



Qatar University Research Magazine

Issue 25, September 2026

From the Legacy of the World Cup to Serving Pilgrims

- Designing Smarter Structures
- Interview with Prof. Hissa Sadiq
- Qatari Shale Rocks are Revolutionizing Renewable Energy Materials
- The First Qatari Faculty Member at Qatar University

Enrich Your Life with Knowledge and Join Our Journey



Scan the QR code with your mobile phone
to view our magazine, or visit us online at:
<https://www.qu.edu.qa/en-us/research/publications/issues>

Editorial

Prof. Aiman Erbad

Vice President for Research and Innovation
Qatar University



At Qatar University, we believe that the value of research is measured not only by the knowledge it generates, but also by the impact it creates and its ability to transform challenges into opportunities, ideas into solutions, and knowledge into meaningful contributions to society and development. Guided by this vision, we continue to build a research and innovation ecosystem that brings together scientific excellence, collaboration, and innovation, enabling knowledge to translate into tangible and sustainable applications.

The transition from the legacy of the FIFA World Cup to serving pilgrims is a clear example of this vision. What began as research to develop innovative solutions for mitigating heat during major events is now being applied in new ways to serve pilgrims at Mount Arafat. This experience highlights the importance of research partnerships in developing solutions and expanding their impact.

This issue offers further insight into Qatar University's research activities and efforts to build a more effective institutional research environment by strengthening research center governance, assessing research quality and impact, and launching initiatives and grants that foster collaboration across disciplines and institutions. It also highlights the use of artificial intelligence in research, education, and knowledge management, as well as research exploring innovative and sustainable solutions in energy, the environment, and food.

Throughout this issue, we showcase research and innovations spanning renewable energy and carbon dioxide conversion, advanced materials,

environmental and food sustainability, and smart technologies, alongside engineering solutions tailored to local environmental conditions.

The issue also explores research topics that address societal priorities and future challenges, including the protection of endangered languages, fairness in artificial intelligence technologies, compliance with international environmental agreements, the circular and digital economy, energy transition, and sustainable solutions for the built environment.

At the same time, we celebrate researchers and innovators who are developing promising technologies and applications, while providing our students with a platform to showcase their research and projects. The issue also features conversations highlighting academic journeys and experiences, as well as the role of the University's research centers in advancing research and entrepreneurship.

This diversity reflects the breadth and interconnectedness of research at Qatar University and the University's commitment to fostering an environment that encourages discovery and collaboration, empowers researchers and students to contribute to research and innovation, and responds to the priorities of society and the aspirations of the State of Qatar.

I invite you to explore this issue and discover the research, experiences, and innovations that reflect Qatar University's ambition for a future driven by knowledge, innovation, and sustainability.



Qatar University Research Magazine is published by the Research & Innovation Sector at Qatar University.

General Supervision

Mira Al-Kuwari

Editor-in-Chief

Noora Ahmed Al-Fardi

Design

Ahmed Mohamed Hanafi

Print

Alwaraq Printing Press

Revision & Proofreading

Qatar University Press

Contents

1 News

Qatar University's Framework for Innovation, Entrepreneurship and Knowledge Transfer	4
Qatar University Launches ARQIF: A Comprehensive Framework for Assessing Research Quality and Impact	6
A Governance Framework for Research Centers: Toward a More Efficient and Sustainable Research System	8
Hyperspectral Imaging Laboratory: The First Facility of Its Kind in Qatar	12
From the Legacy of the World Cup to Serving Pilgrims: A Joint Initiative by Qatar University and the Royal Commission for Makkah City and Holy Sites to Moderate the Climate at Jabal Al-Rahmah	14

2 Projects News

Toward an Integrated Research Ecosystem: Qatar University Launches Interdisciplinary Collaborative Grants to Strengthen Collaboration between Research Centers and Colleges	16
Strategic Research Grants Advancing Innovation and Institutional Collaboration	20
The AI Research and Innovation Hub	22

3 Under Spotlight

Interview with a Researcher: Dr. Nasser Fahad Nasser Al-Dosari, Dean, College of Education	24
Researcher Business Card: Dr. Kholoud Mohammed Abdulla, College of Pharmacy	27

4 Research Achievements

Turning Carbon into Opportunity: Breakthroughs in CO ₂ Capture and Electrochemical Conversion	28
Stepping into the Future: Smart Footwear, Robotic Tracking, and AI for Next-Generation Rehabilitation	32
Designing Smarter Structures: From Topology Optimization to 3D Printing	36
Desert Power: How Qatari Shale Rocks Are Revolutionizing Renewable Energy Materials	40
From Sunlight to Clean Hydrogen: A Qatar–Oman Research Collaboration Advancing Sustainable Energy	42

5 Innovation Oasis

Interview with an Inventor: Prof. Alaaldin Mohammad Alkilany, College of Pharmacy	46
Clarifex: An Automated Membrane Filtration System Engineered to Precisely Separate Fine Particles from Liquids with Intelligent Process Control	50
Beyond Steps and Heart Rate: A Wearable that Reveals What Muscles and Joints Endure	54
Inventor Business Card: Prof. Mustafa Serkan Kiranyaz, College of Engineering	57

6 Under Spotlight

Interview with an Author: Prof. Hissa Mohammed Sadiq, Member of the Board of Trustees at Qatar University 58

7 Student Projects

Exploring Possibilities for Leadership Development in Qatar's Government Schools 61

When Knowledge Becomes an Intelligent Assistant: A Qatari Study Connecting Artificial Intelligence with Sustainable Project Management 64

In the Digital Shadows: Electronic Money Laundering Under Scrutiny 67

Making Sustainability Measurable: An Accounting Framework for the MENA Region 70

8 Under Spotlight

Interview with a Student: Mohammed Al-Hor, College of Medicine 72

Student Business Card: Moza Al-Kuwari, College of Engineering 75

9 Research Issues

Leadership for Social Justice: How School Principals Practice Equity and Inclusion? 76

Transforming Windows into Active Energy Systems in a Hot Built Environment: Msheireb Downtown Doha as a Case Study 78

Qatar's LNG Exports: Advancing Efficiency in Electricity Generation and Reducing Carbon Emissions in the Global Energy Transition 81

How Is Qatar Leveraging International Law to Develop Actionable Solutions for Language, Technology, and the Environment? 84

Can We Be Circular and Digital Without Creating Social Blind Spots? A Policy Perspective for Sustainable Transformation in Qatar and the GCC 86

10 Research Articles

Professor Juhaina Sultan Saif Al-Issa:
The First Qatari Faculty Member at Qatar University 89

Preparing for Pregnancy: An Early Decision for Better Outcomes 92

Green Chemistry and Functional Nanomaterials:
Sustainable Innovation at Qatar University 94

Exploring the Role of Marketing Strategies in Enhancing Local Professional Football League Attendance after Hosting the FIFA World Cup 98

Culture is a Cornerstone of Language Teaching:
Incorporating Culture into Arabic Language Classes for Non-Native Speakers 100

Advancing Youth Health and Wellbeing at a Health-Promoting University:
The QU Health Research Network Group 102

11 Under Spotlight

Story of Knowledge Platform: Center for Entrepreneurship,
College of Business and Economics – Qatar University 105



The Research and Innovation Sector acknowledges the contributions made in support of the publication of this issue. We also welcome editorial contributions via email at: ECO.RGS@qu.edu.qa

All rights reserved. No part of this magazine may be reproduced, stored in a retrieval system, or transmitted in any form or by any means without prior written permission from the Research and Innovation Sector at Qatar University.

The data and opinions expressed in QU Research Magazine are the sole responsibility of the authors and do not necessarily reflect the views of the Research and Innovation Sector.



Qatar University's Framework for Innovation, Entrepreneurship and Knowledge Transfer

Realization of the Knowledge-Based Economy Vision

Qatar University is steadily advancing a pioneering approach to strengthen its role as a key driver of the knowledge-based economy vision. The University has established a unified framework for innovation, entrepreneurship, and knowledge transfer, comprising four key pillars that work in synergy to support innovators throughout their journey from idea to market.

This strategic step aims to bridge the gap between academic research and the needs of local and international markets, while bringing together the efforts of partners and stakeholders under one umbrella. The ecosystem operates under the supervision of the Office of the Vice President for Research and Innovation to empower students, researchers, and faculty members, contributing directly to the transition

toward a knowledge-based economy in line with the Qatar National Vision 2030.

Strategic Objectives

The unified ecosystem focuses on transforming academic ideas, intellectual capital, and research outputs into solutions with tangible economic and societal impact through:

- **Protecting and accelerating the commercialization of intellectual property rights:** Protecting and registering patents internationally and facilitating licensing agreements for various sectors and stakeholders.
- **Empowering the next generation of entrepreneurs:** Providing mentoring, technical, and financial support to students, researchers,

and faculty members to develop promising entrepreneurial projects and transform them into startups.

- **Promoting national and international partnerships:** Connecting scientific research with the needs of national and international companies and government entities to support comprehensive economic development.

The new ecosystem is built around four key entities that work in close synergy to support the innovation journey from idea to market:

- **Innovation Department:** The starting point and safeguard of the ecosystem. The department promotes and protects intellectual property, manages and registers patents, evaluates promising ideas, commercializes and transfers technology, and facilitates licensing agreements for beneficiary sectors and stakeholders. It also manages and operates the Innovation Hub, with its specialized technical laboratories for prototype development.
- **The Innovation Hub** represents a key component of the department and provides integrated infrastructure that includes an engineering design studio, an electronics station dedicated to the Internet of Things and robotics, and a 3D printing and laser-cutting station. The Hub also includes the Innovation Arena, which supports the activities of the Center for Entrepreneurship pre-incubation unit and enables the technical and commercial feasibility of projects to be tested before launch.
- **Center for Entrepreneurship:** The center serves as the University's hub for entrepreneurship education and development by offering training courses, startup clinics, and pre-incubation services. It provides a supportive environment for developing skills and entrepreneurs, focusing on leadership and management skills, mentoring entrepreneurs, empowering startups, and facilitating their access to the investor community.
- **Knowledge Transfer Center (Athar):** The Center connects the University's research and consulting expertise with the government and private sectors to address developmental and societal challenges. It serves as a bridge to

practical applications, focusing on transforming University research into field applications and practical solutions while building strategic partnerships that support national development.

