NATIONAL PRIORITIES RESEARCH PROGRAM - STANDARD (NPRP-S)

Request for Proposals (RFP)

12th Cycle

Revised December 2018
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<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMG</td>
<td>Award Management Guide</td>
</tr>
<tr>
<td>AROR</td>
<td>Authorized Research Office Representative</td>
</tr>
<tr>
<td>GAG</td>
<td>Grant Application Guide</td>
</tr>
<tr>
<td>GS</td>
<td>Graduate Student</td>
</tr>
<tr>
<td>IACUC</td>
<td>Institutional Animal Care and Use Committee</td>
</tr>
<tr>
<td>IBC</td>
<td>Institutional Biosafety Committee</td>
</tr>
<tr>
<td>IP</td>
<td>Intellectual Property</td>
</tr>
<tr>
<td>IRB</td>
<td>Institutional Review Board</td>
</tr>
<tr>
<td>KI</td>
<td>Key Investigator</td>
</tr>
<tr>
<td>LPI</td>
<td>Lead Principal Investigator</td>
</tr>
<tr>
<td>MOPH</td>
<td>Ministry of Public Health – Qatar</td>
</tr>
<tr>
<td>NPRP</td>
<td>National Priorities Research Program</td>
</tr>
<tr>
<td>PI</td>
<td>Principal Investigator</td>
</tr>
<tr>
<td>PR</td>
<td>Peer Reviewer</td>
</tr>
<tr>
<td>QNRF</td>
<td>Qatar National Research Fund</td>
</tr>
<tr>
<td>QNRS</td>
<td>Qatar National Research Strategy</td>
</tr>
<tr>
<td>QRLP</td>
<td>Qatar Research Leadership Program</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>RA</td>
<td>Research Assistant</td>
</tr>
<tr>
<td>REG</td>
<td>Research Ethics Guide</td>
</tr>
<tr>
<td>RFP</td>
<td>Request for Proposal</td>
</tr>
<tr>
<td>RO</td>
<td>Research Office</td>
</tr>
<tr>
<td>ROC</td>
<td>Research Outcome Centre</td>
</tr>
<tr>
<td>SI</td>
<td>Submitting Institution</td>
</tr>
<tr>
<td>TRL</td>
<td>Technology Readiness Levels</td>
</tr>
</tbody>
</table>
## Section 2. NPRP-S Snapshot

<table>
<thead>
<tr>
<th>SCOPE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Competition Opens</strong></td>
<td>15&lt;sup&gt;th&lt;/sup&gt; January 2019</td>
</tr>
<tr>
<td><strong>Submission Deadline</strong></td>
<td>Proposal submission by LPI: 26&lt;sup&gt;th&lt;/sup&gt; March 2019 (12pm, Doha time). Final submission and RO vetting: 9&lt;sup&gt;th&lt;/sup&gt; April 2019 (12pm, Doha time). The complete application is due by this deadline.</td>
</tr>
<tr>
<td><strong>Announcement of Awards</strong></td>
<td>October, 2019</td>
</tr>
<tr>
<td><strong>Anticipated Project Start Date</strong></td>
<td>Project activities cannot begin until a Master Research Funding Agreement (MRFA) has been signed with the Qatar National Research Fund (QNRF). This process can take up to 60 days from the time of the award announcement. This should be taken into consideration when preparing the application implementation timeline.</td>
</tr>
<tr>
<td><strong>Applicant Eligibility</strong></td>
<td>The LPI from academic/research institution must be a researcher who holds a research-oriented doctorate or any of the approved terminal degrees as defined under the approved list of terminal degrees and has at least five peer reviewed publications. The LPI from a research end-user entity may not hold a terminal degree, however they must have a track record in managing technology development projects and/or research projects, and a minimum of five publications or authored patent applications/patents. The LPI must be affiliated with an institution inside Qatar.</td>
</tr>
<tr>
<td><strong>Priority Themes</strong></td>
<td>Proposals submitted under NPRP-S are required to be aligned to at least one of the listed Priority Themes. The identified Priority Themes for the four pillars are summarized under <a href="#">Section 5</a> and are detailed in <a href="#">Appendix A</a> of this document. Cross-cutting and interdisciplinary projects are encouraged.</td>
</tr>
<tr>
<td><strong>Awards Parameters</strong></td>
<td>For up to four-year awards, application budget may not exceed US $200K for a one-year project, US $400K for a two-year project, US $600K for a three-year project and US $700K for a four-year project. For projects exceeding one year, the budget may not exceed US $250K in any year. This amount includes personnel, capital equipment, consumables, materials, services, travel, miscellaneous and indirect costs as applicable.</td>
</tr>
<tr>
<td><strong>Co-funding Opportunities</strong></td>
<td>QNRF encourages co-funding of projects in cash and/or in-kind. No fund match will be provided by QNRF.</td>
</tr>
<tr>
<td><strong>IP Policy</strong></td>
<td>QNRF will follow the Qatar Foundation (QF) Intellectual Property (IP) Policy. For further details, refer to the QF IP policy at <a href="#">link</a>.</td>
</tr>
<tr>
<td><strong>How to Apply</strong></td>
<td>Register and submit the full application through the online submission system website: <a href="https://www.qgrants.org/">https://www.qgrants.org/</a>. The Grant Application Guide (GAG) is available for download at <a href="http://www.qnrf.org">www.qnrf.org</a>, see the Download Center for the NPRP. The site will be active on the 15&lt;sup&gt;th&lt;/sup&gt; of January 2019, 12pm, Doha time.</td>
</tr>
<tr>
<td><strong>QNRF Contact</strong></td>
<td>QNRF support system <a href="https://support.qnrf.org/conversation/new">https://support.qnrf.org/conversation/new</a>.</td>
</tr>
<tr>
<td><strong>Reference Documents</strong></td>
<td>Priority Themes for the four pillars (<a href="#">Appendix A</a> &amp; <a href="#">Appendix B</a>) QNRF Co-Funding Policy (<a href="#">link</a>) Research Ethics Guide (REG) (<a href="#">link</a>) Research Ethics and Regulatory Requirements (<a href="#">link</a>) Travel Policy (<a href="#">link</a>) Intellectual Property (IP) Policy (<a href="#">link</a>) Data Management Plan Policy (<a href="#">link</a>) Other relevant documents (<a href="#">link</a>)</td>
</tr>
</tbody>
</table>
Section 3. Overview

The vision of Qatar National Research Fund (QNRF) is to enable research and development excellence in Qatar in order to achieve a sustainable, diversified economy through the advancement of research and education by providing funding opportunities for original, competitively-selected research and development at all levels and across all disciplines with emphasis on the following four pillars of the Qatar National Research Strategy (QNRS):

- Energy and Environment
- Computer Science and ICT
- Health
- Social Sciences, Arts and Humanities

The National Priorities Research Program (NPRP) is the main funding program of QNRF and the primary means by which QNRF seeks to support research that can help Qatar address the Grand Challenges outlined in the Qatar National Research Strategy (QNRS) 2013 (link) and QNRS 2014 (link). Therefore, QNRF has established stakeholder committees to identify Priority Research Themes within those Grand Challenges.

The NPRP-S encourages collaborative and multi-disciplinary proposals involving teams from more than one institution. QNRF aims for international collaborations to enhance the research capacity and scientific excellence in Qatar. The collaboration of research end-users and co-funding (see definition at link) in proposals is particularly desired and encouraged.

Section 4. Program Objectives

The objective of the program is to competitively select research projects that will address national priorities through supporting basic and applied research as well as translational research/experimental development.

Through this NPRP-S cycle, we intend to stimulate partnerships between academics and research end-users.

The NPRP-S aims to focus on meritorious research projects that demonstrate a potential impact on the development of Qatar’s society and economy with an emphasis on:

- tackling needs and challenges faced by local research end-users;
- supporting projects with tangible impacts;
- focusing on subjects that hold strong commercial and technological potential;
- promoting a public-private partnership culture in Qatar;
- encouraging a more cross-cutting / interdisciplinary approach to projects;
- stimulating scientific excellence and the advancement of knowledge in Qatar.

Section 5. Priority Themes

Proposals submitted under NPRP-S (including resubmissions and renewals) are required to be aligned to at least one of the listed Priority Themes.

The Priority Themes were identified through consultation between QNRF and the main stakeholders in Qatar including ministries, businesses and academic institutions. The themes are aligned with the QNRS 2013 and 2014 Grand Challenges and consider Qatar’s local R&D capacities.

The objectives of the Priority Themes are to focus and optimize QNRF’s funding according to the following main strategic principles:

- Diversification and development of Qatar’s industries and services towards a sustainable, diversified economy.
- Support of the development and enforcement of public policies, governance and public services in Qatar.
The Priority Themes identified by QNRF are categorized on the four pillars. Table 1 below illustrates the first level of the Priority Themes in each pillar. Details of the Priority Themes can be found in Appendix A and summary tables in Appendix B at the end of this document.

Table 1 – The 1st level of Priority Themes per Pillar (details and 2nd level are available in Appendices A&B)

<table>
<thead>
<tr>
<th>1. Energy &amp; Environment Pillar</th>
<th>2. Biomedical &amp; Health Pillar*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td><strong>2.1 Communicable Diseases (Viral &amp; Bacterial)</strong></td>
</tr>
<tr>
<td>1.1 Advanced Materials</td>
<td>2.2 Non-Communicable Diseases (NCDs)</td>
</tr>
<tr>
<td>1.2 Cooling</td>
<td>• Cancer (Breast, Colon, Prostate, Leukemia, Lung, &amp; Thyroid)</td>
</tr>
<tr>
<td>1.3 Energy Efficiency</td>
<td>• Cardiovascular</td>
</tr>
<tr>
<td>1.4 Oil &amp; Gas</td>
<td>• Diabetes</td>
</tr>
<tr>
<td>1.5 Water</td>
<td>• Mental &amp; Neurological</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>• Renal</td>
</tr>
<tr>
<td>1.6 Built Environment</td>
<td>• Reproductive, Maternal &amp; Child health</td>
</tr>
<tr>
<td>1.7 Natural Environment</td>
<td><strong>3. Computer Science &amp; ICT Pillar</strong></td>
</tr>
</tbody>
</table>

| 3.1 Artificial Intelligence  | 4. Social Sciences, Arts & Humanities Pillar |
| 3.2 Cybersecurity            | 4.1 Cultural Identity & the Development of Human Potential |
| 3.3 Healthtech               | 4.2 Economic Diversification & Sustainability |
| 3.4 High Performance Cloud Computing | 4.3 Gulf Security |
| 3.5 Next Generation Networks (NGNs) | 4.4 Lifestyle & Quality of Life |
| 3.6 Smart Cities             | 4.5 Population Growth Sustainability |
| 3.7 Smart Grids              |                                                                 |

* Any personalized type of biomedical research should be submitted to the call “Path towards Precision Medicine” (PPM3)

Section 6. Eligibility

6.1. Eligibility of Submitting Institution

6.1.1 Institutions inside Qatar with approved Research Offices (ROs) are eligible to submit proposals. See submitting institution and RO roles in the “Institutions responsibilities and Post-Award” document available at link.

