions to alleviate water shortages in arid regions
- viii. Technology to reduce harmful diesel emissions to significantly cut nitrogen oxide (NOx) emissions in diesel engines
- ix. Natural gas facilities with no carbon dioxide emissions using chemical looping combustion (CLC)
- x. Integration of graphene and quantum dots with CMOS technology to create an array of photodetectors to take images of invisible objects.
- xi. Magnetoelectric memory cells to increase energy efficiency for data storage
- xii. Metal-ion catalysts and hydrogen peroxide for green plastics production
- xiii. New catalytic converter composite to reduce rare earth element usage in the automobile catalytic converters.
- xiv. Development of transistors made of Carbon instead of Silicon
- xv. Battery-less pacemaker powered through microwave
- xvi. Splitting carbon dioxide using low-cost catalyst materials
- xvii. Bionic implants; repair of injured brain through a prosthetic brain, recovery of eyesight and artificial heart
- xviii. Computational and Data Enabled Science and Engineering
- xix. Communications, circuits and sensing-systems
- xx. Electronics, Photonics and magnetic Devices
- xxi. Intelligent network and e-Health science applications
- xxii. Brain-like computing and machine intelligence
- xxiii. Next generation internet exploration and practice
- xxiv. Design method and application verification of new control system analysis
- xxv. Novel high precision and reliable testing technology and system
- xxvi. High-performance robotics and advanced artificial intelligence system
- xxvii. UV photo-detectors
- xxviii. Narrow line width fiber laser
- xxix. Micro-nano structure optoelectronic devices
- xxx. Integrated theory and design of millimeter wave circuits and antennas
- xxxi. Calculating camera and its applications
- xxxii. Mind, Machine and Motor Nexus
- xxxiii. Network for Computational Nanotechnology
- xxxiv. Collaborative Research in Computational Neuroscience
- xxxv. Critical Techniques, Technologies and Methodologies for Advancing Foundations and Applications of Big Data Sciences and Engineering
- xxxvi. Research at the Interface of the Biological and Mathematical Sciences
- xxxvii. Software Infrastructure for Sustained Innovation
- xxxviii. Training-based Workforce Development for Advanced Cyber infrastructure
- xxxix. Biophotonics

2. National Science & Technology & Innovation Policy-2022

<http://most.comsatshosting.com/policies/NSTPolicy2022.pdf>

3. Priority areas Recommended by 1st Steering Committee

- Lithium-Ion Batteries
- Super Capacitors
- Energy Storage Batteries
- Development of Vaccines

4. Priority areas Recommended by 6th Steering Committee

- Edible oil
- Hybrid seeds
- Vegetable seeds
- Post-harvest technologies
- Organic food colors
- Sodium ion batteries
- Chemical to mineral
- Lithium separation from sea water