- **Qatar University Holding Company and Q-Tech LLC:** They form the University's investment and commercial arm, investing in promising startups and accelerating the market growth of innovative technologies.

Future Initiatives and Projects

Roadmap to 2028

To achieve its vision, the University has adopted several initiatives and projects, including:

- **Developing innovation awareness and culture:** Launching innovation awareness weeks and camps and establishing a network of "Innovation and Entrepreneurship Ambassadors" across all colleges to identify talent and capture exceptional ideas at an early stage.
- **Empowering entrepreneurs and launching the "Innovation Hub":** Establishing and equipping advanced spaces featuring design studios, electronics stations, and 3D printing technologies to provide a pre-incubation environment and enable prototype development for promising ideas and applications.
- **Funding and supporting applied research:** Allocating internal grants to support innovative projects and student teams and transforming research into projects with potential for practical application and commercialization.
- **Digital transformation:** Launching a "Unified Digital Platform" based on a one-stop-shop model to facilitate electronic access to all ecosystem services, while aligning strategic plans with leading national entities such as the Qatar Research, Development and Innovation Council (QRDI), Qatar Science & Technology Park (QSTP), and Qatar Investment Authority (QIA).

Through this innovative model, Qatar University reinforces its pivotal role as a national hub of expertise and a key driver of talent development and sustainable economic growth in the State of Qatar.



Qatar University Launches ARQIF: A Comprehensive Framework for Assessing Research Quality and Impact

A Strategic Step toward Global Excellence and the
Measurement of the True Impact of Scientific Research

Qatar University (QU) has announced the launch of ARQIF (Assessment of Research Quality and Impact Framework), a comprehensive, integrated framework for assessing research quality and impact, as one of the key projects supporting the University's strategic goal of scientific research. This landmark step aims to elevate research performance and strengthen the University's position on the global academic map. The

framework serves as a robust strategic tool for measuring scientific productivity and improving the quality of research outputs, while aligning with the QU's Positioning Strategy 2050 -thereby contributing to impactful research excellence at both the local and global levels, in alignment with Qatar National Vision 2030 and the Third National Development Strategy.

A Strategic Vision toward Excellence

The new framework aims to provide accurate and objective analyses that support strategic decision-making and direct resources toward priority research areas. It is grounded in a rigorous scientific methodology that reinforces Qatar University's standing as a beacon of scientific knowledge at both the national and international levels, with a focus on translating scientific research into tangible economic and societal benefits.

A Precise Methodology and Reliable Sources

The framework is built on reliable data drawn from prestigious global databases, such as Scopus and SciVal, as well as internal institutional data, ensuring the accuracy and objectivity of results. In addition, a digital platform has been launched to facilitate data entry and enhance its precision, while a specialized team continuously reviews, analyzes, and audits the data.

Dimensions and Indicators for Measuring True Impact

The framework consists of ten main domains and 41 indicators that assess various aspects of research activity, as follows:

1. **Research Output Indicators** track the volume of scientific production through globally indexed publications and reputable Arabic-language publications, while calculating average faculty productivity across colleges.
2. **Publication Quality Indicators** focus on average citations, Field-Weighted Citation Impact (FWCI), and the proportion of publications in top-ranked journals (Q1), while also tracking citations in global patents.
3. **Research Collaboration Indicators** measure the level of international and local collaboration through rates of joint research and active agreements both within and with external partners.
4. **Innovation Indicators** assess the University's capacity to convert knowledge into commercial products by tracking the number of patents registered and commercialized over the past three years.
5. **Research Funding Indicators** analyze the internal and external funding ecosystem and

spending efficiency by measuring the number of publications and patents per million Qatari riyals of investment.

6. **Student Research Indicators** focus on the quality of postgraduate research outcomes, including the average number of high-quality publications per academic stage, and the number of student research grants awarded.
7. **Societal Impact Indicators** measure the extent to which research is linked to sustainable development and its goals, the alignment of research with the National Development Strategy, and the extent to which government policies are informed by university studies.
8. **Media Impact Indicators** monitor the global reach of research outputs and researchers' media presence, using the PlumX index to track digital engagement with publications.
9. **International Excellence Indicators** track academic awards, research chairs, global highly-cited researcher rankings, and honorary fellowships attained by the University's researchers.
10. **Stakeholder Satisfaction Indicators** rely on annual surveys to assess partner satisfaction with the quality and impact of research, providing continuous feedback for performance improvement.

Toward Impactful and Sustainable Research

This framework marks a significant advancement in research impact at Qatar University by integrating research quantity with quality, bridging theory and practice, and aligning academic output with national priorities. It provides a strong foundation for ensuring the quality, integrity, and credibility of research. Through this framework, the University reaffirms its commitment to supporting rigorous research that delivers meaningful societal impact and contributes to the development of a knowledge-based economy.

For Contact and Inquiries:

Research Planning and Development Department
Office of the Associate Vice President for Planning and Research Support

Research and Innovation Sector

RPD@qu.edu.qa

A Governance Framework for Research Centers: Toward a More Efficient and Sustainable Research System



Introduction

Today, universities are evaluated not only by the number of their educational programs but also by their ability to generate impactful knowledge and innovative solutions to societal and economic challenges. Amid rapid transformations in the global research sector and the growing role of universities as hubs for knowledge, innovation, and development, institutional frameworks that enhance research management efficiency and sustain its impact have become essential.

Research centers, institutes, and groups play a pivotal role in the research and innovation system by producing knowledge, strengthening inter- and cross-disciplinary collaboration, and developing solutions to national and global challenges. With the growing diversity of these entities and the multiplicity of their funding sources, a clear governance framework is necessary—one that regulates their relationships, defines roles and responsibilities, and provides mechanisms for planning, monitoring, evaluation, and continuous development. Such a framework is a main pillar for institutional excellence, quality, accountability, and the alignment of research activities with strategic priorities.

In this context, Qatar University has developed a comprehensive reference document for research centers as an essential institutional instrument. It serves as the organizing framework that defines concepts, entity models, standards for establishment and evaluation, roles, responsibilities, and work mechanisms - unifying concepts, enhancing institutional consistency, and ensuring clarity of expectations, thereby supporting governance efficiency and reducing variation in organizational practices.

Designing the Governance Framework for Research Entities

The governance framework is based on a progressive organizational classification of research entities that reflects the levels of institutional maturity and the nature of the roles and functions they perform. This classification includes research groups as the initial core of specialized research activities, research units that enjoy a higher degree of organization and independence, college- or sector-affiliated research centers, interdisciplinary university research centers, and, finally, research institutes that represent the highest level in terms of integration and strategic dimension.

This classification is not intended to create rigid structures, but to provide a flexible framework

for the development of research entities based on performance, added value, and contribution to university and community priorities. The ability to move between levels links institutional development to competence and achievement rather than administrative considerations alone.

Effective governance is also based on the clarity of roles and the distribution of responsibilities across supervisory levels, supported by organizational frameworks that facilitate decision-making and ensure the quality of planning, implementation, and follow-up. In this context, scientific supervisory committees and the university-level research entities committee are key tools for strengthening governance by reviewing plans, evaluating performance, identifying development opportunities, and supporting strategic decisions.

The matrix of authorities and responsibilities also serves as an important organizational tool for clarifying the roles of implementation, review, approval, and reporting, thereby enhancing transparency, reducing overlap in responsibilities, and supporting efficient decision-making. This approach helps achieve a balance between the operational independence of research entities and institutional oversight, in line with the principles of good governance.





Sustainability and Continuous Development in Research Governance

The success of governance is closely linked to the effectiveness of strategic planning. Every research entity is expected to operate in accordance with a medium-term strategic plan that includes a clear vision, defined objectives, measurable performance indicators, and executive initiatives aligned with institutional priorities. These plans are an essential tool not only for directing research but also for strengthening alignment between research entities' goals and the university's strategic directions. At Qatar University, this governance framework maps directly onto the integrated governance model described in the Research Priorities 2025–2030, reinforcing the alignment of research center activities with Qatar University's institutional vision and national research objectives. In this way, center governance becomes a key mechanism for sustaining research entities within Qatar's

evolving national research system — ensuring their continued relevance, funding viability, and contribution to the country's long-term knowledge economy goals.

In this context, governance is not limited to organizing structures and processes; it also includes risk management as a key element in sustaining institutional performance. This is achieved by adopting a clear methodology to identify, analyze, and mitigate strategic, operational, financial, and technical risks - enhancing institutional readiness and supporting business continuity.

At the monitoring and evaluation level, the governance framework relies on a periodic evaluation system that combines annual follow-up with comprehensive evaluation, enabling continuous improvement and supporting evidence-based decision-making. Annual evaluation serves as a tool for measuring

progress toward goals and monitoring performance indicators, while a comprehensive evaluation, conducted periodically, provides a broader opportunity to review performance levels and impact, and to identify opportunities for development and improvement.

Independent external review takes on special importance in this framework due to the objectivity it provides and the comparative dimension it adds, helping to align performance with international best practices. Evaluation results also support decisions on institutional development, restructuring, and efficiency improvements, ensuring that resources are directed toward the highest-priority and most impactful areas.

One important aspect in this context is the adoption of dynamic governance, which gives the research system the flexibility needed to adapt to change, whether by developing research entities' operating models to enhance efficiency or by reconsidering the continuity of some entities when needed. This direction reflects an understanding of institutional governance as a flexible, evolving framework that is not limited to control and regulation but also supports responsiveness to change and strengthens the capacity for continuous development.