6.1.2 Submissions should be within the research area(s) of the submitting institutions as declared by the approved ROs.

6.1.3 Authorized Research Office Representatives (ARORs) and other research administrators who are members of the RO are not eligible to participate in any NPRP projects.

6.2. Eligibility of Participants

6.2.1 Eligibility of Lead Principal Investigators (LPIs)

6.2.1.1 The LPI must be affiliated with a submitting institution inside Qatar. He/she is the individual eligible to apply for an NPRP grant. The LPI may collaborate with other research organizations located inside or outside Qatar.
6.2.1.2 An eligible LPI from academic/research institutions must hold a research-oriented doctorate or any of the approved terminal degrees as defined under the approved list of terminal degrees available at link.

6.2.1.3 The LPI should have at least five single- or co-authored peer-reviewed publications uploaded in their profile in the QNRF online submission system. Types of publications accepted by QNRF include journal papers, full paper conference proceedings, books, book chapters or patents by the LPI. In addition, QNRF accepts peer-reviewed creative works that cover the following research areas: performing arts, visual arts, creative writing, design works, and communication media. These creative works are only accepted when the LPI provides an “attestation letter” from the LPI’s affiliated institution, indicating that these particular creative works are acceptable research outcomes.

6.2.1.4 The LPI from a research end-user entity may not hold a terminal degree, however he/she must have a track record in managing technology development projects and/or research projects, and a minimum of five publications or authored patent applications/patents.

6.2.1.5 An LPI awarded from previous NPRP cycles is eligible to submit a renewal application (Section 7.2.3) for a previously-awarded NPRP proposal that shows promising outcomes and justification for renewal. The total number of applications is restricted by the maximum number of roles allowed for each LPI.

6.2.1.6 A post-doctoral scholar is not eligible to act as an LPI (see definition at link).

6.2.2 Number of Roles

6.2.2.1 The LPI can submit only one application in NPRP-S.

6.2.2.2 The count of an individual’s participation in all on-going past normal NPRP/NPRP-S projects as a key investigator (KI) must not exceed four roles, excluding participation in projects ending before 1st October 2019.

6.2.2.3 Previous Co-LPI roles in active NPRP projects are counted as PI roles for this cycle.

Section 7. Submission Process

7.1. Proposal Submission Flowchart and Timeline

7.1.1 Flowchart

The following flowchart illustrates the necessary steps for proposal submission by the LPI and the RO until the notification of the final award.

NPRP Proposal Submission Flowchart

Proposal Submission (10 weeks) → RO Vetting (12 weeks) → QNRF Proposal Screening (4 weeks) → Proposal Peer Reviewing, Programmatic Evaluation, Score Analysis & Funding Decision (20 weeks) → Receiving Complementary documents for funded projects (8 weeks) → RO Vetting (8 weeks)

- 15th Jan. 2019 (Open Proposal Submission & RO Vetting)
- 26th Mar. 2019 (Close Proposal Submission by LPI)
- 8th Apr. 2019 (Close Final Submission & RO vettign)
- May 2019 (Ineligible Proposal Notification)
- October 2019 (Award Notification)
- December 2019 (NRFASigning)

3 Months 7 Months 2 Months

Proposal Preparation & RO Vetting QNRF Internal Processing Pre-Funding Phase
7.1.2 Timeline
The following table shows important dates for the NPRP-S 12th cycle.

<table>
<thead>
<tr>
<th>Description</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online registration for LPIs</td>
<td>Always Open</td>
</tr>
<tr>
<td>Online registration of ROs and other key investigators</td>
<td></td>
</tr>
<tr>
<td>Open proposal submission as well as RO vetting * process.</td>
<td>12pm (Doha Time), Tuesday, 15th of January, 2019</td>
</tr>
<tr>
<td>Close proposal submission by LPI</td>
<td>12pm (Doha Time), Tuesday, 26th of March, 2019</td>
</tr>
<tr>
<td>RO final proposal submission and vetting</td>
<td>12pm (Doha Time), Tuesday, 9th of April, 2019</td>
</tr>
<tr>
<td>Ineligible proposals notification</td>
<td>May 2019</td>
</tr>
<tr>
<td>Successful proposals notification and awards announcement</td>
<td>October 2019</td>
</tr>
</tbody>
</table>

*RO vetting can only start once the proposal is submitted.

7.2. Applications Procedures
During proposal preparation, LPIs must select one of the three types of applications stated below:

7.2.1 New
7.2.1.1 LPI must select “New” application, if it is the first time that the application is submitted for funding.
7.2.1.2 New application may also include proposals that did not pass QNRF screening in previous cycles.

7.2.2 Resubmission
7.2.2.1 A resubmission is a proposal that passed the QNRF screening process, went through the review stage but was not awarded. A resubmission can only be submitted once in the subsequent cycle. The LPI must select “Resubmission” in this case.
7.2.2.2 Previous proposals that passed screening but were not awarded and are being resubmitted as “New” proposals will be disqualified during the screening.

7.2.3 Renewal
7.2.3.1 An eligible LPI may submit a renewal request for a previously-awarded NPRP proposal that shows very promising outcomes/accomplishments as a result of the previous award such as publications, patent(s), human resources development at the level of postdoctoral, graduate, undergraduate etc.
7.2.3.2 An LPI may select “Renewal”, if additional funding is requested to support proposals applying for continuation of a previously-awarded NPRP grant.
7.2.3.3 For LPI eligibility in applying for renewal, please refer to Section 6.2.1.5.
7.2.3.4 A renewal application may be submitted in the last year of an active grant, as long as the grant will end no later than 30 November 2019. If the previous grant has ended, a lapse of 12 months is allowed. The renewal application must comply with this RFP requirement.
7.2.3.5 An LPI is required, during the proposal preparation stage, to justify their request for renewal, and to state the achieved outcome(s)/accomplishment(s) from the previous award.

Section 8. Budget
8.1. QNRF Grant
Table 2 shows the maximum allowed QNRF Basic Grant of each award according to the project’s duration. However, the grant may not exceed US$ 250,000 in any year for projects lasting two years and longer.
Table 2- QNRF Total Basic Grant vs Project's Duration

<table>
<thead>
<tr>
<th>Project duration</th>
<th>QNRF Maximum Basic Grant (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-year project</td>
<td>200,000</td>
</tr>
<tr>
<td>Two-year project</td>
<td>400,000</td>
</tr>
<tr>
<td>Three-year project</td>
<td>600,000</td>
</tr>
<tr>
<td>Four-year project</td>
<td>700,000</td>
</tr>
</tbody>
</table>

8.2. Co-Funding and Fund Matching Rules

QNRF encourages co-funded projects in NPRP-S. In such cases, applicants are requested to comply with QNRF’s Co-Funding policy (link). No fund match will be provided by QNRF.

8.3. Grant and Effort Allocation

At least 50% of the proposed funded research efforts must be conducted inside Qatar by the research team and at least 65% of the QNRF total annual grant of the project must be expended inside Qatar.

Please refer to the Budget Components document available at link.

Section 9. Personnel Requirements

9.1. Lead Principal Investigator

Please refer to the Lead Principal Investigator Eligibility (section 6.2.1).

9.2. Principal Investigator

9.2.1 Principal Investigator (PI) must be affiliated with a submitting institution in Qatar or a collaborating institution inside or outside Qatar.

9.2.2 An eligible PI must hold at least a university post-graduate degree and should have a suitable research experience relevant to the area of the proposal and the tasks assigned to them.

9.2.3 A post-doctoral scholar is not eligible to act as a PI (see definition at link).

9.3. Other Research Team Members

Post-doctoral scholars, graduate students, research associates, research assistants, undergraduate students, lab technicians and engineers are considered Research Team Members.

9.4. Graduate Students

A graduate student (GS) is permitted to participate in NPRP projects provided that they are enrolled in a higher education degree program at the submitting or collaborating institution, and that the NPRP research activities are related to the GS’s degree program. QNRF encourages the applicants to hire QRLP (Qatar Research Leadership Program) graduates and candidates and GSs from Qatar. The QRLP graduates and candidates will be at zero cost.

9.5. Undergraduate Students

If necessary, the LPI may include undergraduate students as Research Team Members under the “Undergraduate Student” roles on the QNRF online submission website, provided that their participation would comply with their institution’s policies.

9.6. Consultants

If the need for consultant (see definition at link) services is anticipated, the nature of the proposed consultant services must be justified and included in the proposal. The consultant services cannot be considered as scientific or intellectual contribution to the project.
Section 10. Online Submission Procedures

10.1. Submission Requirements

10.1.1 The online application, submitted by the LPI, must be vetted by the Research Office (RO) of the submitting institution in order to be considered as an official submission to QNRF. RO vetting must be completed in accordance with the timeline (section 7.1.2), and the RO responsibilities at link.

10.1.2 All principal investigators listed on an NPRP grant application, residing inside or outside Qatar, must register with QNRF at https://oss.qgrants.org/.

10.1.3 An applicant is required to use their official work email addresses (if available) when registering. Those who have previously registered do not need to re-register, but will need to update their profile and CV as applicable. Applicants who register with two different emails will be disqualified.

10.1.4 Each LPI is required to upload a minimum of five peer-reviewed publications. Research end-users LPIS may include patent applications.

10.1.5 Applicants from a research end-user entity who do not hold a terminal degree should request an approval from QNRF to act as LPI through the online system. For more details, please refer to the Grant Application Guide (GAG), at link.

10.1.6 Consultants are required to register and upload their CVs, stating their affiliation.

10.1.7 For the requirements regarding online registration, please refer to the Grant Application Guide (GAG) at link.

10.2. Proposal Registration

10.2.1 After registration, the LPI is required to register the proposal at the following website: https://oss.qgrants.org/. For more information regarding the proposal registration and submission, please refer to the Grant Application Guide (GAG), at link.

10.2.2 The LPI may use the “Comments to QNRF” box to designate persons they would prefer not to review the proposal and should indicate why. The decision to follow the suggestions or not, however, remains with QNRF. The LPI may also utilize the “Comments to QNRF” box for any other issue they need to declare before submission. The LPI should also identify any research work that they have conducted/are conducting which is similar to the proposal and explain how the latter is distinct.

10.3. Proposal Preparation

During the “Proposal Preparation,” the LPI has to submit the information for the online sections listed below and upload documents as required.