For example, some centers with similar activities may be merged into one more efficient entity, or an existing research center may be redirected to align with a new national priority.

From Governance to Maximizing Research Impact

The importance of this direction is increasing in light of global trends linking research excellence with governance efficiency and emphasizing that the sustainability of research impact is achieved not only through resources and infrastructure but also through the quality of institutional systems that organize and support research. From this perspective, developing a governance framework for research centers represents an institutional investment in enhancing performance quality, improving resource efficiency, and supporting integration between research and innovation.

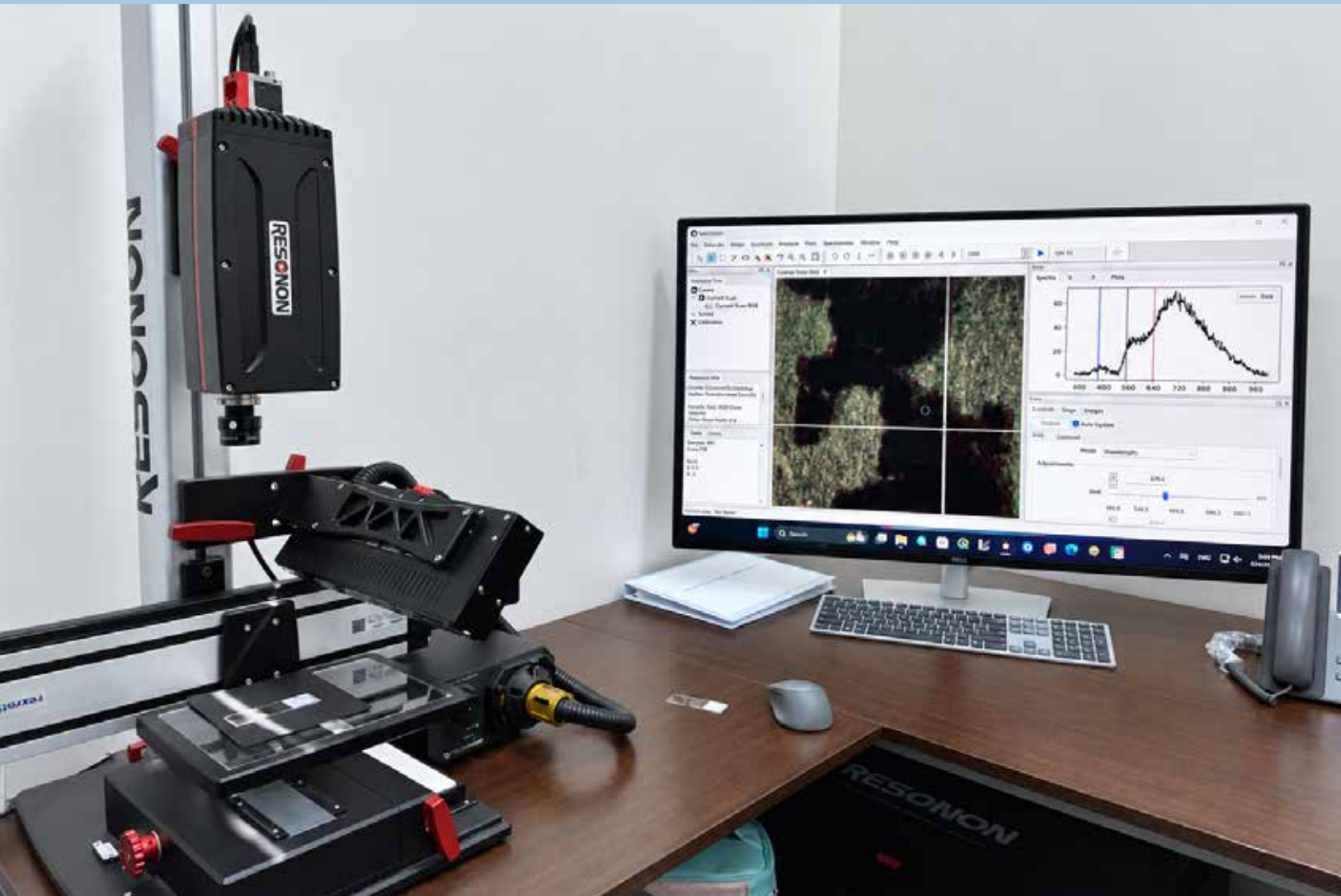
In the context of universities that adopt ambitious goals in research, development, and innovation, governance also serves as a tool to enable research entities to strengthen their contributions to national priorities, expand partnerships, and maximize the impact of research in serving society and the knowledge economy. It also helps provide a cleaner, more stable institutional environment that supports researchers, enhances the efficiency of managing research entities, and drives further excellence and competitiveness.

Developing a governance framework for research centers is not merely an organizational procedure but rather a strategic pillar for building a more integrated, flexible, and efficient research system. It also enhances the institution's ability to direct its research efforts toward impactful priorities, reinforce a culture of shared responsibility based on results, and support continuous improvement, thereby contributing to achieving institutional excellence and maximizing research contributions to national development.

For a university aspiring to become a major partner in building the knowledge economy, the governance of research centers is a practical tool for translating these ambitions into projects and research with a tangible impact on people's lives in health, the environment, education, and the economy.



Hyperspectral Imaging Laboratory: The First Facility of Its Kind in Qatar



The Environmental Science Center (ESC) at Qatar University established the Hyperspectral Imaging Laboratory (HIL), the first facility of its kind in the State of Qatar dedicated to hyperspectral imaging applications in Earth sciences, environmental studies, and biomedical research. The laboratory serves as a national platform that supports scientific research and innovation while contributing to the development of advanced technologies and solutions that benefit society and the environment and strengthen Qatar's position in advanced sensing and imaging technologies.

The laboratory provides state-of-the-art hyperspectral imaging infrastructure for field measurements and high-precision spectral data analysis, supporting scientific research and environmental monitoring in Qatar. The HIL is equipped with the Pika XC2 hyperspectral camera, which operates within the 400–1000 nm wavelength range and can collect data through 1,600 spatial pixels distributed across 447 spectral bands with a spectral resolution of 1.9 nm. The associated hardware and software systems provide advanced capabilities for data acquisition and analysis, enabling studies of



From left: Dr. Rajendran Sankaran, Laboratory Supervisor, and Prof. Fares Al-Momani, Director of the Environmental Science Center.

natural resources and environmental systems, expanding the applications of hyperspectral imaging, and supporting innovative scientific solutions that serve society and the environment in Qatar.

The laboratory is also equipped with advanced image processing systems, including DELL workstations, as well as specialized software packages such as ENVI 6, IDL 9 (NV5) and ArcGIS Pro 3.2 for spatial mapping applications. In addition, several open-source software tools are utilized for the identification and mapping of terrestrial, environmental, and biomedical resources.

The hyperspectral imaging system is highly sensitive to the optical, physical, and chemical properties of different materials, enabling both qualitative and quantitative remote sensing applications for resource identification and mapping in both field and laboratory environments. The laboratory also benefits from national and international open-access databases and satellite imagery with varying spatial resolutions, supporting international research initiatives and collaborative studies.

The research expertise and advanced capabilities available within the laboratory have created a stimulating environment for researchers and graduate students while enhancing the center's ability to attract nationally competitive research projects. One of the most notable achievements is securing the collaborative research project "HyperBrain," funded by the Qatar Research, Development, and Innovation Council (QRDI). The project focuses on developing advanced biomedical imaging technologies for brain tumor detection, supporting innovation in the healthcare sector and contributing to improved quality of life and healthcare services.

As part of its commitment to community service and scientific advancement in Qatar, the laboratory participated in a collaborative research project with the College of Engineering at Qatar University entitled "Hyperspectral Imaging of Early Quranic Manuscripts." The project aims to employ advanced imaging technologies to study and preserve Quranic manuscripts dating back to the early centuries of Islam and was funded by the Qatar Research, Development, and Innovation Council. The laboratory facilities also supported a research project funded by Earthna, a Qatar Foundation initiative, highlighting the Environmental Science Center's role in supporting national research initiatives and strengthening institutional collaboration for the benefit of society, cultural heritage preservation, and environmental sustainability.

The expertise and resources available within the laboratory have further provided valuable opportunities for graduate students and contributed to securing several research projects funded by the Qatar Research, Development, and Innovation Council.

The research team has actively promoted the capabilities and applications of hyperspectral imaging through publications in peer-reviewed scientific journals, demonstrating the importance of this technology in environmental and biomedical research. Laboratory activities have also contributed to research capacity building, strengthened interdisciplinary collaboration, and opened new opportunities for applying advanced technologies in service of society and the environment.

The laboratory is supported by a specialized research team with extensive expertise in reflectance spectroscopy and hyperspectral imaging. Through collaborations with academic institutions and industry partners both within Qatar and internationally, the team conducts multidisciplinary applied research that supports innovation and reinforces the role of scientific research in serving society and promoting sustainable development.





From the Legacy of the World Cup to Serving Pilgrims:

A Joint Initiative by Qatar University and the Royal Commission for Makkah City and Holy Sites to Moderate the Climate at Jabal Al-Rahmah

On the plains of Mount Arafat, where millions of pilgrims gather to perform the central rite of Hajj, one of the most compelling examples of applying scientific knowledge in the service of humanity came to life during the 1447 AH Hajj season. Through a partnership between Qatar University

and the Royal Commission for Makkah City and Holy Sites, engineering solutions were developed to moderate the climate in the courtyard of Jabal Al-Rahmah (Mount of Mercy). The initiative reflects the integration of research expertise and institutional collaboration in serving pilgrims at one

of the busiest and most significant sites of Hajj. The initiative comes amid increasing climatic challenges during the pilgrimage season. Temperatures exceeded 45°C during peak daytime hours as millions of pilgrims from around the world gathered on the plains of Arafat to perform the most important rite of Hajj. In line with the commitment of the Government of the Custodian of the Two Holy Mosques to provide pilgrims with a safe and healthy environment, extensive efforts and resources were mobilized, while innovative solutions were adopted to enhance the quality of services offered during Hajj.

At the heart of this initiative stands Professor Saud Abdul-Ghani, Professor of Mechanical Engineering at Qatar University, whose name became internationally associated with the development of open-space stadium cooling technologies that attracted global attention during the FIFA World Cup Qatar 2022™. Professor Abdul-Ghani led the design efforts and supervised the implementation of the project's initial phase, drawing upon years of accumulated research experience in aerodynamics, computational modelling, and the control of open thermal environments.

During the World Cup, Qatar presented an exceptional model for hosting major events, not only through efficient organization and crowd management, but also through the development of innovative cooling technologies capable of regulating open thermal environments under challenging climatic conditions. The impact of these innovations extended well beyond stadiums, finding new applications that serve humanity in diverse contexts. Today, one of their most meaningful manifestations can be found in the service of pilgrims.

The project team employed advanced computational modelling to understand the thermal characteristics of Jabal Al-Rahmah

and its surrounding courtyards, which cover an estimated area of 62,000 square meters. The analyses revealed that the mountain's rocky mass and the surrounding sun-exposed areas function as a thermal reservoir, absorbing solar energy, storing it, and subsequently re-radiating it into the environment, thereby intensifying heat exposure among densely gathered crowds.

Based on these findings, a phased heat-stress mitigation system was developed, integrating climate moderation measures with crowd management requirements. The initial phase included the deployment of oscillating misting fans and the installation of large umbrellas around parts of the mountain's perimeter to provide shade and reduce direct exposure to solar radiation.

The pilot phase subsequently evolved to incorporate seven cooling stations distributed across the Jabal Al-Rahmah area, with a total cooling capacity of approximately 3,500 refrigeration tons. Chilled air is delivered through an underground network of massive pipes, some measuring up to two meters in diameter, before being distributed through ground-level outlets and specially designed columns to regulate the microclimate in the central courtyard, thereby improving thermal comfort and alleviating the effects of heat stress associated with extreme temperatures.

This initiative demonstrates how regional research partnerships can transform knowledge into tangible impact and translate innovation from the realm of sporting achievement into humanitarian service. In the Holy Sites, Qatar's engineering legacy has acquired a new human dimension, where technological ingenuity meets a spirit of service. In doing so, scientific research becomes a means of protecting people, enhancing their well-being, and improving their experience of performing sacred rituals, reflecting the noblest purpose of science when dedicated to the service of communities.



Toward an Integrated Research Ecosystem:

Qatar University Launches Interdisciplinary Collaborative Grants to Strengthen Collaboration between Research Centers and Colleges

As part of its ongoing efforts to further enhance the research and innovation ecosystem, Qatar University has launched the “Interdisciplinary Collaborative Grants” program as part of its direct college support initiatives. The program is designed to institutionalize collaboration between research centers and academic departments and to support research projects characterized by strategic relevance and long-term sustainable impact.

The program operates under the supervision of the Office of the Vice President for Research and Innovation, represented by the Research Support Department (Grants and Contracts), in alignment with the University’s strategic direction to build an integrated research environment that strengthens academic and research excellence, while also supporting national development priorities and advancing the knowledge-based economy.

Objectives and Strategic Dimensions of the Interdisciplinary Collaborative Grants

The program focuses on a set of strategic objectives aimed at strengthening Qatar University's research and innovation ecosystem. These include:

- Enhancing sustainable research excellence through support for projects with long-term scientific and institutional impact.
- Prioritizing research with strategic relevance linked to University priorities and national development needs, thereby reinforcing the role of research in achieving sustainable development.
- Supporting effective partnerships between research centers and academic departments, while encouraging the involvement of stakeholders and external partners where appropriate.
- Enabling research centers to plan and implement interconnected, multi-year research projects that ensure continuity, coherence, and long-term strategic outcomes.
- Strengthening interdisciplinarity across fields of expertise to develop innovative solutions to national and societal challenges.

Grant Budget

The grants are allocated to eligible research centers according to established quality and competitiveness criteria. This funding model provides research teams with adequate resources to design and implement sustainable strategic projects capable of generating cumulative scientific and institutional outcomes. The University has allocated funding of up to **QAR 500,000 per project over two years**, with the possibility of renewal for two additional cycles, bringing the total duration of each project to a maximum of six years.

General Structure and Requirements for Research Teams

To ensure academic excellence and effective collaboration, the University has established strict requirements for structuring research teams, as follows:

- **Project Leadership:** Each project phase is led by a research team headed by a Lead Principal Investigator (LPI) from either a research center or an academic department (Assistant Professor or above), subject to approval by the Center Director and relevant authorities, with at least one PI required to be affiliated with a research center.
- **The Project Coordinator** (the Research Center Director or their delegate) shall oversee the coordination of all project activities and ensure effective integration and collaboration among the participating research teams and principal investigators to achieve the project's strategic objectives in accordance with the approved plan.
- **Team Structure:** Each team must include at least two Principal Investigators (PIs) from academic departments within University colleges (Assistant Professor or higher), in addition to other PIs from research centers holding the rank of Associate Researcher or above. This structure enhances collaboration between centers and colleges, promotes interdisciplinary research, and allows for the inclusion of additional researchers and stakeholders whenever possible.
- **Student Engagement:** The initiative encourages the active involvement of students at both undergraduate and graduate levels through clearly defined training and supervision plans, intending to prepare a new generation of researchers capable of leading future innovation ecosystems.
- **Use of Research Facilities:** Proposals must clearly outline how University facilities and research infrastructure will be utilized.

Application Process

Research proposals undergo a rigorous, structured, and transparent evaluation process as follows:

1. **Initial Nomination:** After the internal call for proposals within research centers, proposals are presented to center directors, deans, and associate deans (or their equivalents), focusing on the strategic vision of each proposal. Based on this stage, each center director, in consultation with relevant academic leadership, nominates no more than three proposals per center.
2. **Scientific Review:** Internal specialized grant committees-established in coordination with the Research Support Department-conduct detailed scientific evaluations based on approved criteria and submit their recommendations to the Higher Steering Committee for Research Grants.
3. **Strategic Review and Endorsement:** The Higher Steering Committee reviews recommendations, taking into account alignment with the University's research strategy, stakeholder engagement, capacity-building opportunities, and budget availability.
4. **Final Approval:** The Office of the Vice President for Research and Innovation issues the final approval for awarded grants and authorizes their activation.

Internal Governance and Evaluation

Awarded projects are subject to a comprehensive review at the end of each two-year funding cycle, in accordance with Research Support Department procedures. This evaluation assesses progress achieved against predefined strategic objectives, as well as research and societal performance indicators.

Based on the review outcomes, one of the following decisions is made:

- Renewal of funding for the next phase, which may extend for up to two additional years,





subject to an updated research plan and revised milestones.

- Modification of project scope, reprioritization, or deferral for a period not exceeding one year to improve outcomes.
- Recommendation to suspend or terminate projects in cases of significant delay or insufficient outputs.

Eligible Research Centers

The program targets a diverse network of research centers across Qatar University, strengthening interdisciplinary research and collaboration across scientific and humanities fields. These include:

- **Research and Innovation Sector:** Center for Advanced Materials.
- **Health Sector:** Biomedical Research Center.
- **College of Engineering:** Gas Research Center.
- **College of Sharia and Islamic Studies:** Research and Studies Unit.

This initiative reflects Qatar University's commitment to developing more integrated and collaborative research models that leverage diverse expertise across the University by linking specialized research centers with academic capabilities across different colleges. This approach contributes to the development of high-quality research projects capable of delivering innovative solutions to national and societal challenges.

Through these comprehensive initiatives, the University continues to strengthen its role as a leading academic and research institution committed to knowledge production, innovation, and sustainable national development based on science, collaboration, and long-term societal impact.

For inquiries and further information, please contact:

dsg@qu.edu.qa



Strategic Research Grants Advancing Innovation and Institutional Collaboration

Qatar University and Hamad Bin Khalifa University Launch Institutional Collaboration Grant to Advance AI for Energy Research

Qatar University (QU) and Hamad Bin Khalifa University (HBKU) have jointly launched the Institutional Collaboration Grant (ICG) for 2027, a strategic initiative designed to strengthen research partnerships between Qatar's two leading national universities. The program aims to enhance interdisciplinary collaboration, accelerate innovation, and contribute to the development of Qatar's knowledge-based economy. The ICG represents a structured effort to foster long-term academic cooperation by enabling researchers from both institutions to jointly design and implement high-impact research projects. It also promotes the exchange of expertise, supports capacity building, and encourages the development of innovative solutions aligned with

Qatar's national research priorities.

The first cycle of the grant focuses on Artificial Intelligence (AI) for Energy, reflecting the growing importance of AI technologies in transforming energy systems globally. This thematic focus aligns with Qatar's strategic vision for sustainability, efficiency, and technological advancement in the energy sector, where AI-driven models are applied to improve logistics efficiency, enhance predictive capabilities, reduce operational costs, and support data-informed decision-making, emphasizing the integration of automation, digitalization, and advanced analytics to optimize industrial performance, improve safety, and reduce environmental impact across the energy value chain.

The program is open to academic researchers from both QU and HBKU. Each project must be co-led by two Lead Principal Investigators (LPIs), one from each institution, ensuring balanced

institutional representation and joint ownership of research outcomes. Teams may also include additional principal investigators and are required to involve at least one student from each university, reinforcing the program's commitment to research training and talent development. Projects under the ICG may receive funding for up to two years. Each institution contributes up to QAR 219,000 per year per project, resulting in a total potential funding envelope of QAR 438,000 per institution over the full project period. Each university independently manages its allocated budget while maintaining coordination within the joint framework.