10.3.1 Proposal Summary: A brief description written in the third person outlining the major aspect(s) of the proposed activity, while illustrating the envisaged objectives and methods. The description should be informative and highlight the intellectual merit and potential impact of the project. This information is requested during the proposal submission phase in the system.

10.3.2 Submitting Institution’s Information: A research institution registered inside Qatar that has appropriate research resources specializing in area(s) within QNRS and is responsible for submitting research proposals to QNRF. The LPI’s institution in Qatar will be considered as the submitting institution and will be responsible for vetting the proposal.

10.3.3 Collaborative Institutions’ Information: An institution inside or outside Qatar collaborating with the submitting institution in conducting the research proposal. If collaborative institutions are involved in the proposal, the LPI should enter the required information for each institution, including uploading an official support letter. Collaborative Institution must include at least one PI.

10.3.4 Personnel:

10.3.4.1 Research Team: The LPI can nominate Research Team Members (see definition at link) from the submitting and collaborative institutions. PIs are required to be registered in order to be added to the proposal submission. The system will request the PIs to update their profiles with all the required documentations/information, including those related to efforts, in order to be added to the proposal.
10.3.4.2 Consultant: The LPI lists the consultants for the project. Consultants (see definition at link) are required to be registered in order to be added to the proposal.

10.3.5 Research Plan: The LPI should prepare the research plan file according to the research plan template available at link. The research plan should use Arial font for the body text, font size 11, single space and the margins as identified in the template (no less than 0.5 inches). The research plan must not exceed 40 pages excluding cover page, table of contents and references.

10.3.6 Budget: For more information on the budget, see Budget Components document at link.

10.3.7 Co-Funding: In a case of co-funding, the LPI is required to provide justification, the total amount of co-funding, including the expected categories of contributions, and upload a commitment letter from the co-funder(s) signed by an authority of the co-funder(s).

10.3.8 Other grants: The LPI should disclose any information on all on-going and previously completed research funds for each Key Investigator over the last three years such as project title, name of funding agency, project duration, start and end dates, the total amount of fund/year, total effort, remaining effort, abstract and, if applicable, outcome summary.

10.3.9 Ethical Compliance: For research involving human subject(s), stem cells in human subject(s), research with laboratory animals, DNA research and biohazard materials, the LPI is required to comply with the laws and regulations set out by the Ministry of Public Health (MoPH) for the protection of the human subjects and laboratory animals.

10.3.10 IP/Market: This section addresses some questions related to Intellectual Property that need to be answered by the LPI.

10.3.11 Miscellaneous Documents: This section may contain any supporting documents such as tables, appendices, etc. However, documents wrongly uploaded under this section, such as a research plan, will not be considered. All the information required for the evaluation process should be included in the research plan. For any proposal utilizing Qatar BioBank (QBB) resources, a supporting letter from QBB should be uploaded in the miscellaneous documents section.

10.3.12 Declarations: The LPI should declare that the proposal is their own work, except where appropriately referenced and ensure that the proposal was not and will not be submitted in whole, or in part, for funding more than once within the same cycle, or to other funding programs within QNRF, or other funding agencies.

Section 11. Proposal Screening
All proposals submitted are subject to screening by QNRF, which entails the programmatic alignment, feasibility and TRL levels (where applicable) in addition to the usual screening steps. For more details, please refer to the screening process outlined at link.

Section 12. Proposal Evaluation
12.1. Proposal Review and Ranking
The proposal review and ranking process comprises several assessment steps that include an initial peer review by international experts followed by a programmatic review. The two processes are detailed below.

12.1.1 Peer Review
A minimum of three qualified international peer reviewers (representing an appropriate mix of academic, industry and public-sector expertise) are solicited by QNRF to evaluate each proposal against the criteria listed below. The reviewers will evaluate the proposals, make recommendations to QNRF as to “Fund” or “Not Fund” and provide narrative feedback to applicants. The evaluation criteria consist of the following:

12.1.1.1 Intellectual Merit (Excellent; Very Good; Good; Fair; Poor)
- Does the project address an important problem or a critical barrier to progress in the field? Is there a strong scientific premise for the project?
- Are the objectives for the project clear, measurable, realistic and achievable?
- What is the potential for the proposed activity to advance knowledge and understanding within its own field or across different fields?
• How will successful completion of the aims change the concepts, methods, technologies, treatments, services or preventative interventions that drive this field?
• Does the application challenge and seek to shift current research by utilizing novel theoretical concepts, approaches or methodologies, instrumentation or interventions?
• Are the concepts, approaches or methodologies, instrumentation or interventions novel to one field of research or novel in a broad sense?

12.1.1.2 Expected Impact (Excellent; Very Good; Good; Fair; Poor)
• How significant is the envisaged outcome in addressing priority issues, including QNRS, in areas that are critical to Qatar, in terms of:
  o The potential for the proposed activity to benefit society or advance desired economical and societal outcomes,
  o The expected benefits of the proposed research activity to Qatar,
  o Plans to disseminate and exploit the project’s results,
  o Extent to which end-users may realistically benefit (co-funded research) from the research,
  o Plans to utilize project outcomes in future studies.
• For Renewal applications only: Evaluate whether the renewal describes exceptional outcomes/accomplishments that have resulted from the previous NPRP-award (including publications, patent(s), human resources development at the postdoctoral, graduate and undergraduate levels, etc.). Is the request for renewal justified?

12.1.1.3 Work Plan (Excellent; Very Good; Good; Fair; Poor)
• Is the plan for carrying out the proposed activities well-reasoned, well organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
• The breakdown into consistent work packages,
• Timeline and time-allocation for work packages,
• Coherence and effectiveness of the project organization, including appropriateness of the allocation of tasks and resources
• The organizational aspects of the project and the methods of coordination.

12.1.1.4 Qualifications and Complementarity of the Research Team (Excellent; Very Good; Good; Fair; Poor)
• How well qualified is the research team inside and outside Qatar and are their designated roles suitable to conduct the research?
• Assess the LPI’s capability to coordinate the project and the research teams.

12.1.1.5 Budget
• Appropriateness of the budget regarding the work plan and effort planning.
• Evaluation of the adequacy of co-funding commitments, if any.
• Are the proposed outcomes and outputs appropriate for the amount of effort and funding?

12.1.1.6 Research Compliance
• Protections for human subjects
• Inclusion and protection of children
• Vertebrate animals
• Biohazards

The table below shows the weights of the peer review criteria.
Table 3- Weights of the Peer Review Criteria

<table>
<thead>
<tr>
<th>Criteria #</th>
<th>Criteria Name</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Intellectual Merit</td>
<td>25</td>
</tr>
<tr>
<td>C2</td>
<td>Expected Impact</td>
<td>35</td>
</tr>
<tr>
<td>C3</td>
<td>Work Plan</td>
<td>20</td>
</tr>
<tr>
<td>C4</td>
<td>Qualifications and Complementarity of the Research Team</td>
<td>20</td>
</tr>
</tbody>
</table>

12.1.2 Programmatic Review

Following the peer-review evaluation, QNRF will shortlist proposals based on the shortlisting procedure at [link](#) and the weightages above. Subsequently, expert panels will perform a programmatic review under the supervision of QNRF.

The programmatic review is designed to assess and compare all proposals in a given area of science. It takes into account the peer reviewers’ comments as well as the programmatic and strategic goals of QNRF related, but not limited to:

12.1.2.1 The strength of the alignment with the priority themes as identified in this RFP

- To what degree do the project objectives address the priority themes?

12.1.2.2 The quality of the collaboration and the co-funding commitment

- The extent of knowledge-creation inside Qatar and of knowledge-transfer and potential for technology-transfer to Qatar;
- The quality and extent of collaboration among researchers inside Qatar;
- If relevant, the quality level of involvement of research end-users, their capacity to utilize the research outcomes and their ability to benefit from them;
- If applicable, the quality, quantity and relevance of any co-funding commitments.

12.1.2.3 The potential impact on Qatar, the broader commercial market and TRL level (if applicable)

- The relevance of the project to Qatar’s development with respect to industrial development and socio-economic, health and environmental aspects and the ability to address end-user needs, as well as the potential to create positive international scientific visibility for Qatar;
- The extent to which the project provides a solution addressing research needs of end-users in Qatar.

12.1.2.4 The past performance of the LPI and participating PIs

- Prominence in the respective field of research, scientific background and track record (quality of publications/patents, technical expertise), proven ability as an independent researcher to carry out the research projects, research team leadership and project management experience;
- The quality of the outcomes and impact of prior QNRF funded research performed by the LPI and participating PIs.

12.1.2.5 Previous QNRF funding in this area of research

- Does the project duplicate/overlap with previous and existing grants in the QNRF portfolio?

12.1.2.6 The composition of the local research team

- Participation of local industry, academic and/or governmental entities. Local capacity building (training of graduate students in the project/involvement of RAs, Post-Docs, and junior researchers in the project), the level of commitment by local institutional participants (resources, effort).

12.1.2.7 Budget

- Appropriateness of the budget as related to the objectives of the project;
- If relevant, end-users’ contribution to the budget (co-funding).

At the end of the review and ranking processes, proposals are categorized in terms of their competitiveness. The final funding decision will group proposals as shown in the table below:
Table 4 - Final Review Ranking

<table>
<thead>
<tr>
<th>Group</th>
<th>Evaluation Outcome</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortlisted – Programmatic Review</td>
<td>A</td>
<td>Highly Competitive: The proposal was evaluated to be an excellent project during the review process (with minor to negligible weaknesses) and is, therefore, considered “highly competitive” for funding. (Funding decisions are based on the available budget).</td>
</tr>
<tr>
<td>B</td>
<td>Competitive</td>
<td>The proposal was evaluated to be a very good project during the review process (with moderate to minor weaknesses) and is, therefore, considered “competitive” for funding. (Funding decisions are based on the available budget).</td>
</tr>
<tr>
<td>C</td>
<td>Not competitive</td>
<td>The proposal was considered “not competitive” for funding, due to moderate to significant weaknesses identified by the review process.</td>
</tr>
<tr>
<td>Not shortlisted</td>
<td>D</td>
<td>Not shortlisted: The proposal was not shortlisted and is considered “not competitive” for funding due to significant weaknesses or shortcomings identified by the review process.</td>
</tr>
</tbody>
</table>

Section 13. Pre-funding

13.1. Awarded proposals will go through a pre-funding stage, which starts after the award announcement, and continues for approximately eight weeks. During pre-funding, the submitting institution will be notified about the requirements (possible budget reduction, budget details, timeline changes, etc.).

13.2. During the pre-funding phase, the LPI should submit the data management plan as per the Data Management Policy available at link.

See more information on the pre-funding in the “Institutions Responsibilities and Post Award” document available at link.

Section 14. Post-Award

14.1. For rules and regulations related to fund management, payment schedule and reporting, please refer to the Award Management Guide (AMG) document available at link.

Section 15. Research Ethics & Regulatory Requirements

The proposed research must meet all the requirements outlined by Ministry of Public Health’ policies for the protection of human subjects from research risks, and data and safety monitoring (when applicable). Please refer to the Research Ethics and Regulatory Requirements document available at link.

Section 16. Research Integrity

For further information regarding research integrity and other related policies, please see the REG at link.

Section 17. Intellectual Property Policy

QNRF will follow the Qatar Foundation (QF) IP Policy. Please consult the QNRF website for details on the applicable intellectual property policy http://www.qnrf.org/en-us/Funding/IP-Policy.
Section 18. Data Management Plan Policy
This policy supports the development of a robust environment for the sustainable management, use and reuse of QNRF funded research data in collaboration with Qatar National Library (QNL). QNRF recognizes the importance of data management to protect its investment in research and development by ensuring that research data are findable, accessible, interoperable, reusable (FAIR) which will:

1) expedite the scientific process;
2) reduce duplication of effort;
3) support reproducibility and research integrity;
4) optimize availability and reuse of research outputs; and
5) facilitate the preservation of the scholarly record of Qatar.

LPIs of the awarded projects should submit the data management plan during the pre-funding phase according to the templates that will be available on QNRF website. The Data Management Plan Policy is available at link.

Section 19. Inquiries
For any inquiry regarding this RFP and the electronic proposal submission process that is not already answered in the Q&A section of the QNRF-NPRP webpage at link, please use the QNRF Support link on the website (http://support.qnrf.org/index.php/?/Tickets/Submit). Applicants can choose the appropriate department and specify the topic of their query for further information. QNRF’s response may be made publicly available in the Q&A section of the QNRF website.

Section 20. Research Support Resources
This section describes a number of available research support resources whether within QNRF or inside Qatar. For more details, please refer to the “Research Support Resources” at “link”.

These resources include but not limited to:
- Qatar Biobank (QBB) Data and Samples
- Asset management (for available equipment)
- QNRF Researcher Network (QRN)
- QNRF Awarded projects
Appendix A - Priority Themes per Pillar

The Priority Themes were identified through a consultation between QNRF and the main stakeholders in Qatar (ministries, businesses, and academic institutions). They are aligned with the QNRS 2013 and 2014 Grand Challenges and take into account Qatar’s local R&D capacities. The objectives of the Priority Themes are to focus and optimize QNRF’s effort according to the following main strategic principles:

- Diversification and development of Qatar’s industries and services towards a sustainable, diversified economy.
- Support the development and enforcement of public policies, governance and public services in Qatar.

Through this NPRP-S call, QNRF intends to stimulate partnerships among academia, research end-users, and any entity which research and development activity is not part of its main mission and can benefit from the research outcomes of the R&D project.

Where possible, proposals should utilize existing insights and methods (including but not limited to previous NPRP projects in that area).

QNRF will place increasing emphasis on research projects that are truly cross-cutting. A number of priority themes listed in this section are designed to emphasize collaborations across scientific fields and disciplines. Researchers with specializations in all four pillars are particularly encouraged to consider if their research projects and topics would be a good fit for those subjects.

1. Energy and Environment Pillar

Energy and Environment research focuses on the generation and efficient utilization of energy and natural resources, and assesses the interaction between the environment and energy technologies to encourage sustainability.

The growing need of energy and natural resources in Qatar calls for multi-directional efforts, where R&D plays a major role, to address these challenges and ensure environmental sustainability.

In this NPRP-S call, the selection of the priority themes for the Energy and Environment Pillar is based on themes:
- That are important to Qatar in the field of energy and environment;
- That lend themselves to be “researched”;
- Where capacity inside Qatar has been established or needs to be so;
- With high potential to generate innovation, facilitate technology transfer and enhance competitiveness and diversification of Qatar’s economy;
- That contribute to Qatar’s sustainable development.

Priority Themes
Energy

1.1 Advanced Materials
Qatar has the infrastructure, financial capacity and abundant energy to advance and diversify its manufacturing output, primarily from its main industry sectors (oil and gas, metal manufacturers and the petrochemical industry). Although Qatar has established exports, it needs to pay more attention to foster innovation and move forward in the value chain to compete more effectively in international markets. An inventive combination of materials, process industries, business models and links to public-private partnerships in delivering products to markets and customers is the key and is the purpose of this priority theme.

Novel catalyst developments, additive manufacturing, and high value polymer products from the oil and gas industry are an integral part of the QNRS. Whereas, advanced materials is a cross-cutting platform across various impact areas in energy and environment ranging from catalysts for oil and gas to smart membranes for water treatment. Computational materials design is also a vital link in the innovation chain in which the usual route of selecting existing materials for applications, including prototype design and testing, is replaced or enhanced by concurrent design of material and applications.

Research on the following topics is encouraged, targeting IP generation and involving industrial partners:

1.1.1 High Added Value Products
- Develop concepts in hybrid material design for catalysis including scalable synthetic step;
- Explore novel high-performance materials, e.g. self-healing materials; polymers for many applications taking into consideration an innovative and lean process production route; biologically inspired solutions for energy industry and environment applications.

1.1.2 Process Industries
- Energy efficiencies for productivity, cost competitiveness and sustainability (e.g. reduction of industrial pollutants - solid wastes and effluents). Lowering of Qatar’s emissions of greenhouse gases;
- Industrial waste recycling to produce by-products or innovative waste management solutions;
- Novel technologies solving corrosion related technical failures: monitoring systems, control and prevention (coatings), corrosion mechanisms including computational modeling.

1.2 Cooling
Energy efficiency is a key driver to reduce costs and CO2 emissions. Cooling has the lion’s share of the energy demand in the Gulf countries, including Qatar, where, for example, around two thirds of all electricity production is consumed by domestic air conditioners. Therefore, it is important to support R&D capacities and innovation specific to the local market in these key issues for sustainability.

1.2.1 Develop Disruptive Technologies for Cooling
Enhancement of cooling efficiency through disruptive technologies e.g. novel cycles and material; augmented heat and mass transfer processes; efficient design of equipment and buildings etc.

1.2.2 Develop Solutions to Enhance Existing Cooling Technologies
Formulating solutions in areas where Qatar has a distinct advantage, or pressing need, are encouraged, such as outdoors and body cooling, solar driven cooling and district cooling.

1.3 Energy Efficiency
1.3.1 Energy Efficiency Control & Management
This includes areas such as energy management systems, smart and remote measurement and control, innovative sensors, novel materials and active and passive system design, etc.

1.3.2 Process Optimization & Industrial Heat Recovery
Optimizing industrial processes, in terms of energy usage, energy recovery and reusing waste heat is a priority. Applications on monitoring, control, management and modeling of energy processes in industry are encouraged.
1.3.3 Socio-Economic Studies
Factors driving individual or collective energy choices and energy-related behavior are valid subjects of inquiry (such as values and ethics, consumption strategies and behaviors, social or cultural and gender roles). This may include socio-economic studies focusing on incentive structures that encourage or discourage energy-responsible behaviors and business models as well as models of how best to communicate incentives.

1.4 Oil & Gas
Being the main industrial sector and chief contributor to Qatar’s economy, developing knowledge and applying technology to Qatar’s oil and gas sector for safe and sustainable exploitation, production and transformation is of prime importance. Research topics focus here on particular technical challenges (see below) that Qatar faces in exploration, production and transformation of oil and gas. Addressing this theme will preferably involve industry and academia for a multidisciplinary approach.

1.4.1 Application of specific primary, secondary, and enhanced oil and gas recovery techniques in optimizing production of Qatar’s reservoirs for the “Difficult Oil” and “Difficult Gas”;
1.4.2 Characterization, modeling and management of Qatar’s oil and gas reservoirs, specially to carbonate systems which can be integrated within a formation evaluation scheme;
1.4.3 Development and application of well-drilling and completion technologies, specially but not limited to high-pressure and high-temperature conditions, that consider well control, well integrity, safety, environment and economics aspects;
1.4.4 Prevention and remediation of formation damage issues such as precipitates, condensate banking, produced water and well injectivity;
1.4.5 Technologies related to the processing of oil and gas, natural gas in particular, to include but not limited to, gas-to-liquid, compression, fractionation, separation, and transportation.

1.5 Water

1.5.1 Desalination
The biggest challenge of desalination is still the reduction of desalination energy consumption and this leads to the need for further research of high performance hybrid systems; reverse osmosis and forward osmosis; desalination powered by renewables; new membrane materials; and emerging desalination technologies such as Adsorption-Desalination and bio-electrochemical treatment (MFC and MDC). Therefore, research into brine management to achieve zero liquid discharge, including brine, is a priority for Qatar (environmental impact assessment, etc.).

1.5.2 Water Management
Due to the extreme water scarcity in Qatar, the country relies on desalinated water for 99% of its municipal demand, which grows annually by approximately 10%. Therefore, there is an obvious need to have smart water technologies and management plans to meet the demand for sustainable development. R&D topics were defined around water production, supply and management in which Qatar may have the potential to lead innovations where collaboration of industry, academia and government is much needed: Rethink the entire water cycle: Develop comprehensive management tools that help Qatar to achieve its objective of reducing water consumption by 35% in the near future. Mitigate the environmental impact of the desalination process, in particular on the marine environment. Multidisciplinary projects are expected (social-economic sciences, ICT and environmental sciences).

1.5.3 Water Production
Produced waters: Being an oil and gas producer, Qatar’s produced water is considered a potentially valuable source of water that could improve its long-term water security. It is important to accelerate R&D efforts on the main challenges of recycling and reusing the produced water in a cost-efficient manner. This requires further research into establishing standard handling and treatment procedures of produced water; and developing low cost treatment technologies as well as reducing its total produced water.
1.5.4 Water Re-use
Non-conventional water sources: Optimization of water use in industry through cleaner production or making use of industrial/urban/ecological symbiosis and applying innovative technologies to reduce, treat appropriately and reuse water from unconventional sources.

1.5.5 Water Storage
Developing innovative solutions and techniques for water storage (e.g. underground storage and building reservoirs) as well as related monitoring systems are a high priority.

1.6 Built Environment
Research effort into the topic of the Built Environment is encouraged to support interdisciplinary approaches that address the design, planning, construction, management, and use of man-made surroundings as an interrelated arena which directly impact human activities over time. This field is very rich as it draws upon areas such as economics, law, public policy, public health, management, geography, design, engineering, technology, and environmental sustainability.