The application process is competitive and consists of multiple stages. It begins with the submission of a Letter of Intent (LOI), followed by a shortlisting phase. Selected teams are invited to submit full research proposals, which undergo peer evaluation. Final funding decisions are made collaboratively by QU and HBKU based on committee recommendations.

Qatar Anti-Doping Research Grant (QADA): Advancing Integrity and Innovation in Sports

The Qatar Anti-Doping Agency (QADA), in collaboration with Qatar University, has introduced the Qatar Anti-Doping Research Grant 2027 cycle. This initiative is designed to strengthen scientific knowledge, policy development, and ethical practices in sport by supporting high-impact, interdisciplinary research on anti-doping.

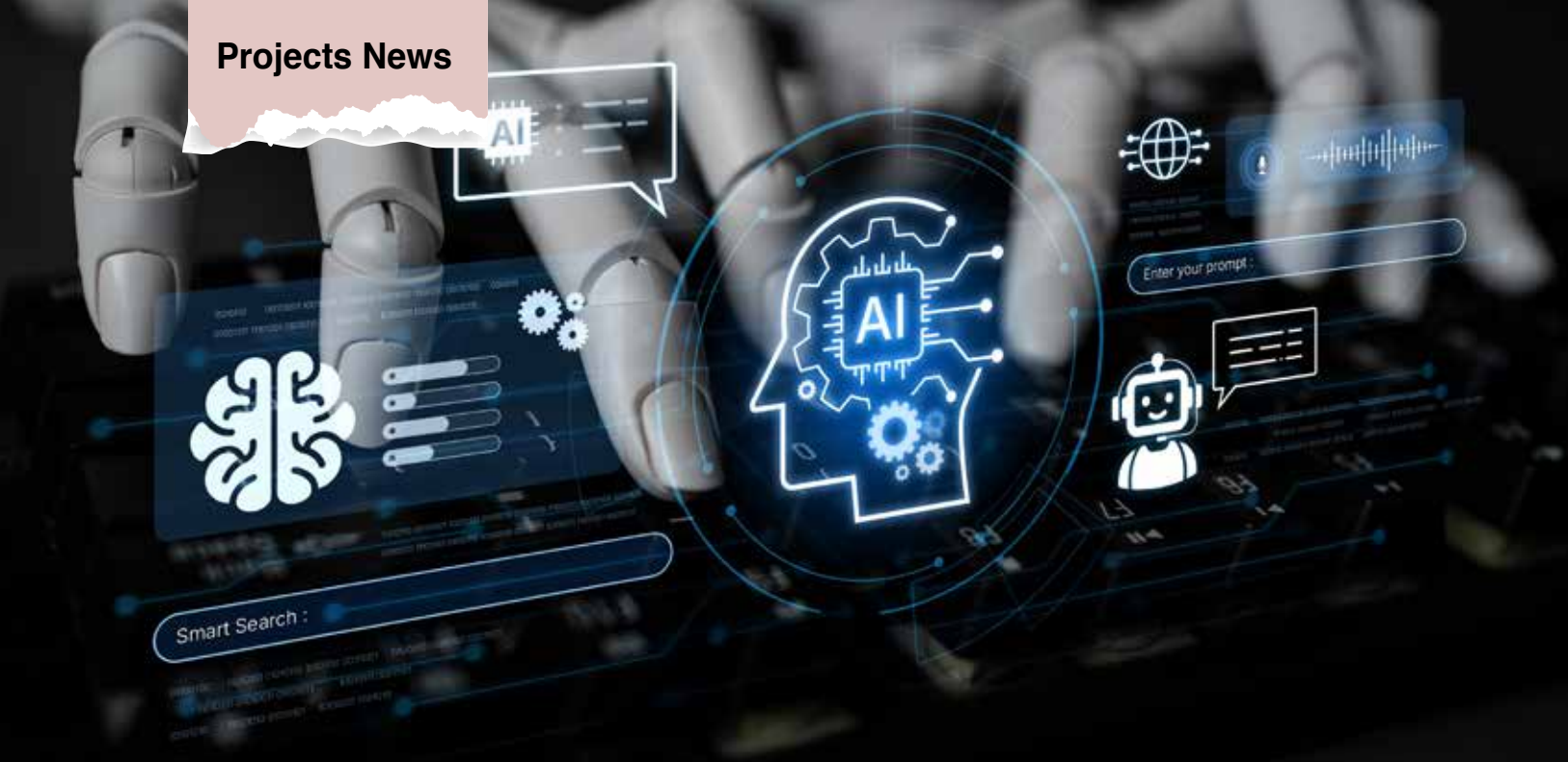
The grant focuses on advancing scientific and social understanding of doping in sports. It encourages research across science, medicine, pharmacy, technology, and social sciences, addressing both biological detection methods and the behavioral, cultural, and policy-related

factors that influence doping. Key scientific priorities include improved detection technologies, enhancement of the Athlete Biological Passport, and the use of artificial intelligence for biomarker discovery. On the social side, the program supports studies on athlete behavior, policy effectiveness, and cultural attitudes toward doping.

The initiative aims to strengthen research capacity in Qatar while fostering collaboration with Qatar University. It also promotes the integration of students into research teams, supporting the development of future experts in anti-doping and related fields. Projects are funded for one to two years, with up to QAR 300,000 allocated for scientific research and up to QAR 200,000 for social science or educational studies.

The application process starts with a Letter of Intent submission, followed by a full proposal for selected applicants. Required documents include the application form, CVs, budget plans, and a plagiarism report. Through this initiative, QADA aims to advance innovative research, strengthen ethical sport practices, and position Qatar as a leader in global anti-doping efforts.





The AI Research and Innovation Hub

Prof. Mahmoud Barhamgi, Member of the AI Research and Innovation Hub and Associate Dean for Research and Graduate Studies, College of Engineering – Qatar University

Launched by the Research and Innovation Sector, the AI Research and Innovation Hub is a key initiative designed to empower researchers, faculty members, and students with advanced AI capabilities. By providing the cutting-edge tools, resources, and dedicated expert support needed to accelerate discovery and elevate research quality, the Hub directly supports Qatar University's broader efforts to drive impactful innovation and develop knowledge-based solutions for our unique national challenges.

The initiative also contributes to strengthening Qatar University's leading role in AI research at both the regional and international levels by focusing on the creation of localized, homegrown AI solutions tailored to national needs.

Rawda Almesallam, Manager of Digital Innovation, Information Technology Services Department – Qatar University

The AI Research and Innovation Hub was established through close collaboration between the Research and Innovation Sector and the Information Technology Services Department, which played a pivotal role in providing the technical support required to develop and operate the Hub, enabling researchers to access and utilize its resources efficiently.

What resources does the Hub provide?

For high-performance computing, researchers have direct access to state-of-the-art hardware designed specifically to handle heavy AI workloads. This includes high-performance NVIDIA H100 and L4 GPUs, alongside Google Cloud TPUs, allowing teams to process large

datasets and train machine learning models much more efficiently.

Beyond raw hardware, Hub offers a comprehensive suite of advanced tools within the Google Cloud ecosystem. This includes Vertex AI, a unified platform that manages the entire AI application lifecycle—from preparing data to deploying the final model. Researchers can also explore the Model Garden to easily access and customize pre-trained models like Gemini and Llama. For projects with massive datasets, secure cloud storage and advanced data analytics tools are fully integrated to make handling and analyzing research data easier.

To accommodate different project needs, the Hub provides two flexible access methods. Researchers can request self-managed Virtual Machines (VMs) if they need full control to build custom environments. Alternatively, those who prefer not to manage system configuration can use the Managed Platform directly through Vertex AI to focus entirely on experimenting and building models.

Who can benefit from Hub?

All QU members, including researchers, faculty, and students across all colleges and research centers, can utilize Hub's resources for research, teaching, and learning. Currently, the platform supports a wide range of innovative projects spanning fields like healthcare, agriculture, telecommunications, energy management, and language processing. Examples of ongoing projects include designing AI-assisted surgical procedures, analyzing DNA and proteins to predict autoimmune diseases before symptoms appear, developing next-generation communication systems for 6G networks, and building models

to automatically score Arabic essays. Alongside research, the Hub fully supports the university's academic curricula. For instance, it provides the vital computational resources required for the newly launched Bachelor of Science in Artificial Intelligence at the College of Engineering. The complete list of ongoing projects is available on the official website: <https://www.qu.edu.qa/en-us/qu-ai/>.



How can researchers access these resources?

We invite researchers to visit the official portal (<https://www.qu.edu.qa/en-us/qu-ai/>) to learn more about the available computing resources, explore our training materials, and find simple step-by-step instructions on how to submit project requests.

An open call for discovery and innovation

With this new initiative, the QU research community is well-positioned to swiftly turn ambitious ideas into tangible discoveries that address pressing national and global challenges. In this context, the Research and Innovation Sector extends an open invitation to innovate with AI. Faculty and researchers from all disciplines, regardless of their prior technical experience, are encouraged to explore how these advanced AI tools can enhance their research and creative efforts.



Dr. Nasser Fahad Nasser Al-Dosari, Dean, College of Education – Qatar University

Interview with a Researcher

Dr. Nasser Fahad Nasser Al-Dosari, Dean of the College of Education at Qatar University, combines academic and leadership expertise, with a career that spans teaching, research, and several administrative positions in different educational institutions. His research interests extend across education, educational psychology, and educational quality, reflecting a sustained commitment to improving educational practices and enhancing their societal impact.

In this interview, we explore key milestones in his academic journey, his perspectives on education and teacher preparation, and his priorities in leading the College of Education at Qatar University.