Topics of particular interest in this call are:

1.6.1 Sustainability and Resilience in Construction Engineering
The research should support sustainable and resilient construction, which may include: optimized design, material choice, recycling of construction materials, self-healing material, sustainable steel buildings etc.

1.6.2 Urban Planning and Architecture
Qatar has and is still experiencing huge urban development and expansion of the economic capacity, activities and infrastructure. This development has been further accentuated by population growth and subsequent growing needs. Consequently, the impact of this development needs to be investigated to address these challenges and propose engineering and policy solutions.

Research effort into the topic of Built Environment is encouraged to support interdisciplinary approaches that address the design, planning, construction, management, and use of man-made surroundings as an interrelated arena which directly impact human activities over time. This field is very rich as it draws upon areas such as economics, law, public policy, public health, management, geography, design, engineering, technology, and environmental sustainability.

1.7 Natural Environment
The R&D priorities in this theme have been defined according to two main drivers: (i) how can R&D better support the design and the implementation of Qatar’s environment policies? (ii) focus the R&D efforts on areas of major environmental vulnerability due to impact of climate change. Efforts are encouraged to focus on research that:

1.7.1 Air Quality
- Develop technologies to improve air quality.
- Develop technologies to monitor, characterize and assess health risks related to urban air quality.

1.7.2 Marine & Terrestrial Biodiversity
- Preserve and restore Qatar’s marine & terrestrial biodiversity. Support research into characterization and protection of marine and terrestrial biodiversity in Qatar through developing models, monitoring and restoration methodologies.
2. Biomedical and Health Pillar

QNRF Biomedical and Health Care priorities are aligned with the National Health Strategy 2018-2022. The restructuring is done to serve and support the National Health Strategy 2018-2022 via supporting biomedical research studies that focus on and impact the people of Qatar. It also minimizes overlap between themes and topics in different calls and gives a better opportunity to underfunded research areas, while meeting the broader needs of the research capacity in Qatar, from basic scientist to clinicians. Moreover, the priorities are structured to effectively utilize the full potential of existing expertise, skill sets and infrastructure within Qatar as this will encourage innovation and discovery in research of high importance to Qatar.

The Biomedical & health themes include basic, applied, translational research this includes investigations of Epidemiology, Genetics, Molecular biology, Multi-omics, Bioinformatics tools and research design. It’s important to note that any personalized type of biomedical researches should be submitted to the call “Path towards Precision Medicine” (PPM3).

LPIs are required to check the availability of the data and samples within Qatar Biobank (QBB), to avoid any duplication in research, the list of research data available can be obtained from the link QBB’s Research Data Available at their website at [http://www.qatarbiobank.org.qa](http://www.qatarbiobank.org.qa). In order to access these samples/data, LPIs are required to submit to QBB Research Collaboration and Data Access/Sample Request Form.

Priority Themes

2.1 Communicable Diseases (Viral & Bacterial)

In today’s age of advanced communications and transportation, the world has become smaller than ever. The unlimited reach of communicable diseases are a serious threat for the whole world with the highly infectious viruses and multi-drug resistance microbes being the most threatening and dangerous.

In November 2017, experts from all over the world assembled in the Fourth International Congress on Pathogens at the Human-Animal Interface in Doha, Qatar, held for the first time in the region, to discuss the contemporary threats and dangers of communicable diseases. The discussions focused on a wide range of complex issues including antimicrobial resistance, current technological advances in diagnosis, vaccine development, biosecurity, biodefense, disaster response and the limitations and gaps in knowledge on pathogens at the animal-human interface.
The first Communicable Disease Center (CDC) in the region started operations at the Hamad bin Khalifa Medical City in late 2016. The CDC focuses on treatment, diagnosis and prevention of respiratory diseases including TB and other infectious diseases such as leprosy, MERS, influenza, measles, hepatitis and HIV among other emerging and re-emerging infections. It is imperative to have research activities that support and improve the National Health Strategy 2018-2022 in fighting infectious diseases.

The focus of this theme will be on viral and bacterial infectious diseases from the following perspectives:

2.1.1 Early detection, diagnosis, prevention and control,
2.1.2 Epidemiology,
2.1.3 Treatment.

2.2 Non-Communicable Diseases (NCDs)
The prevalence of multiple chronic conditions is increasing worldwide. This is due partly to the increasing age of population, and to the high prevalence of unhealthy lifestyle choices such as smoking, physical inactivity and poor dietary habits which cause non-communicable diseases. Chronic diseases such as heart disease, cancer and diabetes share same risk factors and lifestyle habits that increase a person’s chances of developing more than one of these conditions. A Center for Disease Control (CDC) study shows that as a person’s number of chronic conditions increases, his or her risk of dying prematurely and being hospitalized also increases. Such patients also have a higher tendency of suffering from medication errors and interactions due to multiple medications, being exposed to duplicate tests, and receiving conflicting advice. This population acquires substantial healthcare costs upon the healthcare system. For example, 71% of the total healthcare spending in the US is on providing care for people with more than one chronic condition.

Qatar as well, faces several population health and health system challenges. Identifying these challenges allows us to concentrate our research and health care efforts and resources in the areas of greatest need. According to Qatar National Health Strategy 2018-2022, the prevalence and incidence rates of specific chronic diseases including cardiovascular diseases, diabetes, and cancer are the three top causes of mortality. Diabetes in particular implies several complications and concurrent diseases. In addition, as a result of data collected by Hamad Medical Corporation between 1st April 2016 and 31st March 2017, it was found that 69% of mortalities occur from chronic conditions, particularly cardiovascular diseases (24%), cancer (18%) and diabetes (7%). According to the Institute of Health Metrics and Evaluations in Qatar, the top four causes of death in 2017 are ischemic heart disease, road injuries, diabetes and strokes.

Many of the risk factors common in non-communicable diseases such as high blood pressure, diabetes and excess body fat are also high-risk factors for chronic kidney disease. Qatar’s annual renal data analysis shows that by December 2016, the prevalence of renal replacement therapy reached 659 per million population due to end-stage-renal-disease. According to MoPH, the incidence of end stage renal disease (ESRD) is 202 patients/million/year; the prevalence of ESRD is 624 patients/million and Diabetic nephropathy is the commonest cause of ESRD (48%), followed by primary glomerulonephritis and hypertensive glomerulonephropathy.

The health and wellbeing of women and their children are also considered as top priorities to ensure successful healthy human development. This is in the first pillar of Qatar National Vision 2030 which aims for a healthy and prosperous population, both physically and mentally. Hence, QNRF will fund studies that tackle reducing infant mortality and improv maternal and reproductive health.

According to the WHO 2017 report, the prevalence of mental health disorders has reached about 14.2% of total years lived with disability. On the other hand, a recent study in Qatar has shown that around 25% of individuals, who seek public health consultation, had a minimum of one type of mental health issue.

The focus of this theme includes:

2.2.1 Cancer (Breast, Colon, Prostate, Leukemia, Lung, & Thyroid)
- Prediction, diagnosis and prevention
2.2.2 Cardiovascular
- Prevention, diagnosis and early detection
- Epidemiology
- Treatment

2.2.3 Diabetes
- Prevention, diagnosis and early detection
- Epidemiology
- Treatment

2.2.4 Mental & Neurological
- Autism
- Neurodegenerative diseases
- Depression, anxiety & bipolar disorder
- Eating disorders & substance abuse

2.2.5 Renal
- Prevention, diagnosis and early detection
- Epidemiology
- Treatment

2.2.6 Reproductive, Maternal & Child health
- Infertility
- Children health, such as ADHD
- Maternal health, such as high-risk pregnancy

3. Computer Science and ICT

Information and Communication Technology (ICT) research, development and innovation (RDI) builds on Qatar’s existing strengths and capacity in ICT to address areas and gaps that require attention in order to address Qatar’s Grand Challenges. This will create world-class ICT competencies and achieve a strong innovation system that will increase ICT patenting, commercialization and entrepreneurship and creation of a strong Qatari ICT brand. This requires the participation of RDI, stakeholders and appropriate research end-users to improve quality of life and enhance economic competitiveness. Computer Science and ICT focuses on the following priority themes:

- Artificial Intelligence
- Cybersecurity
- Healthtech
- High Performance Cloud Computing
- Next Generation Networks
- Smart Cities
- Smart Grids

The priorities related to ICT for Water Monitoring and Management are specified in the Energy & Environment Pillar section.
We are looking to address Technology Readiness Levels (TRL) 3, 4 and 5 (see definitions at link). Below is a description of the ICT priorities.

**Priority Themes**

**Computer Sciences & ICT**

**3.1 Artificial Intelligence**

Artificial Intelligence (AI) was built up along computer power development trend and problem-solving challenges. Many applications today leverage on AI to support new disruptive development trends such as autonomous vehicles, robot assistants including many others. One key domain of AI is machine learning and the major areas of machine learning include a variety of applications such as natural language processing, vision, computational biology, the Web, and social networks. The key area of focus is the use of integrated smart digital systems that overcome the challenges and provide fast and efficient solutions.

As many AI applications are interdisciplinary in nature that make use of heterogeneous data, further investigation of multi-modality machine learning is needed to enable knowledge discovery from a wide variety of different types of data (e.g., discrete, continuous, text, spatial, temporal, spatio-temporal, graphs). The optimal amount of data needed for training to properly address large-scale versus long-tail data needs more work as well as to determine how to identify and process rare events beyond purely statistical approaches.

There is also a need to work with knowledge sources (i.e., any type of information that explains the world, such as knowledge of the law of gravity or of social norms) as well as multidisciplinary data sources and integrate models and ontologies in the learning process.

In addition, obtaining effective learning performance with little data, when big data sources may not be available, is required in a multitude of areas including oil and gas, energy, environment, finance, social media, healthcare, transport & logistics, sports, education and tourism; creating "generic AI" that functions well across a variety of cognitive domains. The topics under AI include:

**3.1.1 Applications of AI**
- Application in oil & gas, energy, finance, healthcare, social media, economics, education, society, law, ethics and other related sectors

**3.1.2 Human-Centered AI**
- AI technology that better augments, communicates, collaborates and interacts with people

**3.1.3 Next Generation AI**
- Next generation AI inspired by neuroscience, cognitive science and behavioral science

**3.2 Cybersecurity**

Qatar is one of the most cyber-connected countries in the world. In this age of the 'Internet of Everything,' boundaries between citizens, governments, media, and societal organizations are becoming increasingly

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fuzzy as interconnected digital devices are enabling the collection and exchange of huge amounts of information across the globe.

In the context of developing smart cities, the spread of use of sensors and the internet of things add to the cybersecurity risks. The availability of data gathered by these devices, coupled with advances in digital communications, have created a host of new opportunities for gaining a deeper understanding of human behavior across a range of activities including agriculture, energy, transportation, healthcare, policing and education – creating the potential for a ‘smart planet.’ However, these advances also open the door to new threats from a range of sources ranging from attackers with malicious intent to opportunists exploiting vulnerabilities in systems to cause deliberate or accidental harm.

The cyber threat landscape has evolved from individual hackers to highly organized groups and advanced cybercriminal syndicates. Cyber-attacks are more targeted and sophisticated than ever before. Ranges of powerful new malware can steal confidential data and disable network infrastructure. Attacks on critical infrastructure, including industrial control systems (ICS), can disable physical machinery, cause catastrophic equipment failure and even result in loss of life. Consequences of cyber-attacks can affect financial institutions, customers, data (customer and corporate), patents, business continuity and can cause reputation losses resulting in huge costs of recovery and activation of penalty clauses.

While the industrial and research communities in many disciplines have sought to explain and mitigate security concerns, the disciplinary focus of such communities has inevitably led to partial rather than holistic views on the problem and solutions.

Moreover, while there have been targeted projects and initiatives focusing on multidisciplinary security concerns, including discussion forums and workshops, there has been limited substantive, dedicated, and sustained research presence with the prime focus of investigating the interplay between security interdisciplinary aspects and the intricacies of human behavior, legal frameworks and business issues.

To address Qatar’s critical cybersecurity challenges, the cybersecurity theme aims to study, research and provide solutions through collaborative research and development projects that will:

- Provide safer environments for citizens and residents
- Protect Qatar’s infrastructure, business and data
- Enhance public awareness
- Assist local organizations

More specifically, the topics of focus are:

3.2.1 **Blockchain & its Applications**
- Blockchain to enhance data privacy
- Blockchain, secured Distributed Ledger Technology (DLT) and smart contract–based technologies to increase trust, authenticity, traceability, transparency and compliance between actors and users in different sectors such as energy, healthcare, food management and land/property registry.

3.2.2 **Critical Infrastructure Security and resilience**
- Foundational understanding of critical infrastructure systems and systems dynamics including industrial control systems, energy, health and transportation
- Harnessing the power of data sciences to create unified, integrated situational awareness and to understand consequences of action
- Integrated and proactive capabilities, technologies, and methods to support secure and resilient infrastructure
- Integrated and scalable risk assessment and management approaches

3.2.3 **Threat Intelligence and Proactive Security**
- Adaptive security to real-time cyber threat
- Big data analytics, AI & deep learning in cybersecurity
• Defense against threats, including incident response planning, system performance insights and potential approaches to anticipate and counter measure threats
• Human behavior in cybersecurity
• Identification & authentication – Biometric credentials and new form of strong authentication mechanisms
• Internet of things security
• Predictive cyber threats analytics to prevent cybersecurity issues with informed based AI engines
• Self-learning cybersecurity technologies and the establishment of feedback in cyber systems to learn from cyber-attacks

3.3 Healthtech
The ICT domain will support the development of a better-informed decision practice across the healthcare pathway overall. Thanks to the integration of patient data and real-time processing, it becomes possible to initiate preventive care actions from distance. Virtual healthcare can connect clinicians and patients to provide virtual access to health services, support self-management and coordinate care. The combination of smart devices, predictive analytics and behavioral science for better digital preventive care will help fight chronic diseases. Wireless sensor networks used for pervasive health monitoring provide continuous monitoring and analysis of physiological parameters. Wireless body sensors incorporate context-aware sensing for increased sensitivity and specificity. These sensors promise to revolutionize healthcare by allowing inexpensive, non-invasive, continuous, ambulatory health monitoring with almost real-time updates of medical records via the internet. Though, several ongoing research efforts are focusing on various technical, economic, and social issues; many technical challenges still need to be resolved in order to have flexible, reliable, secure and power-efficient wireless body sensor networks suitable for medical applications to monitor changes in vital signs, maintain an optimal health status and alert medical personnel when life-threatening changes occur.

The topics of focus to be considered in ICT for Healthtech include:

3.3.1 Digital Preventive Care
• Non-invasive technologies, bio sensors and smart health appliances
• Wireless body sensors and systems for remote health diagnosis and monitoring

3.3.2 Virtual Care Delivery
• Digital pre-screening for virtual diagnostics
• Smart adaptive treatment with ingestible sensors

3.4 High Performance Cloud Computing
High performance computing and cloud computing are usually deployed to address distinct aims and objectives for the academia, industry and community. The aim of this theme is to merge the two infrastructures into one enhanced HPC-Cloud infrastructure for Qatar including hardware, advanced algorithms and software systems that will enable quick discoveries, increase productivity, facilitate collaboration and ensure security, high availability and resilience. The HPC-Cloud infrastructure will be particularly beneficial in modeling the behavior of complex, iterative, multivariate physical systems—such as weather patterns, the dynamics of living cells and complex organs or the movement of air and airplanes. The infrastructure will foster oil and gas exploration, drug discovery, weather prediction and climate modeling, complex financial modeling, consumer product design and optimization, 3-D animation, automotive and aerospace product development, sports and advanced business analytics among a litany of additional applications. Moreover, it will play an essential national security role in communications, cryptography, signals processing and weapons design and testing. The HPC-Cloud topics to be addresses include services to the users; in particular:

3.4.1 Infrastructure as a Service (IaaS)
• Centralized, adaptable and high-performance IT resources such as computing power, data storage or networks are offered as a service

3.4.2 Platform as a Service (PaaS)
- Standardized interfaces to multi-client capability, scalability, access control, database accesses etc. provided as a service. The user will have no access to the underlying layers (operating system, hardware), but is able to run its own applications on the platform. Application development will require specialized software development kits (SDKs) on the platform.

3.4.3 **Software as a Service (SaaS)**
- Including a wide range of services to a variety of fields applications ranging from life sciences, bioinformatics, next generation sequencing (NGS), big data analytics, energy, engineering, material science and nanoscience to earth science and weather

### 3.5 Next Generation Networks (NGNs)

This priority theme targets the optimization of IT and communication resources used in the country to provide reliable network infrastructure and services while deploying the 5G telecommunication standard. Following the 4G telecommunication standard official release, NGNs changed focus to the 5G network softwarization (Software-Defined Networks (SDN) and Wireless Network Functions Virtualization (NVFs)) that entails technical challenges and consequences (from cloudification of certain network services to pushing certain others to the edge). In addition, the new concept of Internet-of-Things/IoT redirected NGNs research to include IP- or packet-based large-scale networks and next generation wireless sensors challenges (form MAC layer redesign to big data –enabled network design and organization). Relevant topics to the local context with high innovation and implementation perspectives include:

#### 3.5.1 Self-Organizing Networks
Typically, such self-organizing systems are very flexible, adaptive, failure-robust, and scalable. A Self-Organizing Networks (SON) is meant to manage telecommunication networks in an automated way. Automation of some network planning, configuration and optimization processes via the use of SON techniques become inevitable to reduce the cost of installation and management of 4G and future 5G networks, by simplifying operational tasks through the capability to configure, optimize and heal itself (the three main functionalities of SON). New research directions on how to enable SON with big data are considered to guarantee novel, conflict-free and reliable SON functionalities. In addition, to satisfy 5G network management requirements; this autonomous management must be extended to the end-to-end network (a need to integrate intelligence for better network visibility). Machine learning has been identified as the key tool to implement autonomous adaptability and take advantage of experience when making decisions. Associated sub-topics include:
- Big Data enabled Self-Organized Networking
- Network slicing and softwarization (virtual network management & orchestration)
- Mobile-Edge (Fog) computing and networking
- Machine-to-machine communication
- MAC for cloud-RAN

#### 3.5.2 Spectrum Management and Resource Optimization
This includes novel research activities towards context-aware dynamic spectrum management for 5G, and innovative ways to use the spectrum more efficiently and support communication activities in Large Scale Networking. In fact, the new 5G-precise features (i.e. heterogeneity, massive deployment and coexistence) need novel dynamic spectrum management instruments. The integration between interoperability and interference control techniques is a key element for spectrum efficiency and 5G service requirements. Two main research sub-fields need to be tackled under this theme. Firstly, from the cellular network perspective, multiple heterogeneous and overlapping network tiers (so-called HetNets) which include Macro Base Stations and Power-limited Small Base Stations (i.e. femto, pico and macro BSs) will be sharing the same wireless resources. Under such tiers’ coexistence, spectrum efficiency challenges are foreseen and innovative interoperability techniques between tiers are required (e.g. offloading and handover) as well as interference management between different- versus similar-priority tiers. Secondly, 5G architecture anticipates the use of multiple radio access technologies (RATs) and users will be able to change dynamically between RATs within the same connection. The RAT diversity will lead to multi-RAT HetNets...
(the core of the 5G network) and thus, to new research niches. In addition to 3G, 4G and WiFi, the new 5G-enabled devices will support 5G standards and device-to-device (D2D) operation mode, which is not coordinated with the cellular network and will operate across licensed versus unlicensed frequency bands. The subtopics include spectrum management and resources optimization in:

- Multiple heterogeneous and overlapping network tiers
- Use of multiple radio access technologies

### 3.6 Smart Cities

In line with the Qatar National Vision 2030 of staying at the forefront of innovation for enhancing quality of life and achieving sustainable development, Qatar has embarked on a journey to develop smart cities (cities of the future) such as the new Lusail city and Musheireb downtown. Both projects establish two open living-lab platform where various technologies could be integrated and considered as premiere in the region and globally. From a RDI angle, this priority theme targets building an ideal platform for scientists, innovators, smart technology providers, entrepreneurs, local stakeholders, and other sector specialists to collaboratively design and showcase cutting-edge technologies while deploying smart applications in infrastructure, buildings, energy, mobility and utilities novelties. More essentially, such platforms will explore the requirements for Qatar’s digitized cities in terms of smart building, smart energy, and smart transportation. Moreover, this priority theme addresses the challenges and opportunities for digital technology to provide new forms of civic participation of people in sustainable living approaches, and to deliver services and activities offered by government, business and third parties.