To begin, Dr. Nasser, could you introduce yourself to our readers and share your academic and professional journey, as well as the key milestones that have shaped you as a researcher and academic leader?

My academic journey began with an early interest in education and teacher preparation, which led me to specialize in Teaching English as a Foreign Language and pursue my postgraduate studies in this field. This path helped me build a solid academic foundation that integrates applied linguistics and educational sciences, with a particular focus on learner motivation.

Throughout my career, I have held several academic and administrative positions, including Head of the Department of Educational Sciences and Dean of Academic Affairs at the Police College. I have also gained experience in academic planning, curriculum development, quality assurance, learning outcomes assessment, and faculty affairs management. In addition, my experience in the private sector, through administrative roles in several companies, has strengthened my understanding of labor market needs and the alignment between educational outcomes and development requirements.

This diversity of experience has shaped my view of academic leadership as an integrative practice that brings together academic quality, institutional governance, and a strong connection to societal and labor market needs.

You obtained your PhD in Teaching English as a Foreign Language, with a focus on student motivation. What led you to this field, and how has it influenced your teaching philosophy?

My interest in student motivation stems from a firm belief that it is one of the most critical factors in successful learning, particularly in second language education. This conviction was reinforced through my teaching experience, where I observed that students perform significantly better when they are motivated and actively engaged in the learning process.

This understanding has shaped my teaching philosophy, which focuses on creating positive and motivating learning environments that encourage active participation and independent thinking, while also supporting students' academic and personal development as an integral part of the educational process.

Your research interests span teacher education, teaching strategies, educational quality, and challenges in learning English. How have these interests evolved, and which area is closest to your current research passion?

My research interests have evolved gradually and consistently alongside my academic career and diverse professional experiences in university teaching and institutional work. I initially focused on English language teaching and learning, before expanding into teacher education, educational quality, and aspects of educational psychology related to classroom learning contexts.

My work has also extended to comparative studies in higher education systems, teacher education programmes and their evaluation, as well as issues related to English as a second language, including learning challenges and factors affecting teachers' career opportunities. In addition, some of my research has addressed topics in educational psychology such as

motivation and learners' psychological and social transitions, alongside contemporary issues such as differentiated instruction and the impact of crises like the COVID-19 pandemic.

Currently, my main research focus is on the professional development of teachers and empowering them to respond effectively to contemporary educational challenges, as this is a key factor in improving education quality and ensuring sustainable educational impact.

Based on your exposure to different educational experiences, what key lessons or practices could be leveraged to develop higher education in the region?

One of the most important practices for advancing higher education in the region is strengthening student-centered learning approaches, which enhances students' active engagement and develops their critical thinking and independence. Embedding a culture of research and innovation within academic institutions is also essential for improving knowledge production and enhancing the quality of academic outcomes.

In addition, building effective partnerships between universities and various institutions, investing in faculty development, and aligning academic programmes with societal and labor market needs are key factors in improving the quality of higher education and ensuring its responsiveness to developmental changes.

Considering the growing use of technology and artificial intelligence in education, how do you see the role of Colleges of Education at universities in preparing teachers to effectively integrate these tools in classrooms?

Colleges of Education play a pivotal role in preparing future teachers considering the rapid expansion of technology and artificial intelligence in education. This involves equipping them with the knowledge and skills required to use these tools effectively within pedagogical practice. This role goes beyond technical proficiency to include a deeper understanding of how to integrate such tools into teaching strategies in ways that enhance student learning.

It also requires developing teachers' awareness of the ethical and professional dimensions associated with the use of artificial intelligence, ensuring responsible and safe application that adds educational value and contributes to improving learning outcomes and overall educational quality.

What priorities do you believe will shape the next phase of the College of Education, enhancing its role in preparing educators capable of making a real societal impact?

The key priorities for the next phase of the College of Education include further enhancing academic programmes in line with contemporary standards in teacher preparation, as well as strengthening educational research as a key driver for improving teaching practices and informing educational decision-making.

Other priorities include expanding partnerships with schools and educational institutions to strengthen the link between theory and practice, supporting innovation and the use of modern technologies in education, and preparing graduates with professional competence and adaptability to changing educational systems, enabling them to make a meaningful societal impact.

What message would you like to convey to students at the College of Education and young researchers aspiring to build an impactful academic and professional career?

I encourage them to embrace passion and a commitment to lifelong learning as the foundation of a successful academic and professional journey. I also urge them to take advantage of all available opportunities for academic and professional development and to actively engage in research as a means of understanding and improving reality.

At the same time, it is essential to uphold professional and ethical values, which form a cornerstone of the teaching profession, while recognizing that investment in knowledge and education is a long-term investment in the future of individuals and societies alike.

Dr. Kholoud, to begin, we would like to learn more about your academic and professional journey in pharmacy and precision medicine, as well as the key milestones that have shaped your scientific and research expertise.

My academic journey began with a strong interest in precision medicine and translational research aimed at improving treatment outcomes. After studying pharmacy and specializing in clinical pharmacy, I developed a deeper interest in why patients respond differently to the same medication, which led me to pharmacogenomics and precision medicine.

Throughout my career in clinical practice, academia, and research, I have bridged the gap between scientific discovery and healthcare application. A key milestone was becoming one of the early researchers in Qatar focusing on pharmacogenomics and translating it into clinical practice.

I have also received research grants in precision medicine and pharmaco-multi-omics, and contributed to national efforts to integrate genomics into healthcare.



Dr. Kholoud Mohammed Abdulla

Assistant Professor of
Pharmaceutical Sciences,
College of Pharmacy -
Qatar University

As one of the early and first Qatari specialists in pharmacogenomics, what motivated you to pursue specialization in clinical pharmacy and genomic medicine?

My motivation stemmed from a simple but important clinical observation: patients receiving the same medication often experience very different outcomes. Some achieve excellent therapeutic benefits, while others experience treatment failure or serious adverse drug reactions. Traditional prescribing approaches do not always account for these differences. Pharmacogenomics offered a powerful scientific framework to understand how genetic variations influence drug response and provided an opportunity to move beyond the “one-size-fits-all” approach to healthcare.

As the field evolved, I became increasingly interested integrating multiple layers of biological information, including genomics, metabolomics, microbiomics, and epigenetics, to better understand treatment response. This led me to focus on pharmacomultiomics, which I believe represents the next generation of precision medicine.

How do you describe your role in the Health Hackathon hosted by Qatar University, and what impact did this experience have on your future directions?

I have always been a strong believer in advancement, particularly in healthcare, where many of the challenges we face require creative, interdisciplinary, and technology-driven solutions. One of my aspirations has been to position Qatar University as a hub for healthcare transformation

by bringing together healthcare professionals, researchers, students, engineers, entrepreneurs, and industry experts to collaboratively address real-world healthcare challenges.

With this vision in mind, I had the privilege of leading and chairing one of the first health-focused hackathons in Qatar. The hackathon was designed to foster a culture of innovation, entrepreneurship, and multidisciplinary collaboration, providing participants with an opportunity to transform ideas into practical healthcare solutions. My role involved developing the vision of the event, building strategic partnerships, engaging mentors and experts, and creating an environment that encouraged creativity and problem-solving.

This experience further strengthened my belief that scientific research should be translated into practical solutions that improve patient care and enhance healthcare systems.

How do scientific hackathons contribute to enhancing research, innovation, and the development of the healthcare sector in the State of Qatar?

For me, the real value of a hackathon is that it pushes students to move from theory to action. In a short time, they learn how to define a problem, work with people from different backgrounds, accept feedback, and improve their ideas. This is exactly the kind of mindset we need to strengthen research and innovation in Qatar’s healthcare sector. These experiences also help foster a culture of innovation and encourage the development of new healthcare solutions that address real-world needs.

Turning Carbon into Opportunity: Breakthroughs in CO₂ Capture and Electrochemical Conversion



Dr. Abdul Hakeem Anwer,

Postdoctoral Fellow, Gas Processing Center, College of Engineering - Qatar University

Prof. Abdelbaki Benamor,

Research Professor, Department of Chemical Engineering and Gas Processing Center, College of Engineering, Qatar University

Prof. Mazen Khaled,

Acting Department Head of Chemistry and Earth Sciences, College of Arts and Sciences, Qatar University

Climate change is one of the defining challenges of our time. Carbon dioxide (CO₂), the primary greenhouse gas emitted from fossil fuel combustion, accounts for nearly three-quarters of global greenhouse gas emissions. While traditionally viewed as a polluting and unwanted by-product of industrial activity, scientists are increasingly exploring ways to transform CO₂ from a pollutant into a valuable resource.

Prof. Abdelbaki Benamor from the Gas Processing Center and his research team, in collaboration with Prof. Mazen Khaled from the College of Arts and Sciences, are leading an innovative project focused on developing a novel integrated electrochemical system for CO₂ utilization. The system is capable of capturing CO₂ and converting it into valuable products such as syngas, a mixture of hydrogen (H₂) and carbon monoxide (CO) widely used in the chemical and energy industries.

This research represents an important step toward building a circular carbon economy where industrial emissions are reused rather than released into the atmosphere.

From Waste Gas to Valuable Resource

CO₂ is emitted in large quantities from power plants, natural gas processing facilities, and other industrial operations, with estimated global emissions of approximately 44 Gt annually, including about 56 million tons emitted yearly in Qatar. Traditionally, carbon capture technologies absorb CO₂ using chemical solvents (or sorbents) and later release it to the atmosphere through an energy-intensive regeneration process.

The innovative approach developed at Qatar University integrates two traditionally separate processes- CO₂ capture and CO₂ conversion- into a single electrochemical system, as shown in Figure 1. Instead of releasing the captured CO₂ through heating, the system directly converts it into useful chemical products within the same solvent medium.