In addition, in connection with local setting, it will help to understand centralization versus localized decision-making in certain domains (healthcare, education, economy, mobility), and on the other hand, it will encourage audience participation in sporting, cultural and media events of all kinds (e.g. broadcast and live performance). This theme will explore new methodologies, including both qualitative and participatory ICT methods to engage with users and includes the below topics:

#### 3.6.1 Intelligent Transportation Systems (ITS)

ITS can provide efficient means not only to enforce the traffic rules and support the traffic authorities on ground, but also provide the road users with efficient real-time information on traffic and route optimization (also known as “intelligent traffic management”). Potential smart transportation applications are broad and cover almost all civilian fields and areas of daily life. ITS is defined by the Ministry of Transport and Communications (MoTC) as an emerging area where Qatar must play a major role by being active and enabling a local knowhow. There is a considerable space for R&D community to excel in this area and propose adapted solutions for the local markets and it needs to contribute in designing first gears needed locally to enable smart transportation technologies. The sub-topics of focus in ITS include:

- Information Management services
- Intelligent Smart Parking Solutions
- ITS and Advanced Traffic Management Services (e.g. traffic congestion avoidance, commercial vehicle operation services, mega-events’ traffic coordination)
- Multi-layer Inter-domain traveler information services
- Unmanned Inter-domain traveler information services

#### 3.6.2 Internet of Things and Connected Communities

The boom in local widespread use of smartphones, tablets and wirelessly connected devices has made Qatar one of the most cyber-connected countries in the world. Qatar’s ICT key indicators show that in 2016, the internet penetration for mainstream individuals reached 92%. Such digital technologies adoption rates have an enormous potential to leverage citizen engagement in planning, design and collaborative decision-making on the national, regional and local levels. Moreover, the convergence of ICT, cybersecurity, analytics technologies and infrastructures, provides elementary components toward the “smart cities” depiction. If augmented by the IoT technology, further process optimization and automation will occur, thereby making the traditional infrastructure “smarter” and a digitally-enabled platform in which the city and its citizens are simultaneously users and enablers of the system incorporating shared
objectives of economic competitiveness, sustainability and quality of life. The sub-topics of interest on applying IoT include:

- City-level participatory and crowd-based ICT platforms
- Large-scale networks and sensing/actuator platforms
- Smart environment sensing and monitoring
- Streets and public areas lighting control and smart buildings energy management

### 3.7 Smart Grids

The importance of the national electric grid cannot be overstated as it constitutes a key driver for the economic growth, and a critical component of the country’s energy security. Upgrading the electrical power grid becomes a necessity due to:

- the change of electricity generation mix (renewable-energy target stated in QNV 2030);
- threats to grid resilience and reliability, especially those arising within a harsh environment;
- the uprising intervention of ICT and remote-control technologies; and
- the need for better management of the demand side to regulate the electricity load profile and ensure consumer-side involvement.

The three topics below have been identified to better clarify the scope and the breadth of this priority.

#### 3.7.1 Electric Transportation Infrastructure in Harsh Environment

In spite of obvious promises of electric vehicle deployment, there are substantial technical, social and economic barriers to widespread adoption of electric vehicles including vehicle cost, small driving range, long charging times and the need for a charging infrastructure. Sub-topics of interest include but are not limited to:

- Developing reliable and fast charging infrastructure customized for the country environment
- Quantifying the values, cost, complexity, and risks of smart grid systems
- Real-world deployment and grid integration of large collections of vehicles
- Sensing, modeling, communications, control, and optimization of vehicle and grid systems

#### 3.7.2 Modeling and Real-Time Simulation of Power Grids

The view of power systems has become broader, including multiple (physical) domains and detailed ICT-based control schemes. Different computer simulation programs were developed to satisfy the individual modeling needs of different studies in power systems and smart grid. Hence, the objective here is to address the key interfacing techniques for the combination of different simulators in smart grid studies. Sub-topics of interest include but are not limited to:

- Coupled simulation of infrastructures, e.g., gas network - electric grid
- Interfacing issues in real-time digital simulators, hardware-in-the-loop simulation, and multi-physics simulation
- Interlinking power system, ICT-based enabling tools, and electromagnetic field simulation environments
- Optimized co-simulation of transmission-distribution-communication models

#### 3.7.3 Modernization and Further Automation of Distribution Power Grids

The ongoing evolution of power distribution systems brings new challenges to grid operation, monitoring and control activities. Unlike transmission networks, automating distribution systems seem neither practical nor realistic both technically and economically. Moreover, stimulating demand response with practical strategies and techniques to support grid reliability and efficiency needs untraditional and customized tools. For these reasons, there is an emerging field of research that specifically targets automation and management of the future power distribution grid in an attempt to exploit the peculiarities of this infrastructure by proposing new and effective solutions. The aims of the smart grids and energy efficiency are:

- to encourage innovative, feasible tools and technologies in modern distribution grid automation, and
to enable the institutional conditions that allow for more rapid development and widespread adoption of these tools and technologies.

To address this point, the following subtopics are listed:

- Advanced metering infrastructure for active distribution systems
- Real time power quality monitoring for distribution systems
- Real time state estimation architectures
- Regulatory frames and policy recommendations for distribution system prosumers
- Substation technology tailored for distribution, and real time aggregation
- Ultra-short forecasting tools for producers/consumers (prosumers)
- Unified voltage control and congestion management in distribution grids

4. Social Sciences, Arts and Humanities

During the past decades, Qatar has transformed from a low-income to a high-income country. This transition led to major changes in terms of demography (currently the foreign labor force is seven times the Qatari population), lifestyle, morbidity and mortality patterns. It also brought about decreasing air quality due to the oil and gas industry, heavy construction and traffic. Other changes include significant investments and progress in education and research and development, pressure on traditional norms and values, and last but not least a growing international reputation in sports, media and foreign policy.

Currently, the country is on the brink of another transformational change. The relations between nations within the region have changed dramatically. The drop in oil prices and expectations that it will not rise to the high levels of the recent past coupled with the increasing interest in renewables demonstrate that there is an urgent need to diversify the economy. Low-cost labor will have to be replaced by high-productivity jobs in order to realize the transformation to a sustainable, diversified economy; and the consequences of changed lifestyles need to be addressed.

The Qatar National Vision (QNV) 2030 identifies the following five main challenges for Qatar:

- Economic growth, social development and environmental management.
- Managed growth and uncontrolled expansion;
- Modernization and preservation of traditions;
- The needs of this generation and the needs of future generations;
- The size and the quality of the expatriate labor force and the selected path of development;

The social sciences, arts and humanities – with their focus on human interaction, tradition and culture and societal dynamics – are essential in providing answers to how Qatar can navigate these developmental crosscurrents. For this year, the focus of research awarded in the social sciences, arts and humanities will be on the following five priority themes.

Priority Themes
4.1 Cultural Identity and the Development of Human Potential

It is apparent that deep-seated and cherished cultural values and views of heritage have a significant impact on how Qatar’s society evaluates and manages the transformation to a sustainable, diversified economy that is competing in a global setting. At the nexus of these adjustment processes lies the question of identity. A sense of cultural identity (as a person, a household, a tribe, a nation) has an impact on how the development of human potential in all its facets is viewed and how it is communicated throughout society. One of the main characteristics of a sustainable, diversified economy is the proportion of knowledge-intensive jobs and national human capacity development is required to provide a sustainable source of talent. Researchers are encouraged to submit proposals that address research questions related to identity and identity formation in the context of Qatar as well as projects that focus on the challenges and opportunities of human capacity development. Projects are expected to address specific challenges facing Qatar and to outline how the proposed research may be able to provide solutions to those challenges. Topics of particular interest are:

4.1.1 Contemporary issues in Islam;
4.1.2 Gender roles in Qatar (gender equality, gender equity) and their impact on the development of human potential;
4.1.3 Identity and media in the Arab world with an emphasis on Qatar;
4.1.4 Preservation of Qatari heritage objects in a time of rapid urbanization.

4.2 Economic Diversification and Sustainability

Many resource rich countries have either announced or already put in place policies to help transform their economies and move away from resource dependence. Most fossil fuel exporters have been concerned with the need to diversify their economies. However, very few have successfully moved away from their dependence on fossil fuel(s). The regulatory and technological change sweeping the energy market are making this an ever more urgent priority.

Researchers are encouraged to submit proposals that address research questions related to:

4.2.1 Enabling and supporting entrepreneurship and small and medium-sized enterprises.
4.2.2 Innovation and natural resources;
4.2.3 Supply chain innovations and management;
4.2.4 The development of critical pathways to diversifying the economy in the identified areas in the new Qatar National Development Strategy (QNDS), to become available soon;
4.2.5 The role of technical changes in shaping markets;
4.2.6 The understanding of the nature of the risks and opportunities associated with the transformation of markets;
4.2.7 Ways to leverage the emerging technologies to benefit Qatar;

4.3 Gulf Security

The current crisis in the Gulf has put the region under international spotlight, and has changed the dynamics and security threats of the region. This theme is not exclusively on the blockade but rather on the wider gulf studies and following are the topics of particular interest:

4.3.1 Gulf Corporation Council (GCC)
4.3.2 Security of the Gulf region
4.3.3 The blockade and international relations

4.4 Lifestyle and Quality of Life

Behavioral insights are expected to provide solutions to several grand challenges issues identified for Qatar. Therefore, this call specifically encourages researchers specializing in cultural, sociological, economic and behavioral studies to submit proposals with a clear connection to problems identified in Qatar, and explore determinants of behavior and social, cultural, economic and individual based interventions to modify behaviors. As outlined above, some of the envisioned topics are cross-cutting with other scientific fields; and researchers in all pillars are expected to collaborate across disciplines to address these issues:

4.4.1 Behaviors and interventions that contribute to research, innovation, entrepreneurship and diversification.
4.4.2 Behaviors and interventions that contribute to sustainability and security (cyber-, food-, water- and energy-security, environmental protection, crime prediction, prevention and early intervention);

4.4.3 Behaviors and interventions that improve quality of life (exercise and healthy food) and decrease risk (alcohol abuse, drug abuse, dangerous traffic behaviors, etc.);

4.5 Population Growth Sustainability

Qatar has experienced high rates of population growth (increased by more than 100% in the last decade). This population growth is due mainly to massive urban development, large-scale investment projects and rising government expenditure. It has led to the expansion of the economic capacity, activities and infrastructure. The high growth rate is likely to diminish in the coming years due to the completion of massive development projects and related factors. The scale and impacts of these expected changes need to be investigated. Researchers are invited to propose research that addresses these challenges and proposes policy solutions. Topics of particular interest are:

4.5.1 Immigration, naturalization, and citizenship;
4.5.2 Incentive structures regarding public/private employment in Qatar (entitlement systems);
4.5.3 Labor laws and regulations in Qatar;
4.5.4 Long-term prospects and planning security for workers as well as their families;
4.5.5 Sustainable size and quality of expatriate labor that Qatar needs in the long run.
## 1. ENERGY AND ENVIRONMENT

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<th>Priority Themes Level 1</th>
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<td><strong>Energy</strong></td>
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| **1.1 Advanced Materials** (For details refer to 1.1) | **1. High Added Value Products:**  
  - Develop concepts in hybrid material design for catalysis including scalable synthetic steps.  
  - Explore novel high-performance materials, e.g. self-healing materials; polymers for many applications taking into consideration an innovative and lean process production route;  
**2. Process Industries:**  
  - Develop industrial waste recycling technologies to produce by-products or innovative waste management solutions  
  - Enhance energy efficiencies for productivity, cost competitiveness and sustainability (e.g. reduction of industrial pollutants - solid wastes and effluents). Lowering of Qatar’s emissions of greenhouse gases.  
  - Novel technologies solving corrosion-related failures: monitoring systems, control and prevention (coatings), corrosion mechanisms including computational modelling |
| **1.2 Cooling** (For details refer to 1.2) | **1. Develop disruptive technologies (products e.g. new materials and processes) for cooling**  
  2. Develop solutions to enhance existing cooling technologies e.g. solar driven cooling, efficient building design, district cooling |
| **1.3 Energy Efficiency** (For details refer to 1.3) | **1. Energy Efficiency Control & Management:**  
  - Develop solutions for energy efficiency of industrial processes: monitoring, control and modeling  
**2. Process Optimization & Industrial Heat Recovery:**  
  - Develop innovative solutions for industrial heat recovery  
**3. Socio-Economic Studies:**  
  - Develop proposals covering the socio-economic aspects of energy: Social behaviors, incentive structures, business models |
| **1.4 Oil & Gas** (For details refer to 1.4) | **1. Application of specific primary, secondary, and enhanced oil and gas recovery techniques in optimizing production of Qatar’s reservoirs**  
**2. Characterization, Modeling & Management of Qatar’s Reservoirs (reservoir monitoring & sensors)**  
**3. Development and application of well drilling and completion technologies (under high-pressure and high-temperature)**  
**4. Prevention and remediation of formation damage issues, such as precipitates, condensate banking, and well injectivity** |
5. Technologies related to the processing of oil and gas and in particular natural gas, to include but not limited to: gas-to-liquid, compression, fractionation, separation, transportation.

| 1.5 Water | 1. Desalination  
> Develop brine management technologies to minimise or eliminate liquid discharge  
> Develop desalination technologies powered by renewable energies  
> Develop new membranes materials  
> Develop solutions for reducing energy consumption  

2. Water Management  
> Develop comprehensive management tools  
> Develop models and policies to optimise socio economic aspects of water cycle and consumption e.g. behavioral changes to reduce the consumption of water; incentives; policies  
> Investigate ways to mitigate the environmental impact of desalination processes  

3. Water Production  
> Explore Innovative handling, treatments, recycling and re-use of produced water from oil and gas fields  

4. Water Re-use  
> Develop technologies to enhance water re-use and explore alternative water sources (e.g. reuse of wastewater, grey water, etc.)  

5. Water Storage  
> Develop innovative technologies for water storage and monitoring |

| Environment | 1. Develop sustainability and resilience in Construction Engineering  

2. Develop technologies and policies to improve Urban Planning and relevant Architecture |

| 1.6 Built Environment  
(For details refer to [1.6](#)) | 1. Air Quality  
> Develop technologies to improve air quality  
> Develop technologies to monitor, characterize and assess health risks related to urban air quality  

2. Marine & Terrestrial Biodiversity  
> Studies aiming to preserve and restore Qatar’s marine & terrestrial biodiversity |
## 2. BIOMEDICAL AND HEALTH

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| **2.1 Communicable Diseases (Viral & Bacterial)**  
(For details refer to 2.1) | 1. Early detection, diagnosis, prevention and control  
2. Epidemiology  
3. Treatment |
| **2.2 Non-Communicable Diseases (NCDs)**  
(For details refer to 2.2) | 1. Cancer (Breast, Colon, Prostate, Leukemia, Lung, & Thyroid)  
- Epidemiology  
- Prediction, diagnosis and prevention  
- Treatment  
2. Cardiovascular  
- Epidemiology  
- Prevention, diagnosis and early detection  
- Treatment  
3. Diabetes  
- Epidemiology  
- Prevention, diagnosis and early detection  
- Treatment  
4. Mental & Neurological  
- Autism  
- Depression, anxiety & bipolar  
- Eating disorders & substance abuse  
- Neurodegenerative diseases  
5. Renal Diseases  
- Epidemiology  
- Prevention, diagnosis and early detection  
- Treatment  
6. Reproductive, Maternal & Child health  
- Children health, such as ADHD  
- Infertility  
- Maternal health, such as high-risk pregnancy |
### 3. COMPUTER SCIENCE AND ICT

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| **3.1 Artificial Intelligence** *(For details refer to 3.1)* | **1. Applications of AI**  
- Application in oil & gas, energy, finance, healthcare, social media, economics, education, society, law, ethics and other related sectors.  
**2. Human-Centered AI**  
- AI technology that better augments, communicates, collaborates and interacts with people.  
**3. Next Generation AI**  
- Next generation AI inspired by neuroscience, cognitive science and behavioral science. |
| **3.2 Cybersecurity** *(For details refer to 3.2)* | **1. Blockchain & its Applications**  
- Blockchain to enhance data privacy  
- Blockchain, secured Distributed Ledger Technology (DLT) and smart contract–based technologies to increase trust, authenticity, traceability, transparency and compliance between actors and users in different sectors such as energy, healthcare, food management, and land/property registry.  
**2. Critical Infrastructure Security & Resilience**  
- Foundational understanding of critical infrastructure systems and systems dynamics including industrial control systems, energy, health and transportation  
- Harnessing the power of data sciences to create unified, integrated situational awareness and to understand consequences of action  
- Integrated and proactive capabilities, technologies, and methods to support secure and resilient infrastructure  
- Integrated and scalable risk assessment and management approaches  
**3. Threat Intelligence & Proactive Security**  
- Adaptive security to real-time cyber threat  
- Big data analytics, AI & deep learning in cybersecurity  
- Defense against threats, including incident response planning, system performance insights and potential approaches to anticipate and counter measure threats  
- Human behavior in cybersecurity  
- Identification & authentication – Biometric credentials and new form of strong authentication mechanisms  
- Internet of things security  
- Predictive cyber threat analytics to prevent cybersecurity issues with informed based AI engines  
- Self-learning cybersecurity technologies and the establishment of feedback in cyber systems to learn from cyber-attacks |
| **3.3 Healthtech** *(For details refer to 3.3)* | **1. Digital Preventive Care**  
- Non-invasive technologies, bio sensors and smart health appliances  
- Wireless body sensors and systems for remote health diagnosis and monitoring  
**2. Virtual Care Delivery**  
- Digital pre-screening for virtual diagnostics  
- Smart adaptive treatment with ingestible sensors |
| **3.4 High Performance Cloud Computing** *(For details refer to 3.4)* | **1. Infrastructure as a Service (IaaS)**  
- Providing computing power, storage and network |
### 2. Platform as a Service (PaaS)
- Offering multi-client capability, scalability, access control, database accesses, SDKs

### 3. Software as a Service (SaaS)
- Supporting life sciences, bioinformatics, next generation sequencing (NGS), energy, material science and environment

### 3.5 Next Generation Networks (NGNs)
(For details refer to 3.5)

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### 3.6 Smart Cities
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### 3.7 Smart Grids
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<th>1. Electric Transportation Infrastructure in Harsh Environment</th>
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<tr>
<td>- Developing reliable and fast charging infrastructure customized for the country environment.</td>
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<tr>
<td>- Quantifying the values, cost, complexity, and risks of smart grid systems.</td>
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<tr>
<td>- Real-world deployment and grid integration of large collections of vehicles.</td>
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<td>- Sensing, modeling, communications, control, and optimization of vehicle and grid systems.</td>
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<tr>
<th>2. Modeling &amp; Real-Time Simulation of Power Grids</th>
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<tr>
<td>- Coupled simulation of infrastructures, e.g., gas network - electric grid.</td>
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<tr>
<td>- Interfacing issues in real-time digital simulators, hardware-in-the-loop simulation, and multi-physics simulation.</td>
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<tr>
<td>- Interlinking power system, ICT-based enabling tools, and electromagnetic field simulation environments.</td>
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<td>- Optimized co-simulation of transmission-distribution-communication models.</td>
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<th>3. Modernization &amp; Automation of Distribution Power Grids</th>
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<tbody>
<tr>
<td>- Advanced metering infrastructure for active distribution systems</td>
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<tr>
<td>- Real time power quality monitoring for distribution systems</td>
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<tr>
<td>- Real time state estimation architectures</td>
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<tr>
<td>- Regulatory frames and policy recommendations for distribution system prosumers</td>
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<tr>
<td>- Substation technology tailored for distribution, and real time aggregation</td>
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<tr>
<td>- Ultra-short forecasting tools for producers/consumers (prosumers)</td>
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<td>- Unified voltage control and congestion management in distribution grids</td>
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## 4. Social Sciences, Arts and Humanities

<table>
<thead>
<tr>
<th>Priority Themes Level 1</th>
<th>Priority Themes Level 2</th>
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</table>
| **4.1 Cultural Identity & the Development of Human Potential**  
(For details refer to 4.1) | 1. Contemporary Issues in Islam;  
2. Gender roles in Qatar (gender equality, gender equity) and their impact on the development of human potential;  
3. Identity and Media in the Arab world with an emphasis on Qatar;  
4. Preservation of Qatari heritage objects in a time of rapid urbanization. |
| **4.2 Economic Diversification & Sustainability**  
(For details refer to 4.2) | 1. Enabling and supporting entrepreneurship and small and medium-sized enterprises;  
2. Innovation and natural resources;  
3. Supply chain innovations and management;  
4. The development of critical pathways to diversifying the economy in the identified areas in the new Qatar National Development Strategy (QNDS);  
5. The role of technical changes in shaping markets;  
6. The understanding of the nature of the risks and opportunities associated with the transformation of markets;  
7. Ways to leverage the emerging technologies to benefit Qatar. |
| **4.3 Gulf Security**  
(For details refer to 4.3) | 1. Gulf Corporation Council (GCC);  
2. Security of the Gulf region;  
3. The blockade and international relations. |
| **4.4 Lifestyle & Quality of Life**  
(For details refer to 4.4) | 1. Behaviors and interventions that contribute to research, innovation, entrepreneurship and diversification;  
2. Behaviors and interventions that contribute to sustainability and security (cyber-, food-, water- and energy-security, environmental protection, crime prediction, prevention and early intervention);  
3. Behaviors and interventions that improve quality of life (exercise and healthy food) and decrease risk (alcohol abuse, drug abuse, dangerous traffic behaviors, etc.). |
| **4.5 Population Growth Sustainability**  
(For details refer to 4.5) | 1. Immigration, naturalization, and citizenship;  
2. Incentive structures regarding public/private employment in Qatar (entitlement systems);  
3. Labor laws and regulations in Qatar;  
4. Long-term prospects and planning security for workers as well as their families;  
5. Sustainable size and quality of expatriate labor that Qatar needs in the long run. |