This integration offers several advantages:

- Reduced energy consumption by eliminating the desorption step.
- Lower operational costs for carbon capture systems.
- Direct production of valuable chemicals from captured carbon.

Such advances could significantly improve the economic feasibility of carbon capture technologies worldwide.

How the Integrated System Works

The research project proposes a system where CO₂ is first absorbed into a chemical solvent, typically an amine-based capture solution, which is widely used in industrial gas treatment processes. Once absorbed, the CO₂ is transported to an electrochemical reactor where specially designed catalysts trigger its transformation into valuable products.

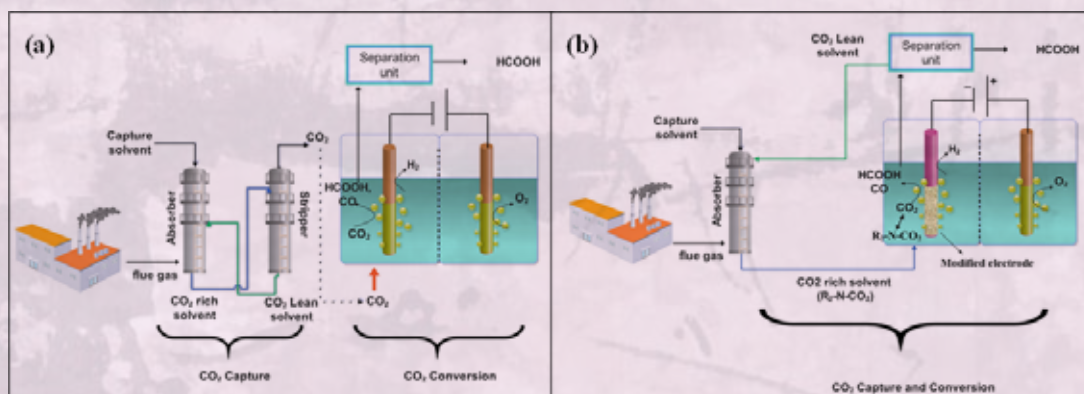


Figure 1: A schematic representation of two different CCU technology approaches: (a) a separate process where CO₂ capture and conversion take place independently, and (b) the proposed integrated approach that merges both steps. In the integrated system, R₂-N-CO₂ signifies CO₂ captured in an amine solution, existing in the form of either bicarbonate or carbamate species.

The process involves three main stages:

1. CO₂ Absorption

CO₂ from industrial sources dissolves in an amine-based solvent, forming intermediate chemical species such as carbamates and bicarbonates.

2. Electrochemical Conversion

Within an electrochemical reactor, catalysts facilitate reactions that convert CO₂ into carbon monoxide (CO) and hydrogen (H₂).

3. Syngas Formation

The mixture of CO and H₂ forms syngas, a key feedstock used to produce fuels, chemicals, and synthetic hydrocarbons.

This integrated process enables continuous CO₂ capture and conversion within the same system.

Research Process for the Integrated CO₂ Capture and Conversion System

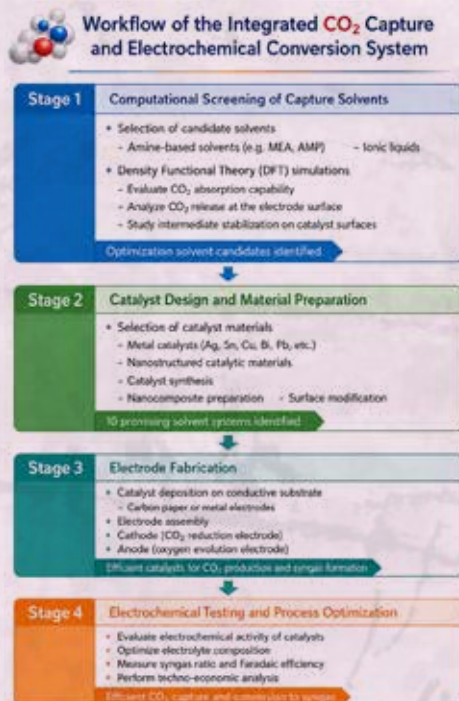


Figure 2: Schematic workflow illustrating the overall research strategy.

The workflow illustrated in Figure 2 presents the research strategy starting with computational

solvent screening using density functional theory (DFT), followed by catalyst design, electrode fabrication, and electrochemical testing to optimize CO₂ conversion efficiency and syngas production.

Designing the Catalysts of the Future

At the heart of this technology are advanced electrocatalysts developed by the research team. These materials accelerate chemical reactions while maintaining selectivity toward the desired products.

The research focuses on developing several innovative catalytic materials, including:

- Single-atom nickel catalysts supported on graphene oxide.
- Copper-based metal oxide catalysts with mesoporous structures.
- Hybrid catalysts engineered to improve activity and selectivity.

These materials are designed to achieve:

- High catalytic activity.
- High Faradaic efficiency toward syngas production.
- Long-term operational stability.

Experimental evaluation involves advanced techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM), XPS, and electrochemical testing to ensure that the catalysts maintain their performance under real operating conditions.

Combining Experiment with Advanced Simulation

One of the unique strengths of this project lies in the integration of computational modeling and experimental research. Before testing solvents and catalysts in the laboratory, researchers perform quantum-mechanical simulations using Density Functional Theory (DFT) to screen potential materials and electrolytes.

These simulations help identify:

- The most promising CO₂ capture solvents.
- Optimal catalyst–solvent interactions.
- Reaction pathways and energy barriers.

This combined computational and experimental approach accelerates discovery and reduces the time required to develop efficient systems.

Laboratory Experiments and Results

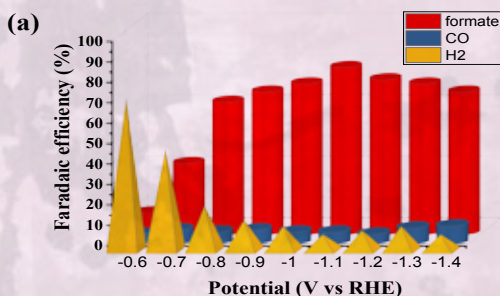
Recent laboratory studies have demonstrated encouraging progress in the electrochemical conversion of CO₂ into valuable chemicals. A dendritic bimetallic electrode, synthesized through controlled electrodeposition, showed excellent performance for converting CO₂ into formate, achieving a Faradaic efficiency of 86.5% and a partial current density of -27.3 mA cm⁻² at -1.1 V vs. RHE.

This remarkable activity is attributed to its unique dendritic nanostructure and optimized PbSn interface, which enhances electron transfer and stabilizes key reaction intermediates while suppressing the competing hydrogen evolution reaction as shown in Fig. 3a.

In parallel investigations, Ni-doped SrTiO₃ catalysts have also demonstrated promising activity for CO production in CO₂-saturated MEA solutions, delivering a current density of approximately -46 mA cm⁻² at -1.0 V with high Faradaic efficiency and low charge-transfer resistance.

These findings highlight the critical role of advanced catalyst design and electrolyte optimization in improving CO₂ electro-reduction performance, as shown in Fig 3b.

Building on these results, ongoing research aims to further refine catalyst structures and reaction conditions to achieve even higher efficiencies and improved selectivity toward valuable products such as formate and syngas, which are important feedstocks for sustainable fuels and industrial chemicals.



Toward the Next Generation of Carbon Technologies

Beyond laboratory experiments, the research team is also evaluating the economic feasibility of the proposed system. Using process modeling and techno-economic analysis, the researchers aim to determine:

- Capital and operating costs.
- Energy efficiency.
- Scalability for industrial implementation.

These studies will help move the technology toward Technology Readiness Level (TRL-5), bringing it closer to real-world deployment.

Looking Ahead

The work led by Prof. Abdelbaki Benamor represents an exciting step toward transforming CO₂ from an environmental challenge into a valuable resource. By integrating capture and conversion technologies into a single process, the project could open new pathways for sustainable chemical production and carbon management. As global efforts intensify to reduce emissions, innovations like these demonstrate how advanced science and engineering can turn environmental challenges into opportunities for innovation and economic growth.

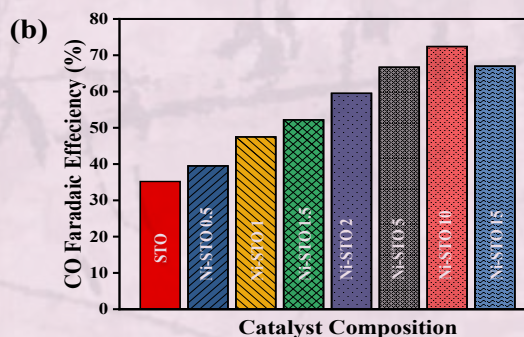


Figure 3: Faradaic efficiency in a CO₂-saturated electrolyte: (a) bimetallic Pb/Sn catalysts and (b) Ni-doped SrTiO₃ with varying weight ratios.



Stepping into the Future: Smart Footwear, Robotic Tracking, and AI for Next-Generation Rehabilitation

Prof. Uvais Ahmed Qidwai,

Professor of Computer Engineering, College of Engineering, Qatar University

Dr. Noora Al-Qahtani,

Research Assistant Professor, Center for Advanced Materials (CAM), Office of the VP for Research and Innovation (VPRI), Qatar University

Dr. Ajimsha Sharafudeen,

Physician, Hamad Medical Corporation

Mr. Abdullah Almubark,

Student, Department of Mechanical and Industrial Engineering, College of Engineering, Qatar University

Rehabilitation is often described as a journey—one marked by persistence, gradual progress, and deeply personal milestones. Yet despite its importance, the way we measure recovery has long remained limited, relying on brief clinical observations and specialized laboratory assessments that capture only fragments of a patient's progress.

Today, researchers at Qatar University are reshaping this landscape. By combining wearable technology, robotics, and artificial intelligence, they are creating a new paradigm—one where every step a patient takes can be measured, understood, and improved in real time.

At the heart of this transformation are two pioneering innovations: SHIBBY and MESHY. Together, they form an integrated, intelligent system that captures human movement from both within the body and across the surrounding environment—offering an unprecedented, holistic view of gait and rehabilitation.

Reimagining Rehabilitation: From Snapshots to Continuous Insight

Traditional rehabilitation assessment methods are often episodic. Patients visit clinics periodically, where clinicians evaluate their progress using visual observation or specialized equipment. While effective to a degree, these methods provide only isolated snapshots of recovery, missing the continuous and dynamic nature of human movement.

The vision behind SHIBBY and MESHY is fundamentally different. It shifts rehabilitation from a series of disconnected assessments to a continuous, data-driven journey, where progress is monitored in real time, and insights are always within reach.

This transformation is not merely technological—it is conceptual. It redefines rehabilitation as an ongoing, intelligent process that adapts to each patient's unique needs.

SHIBBY: Intelligence Embedded in Every Step

At the core of the wearable system is SHIBBY, a compact multi-sensor smart insole designed to fit seamlessly within customized footwear. Though small, it represents a significant leap in rehabilitation technology (Figure 1).

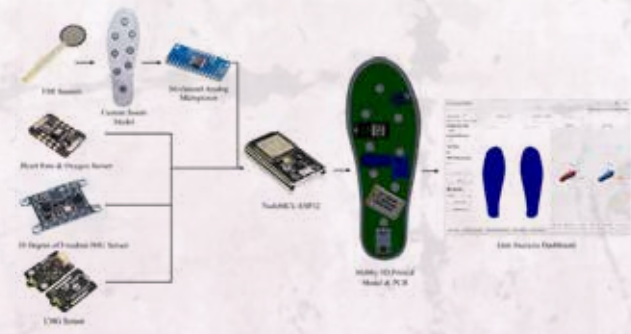


Figure 1: The SHIBBY smart insole.

Embedded within SHIBBY is an array of force-sensitive sensors that continuously map how the foot interacts with the ground. With each step, the system captures detailed information about plantar pressure distribution, revealing how weight is transferred, how balance is maintained, and how symmetry evolves (Figure 2).

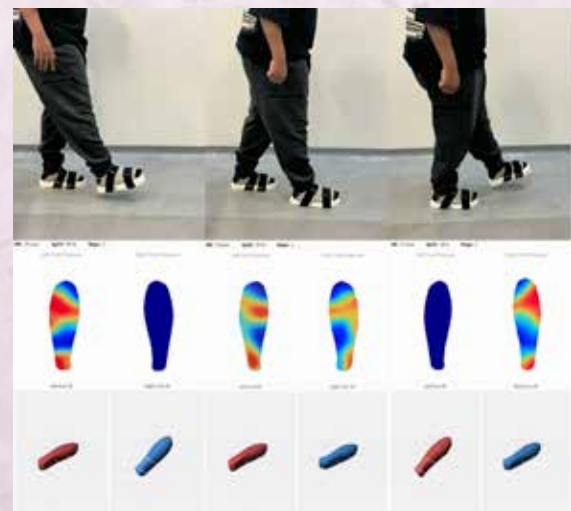


Figure 2: Foot pressure distribution captured by SHIBBY.

These measurements are critical in rehabilitation, particularly for patients recovering from conditions such as stroke, injury, or mobility impairments.

But SHIBBY goes further.

It integrates multiple sensing modalities, including:

- Inertial motion tracking to capture movement dynamics
- Heart rate monitoring to assess physiological response
- Electromyographic signals to measure muscle activation

Together, these data streams provide a rich, multidimensional picture of human movement—linking biomechanics with physiological function (Figure 3).

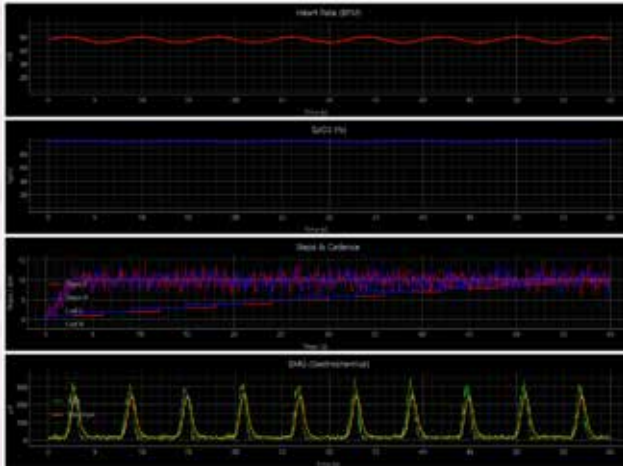


Figure 3: Integrated data streams linking biomechanics and physiological function.

All data is transmitted wirelessly to an interactive digital dashboard, where clinicians can visualize:

- Step patterns and cadence
- Load distribution and balance
- Muscle activity and cardiovascular response

What was once complex and difficult to interpret is now presented as clear, actionable insights. This empowers clinicians to make more informed decisions and enables continuous monitoring beyond the confines of traditional laboratory settings.

MESHY: Seeing Movement in Space

While SHIBBY captures what happens within the body, MESHY provides an equally powerful external perspective.

MESHY is an autonomous, LiDAR-based robotic platform designed to follow patients as they walk naturally. Using advanced laser scanning technology, it continuously tracks position and movement with remarkable spatial accuracy (Figure 4).

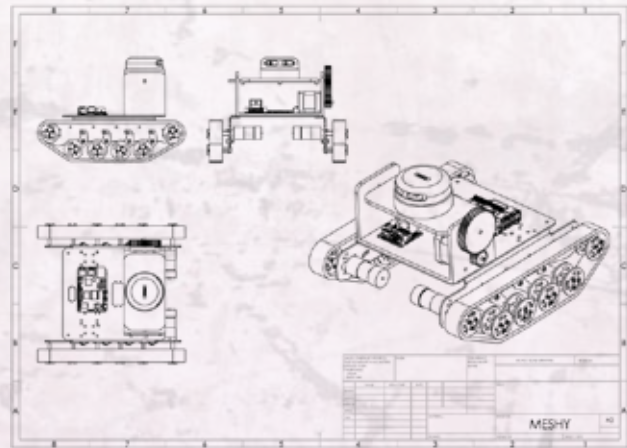


Figure 4: MESHY robotic system for patient movement tracking.

As patients move, MESHY reconstructs their walking trajectory in real time (Figure 5), generating key performance metrics such as:

- Total walking distance
- Path consistency
- Lateral drift
- Overall movement stability

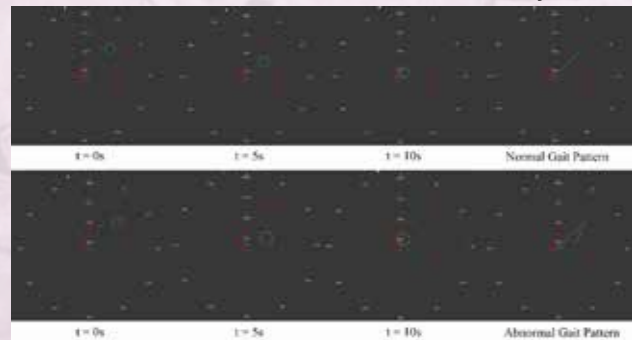


Figure 5: MESHY real-time gait trajectory tracking.

Yet its capabilities extend far beyond simple tracking. Through a rotating LiDAR system, MESHY creates a dynamic three-dimensional representation of the patient in motion (Figure 6). This enables detailed analysis of complex gait characteristics, including:

- Postural alignment
- Trunk sway
- Stride variability
- Limb coordination

These are subtle yet critical indicators of recovery—often difficult to quantify using conventional tools. By capturing them with precision, MESHY provides a deeper, more nuanced understanding of how patients move and improve over time.

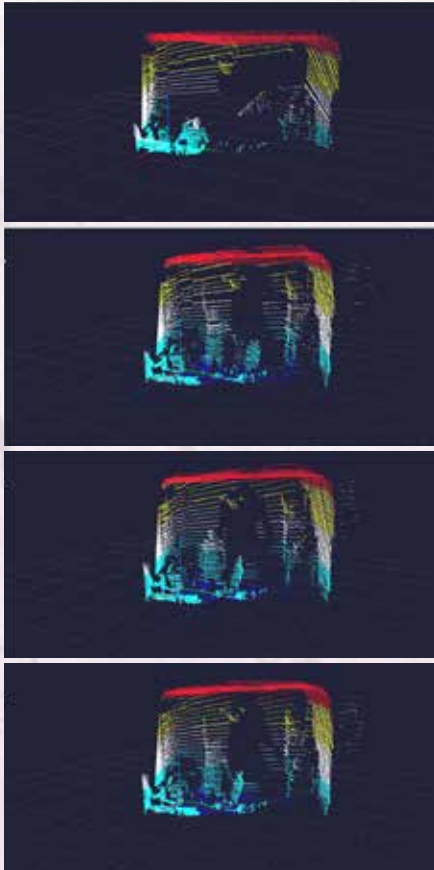


Figure 6: 3D patient motion model created by MESHY.

A Unified Vision: Where Data Meets Understanding

Individually, SHIBBY and MESHY are powerful tools. Together, they create something far greater: a unified system that bridges the internal and external perspectives of human movement.

By synchronizing wearable sensor data with spatial trajectory mapping, the system delivers a dual-perspective model of gait. It connects what is happening inside the body—muscle activation, pressure distribution, physiological response—with what is observed externally—movement patterns, posture, and spatial stability.

This integration marks a significant step forward in rehabilitation science. It allows clinicians to move beyond isolated measurements and toward a holistic, data-driven understanding of recovery.

In this model, every step is no longer just recorded—it is interpreted, analyzed, and transformed into meaningful insight.

Accessible Innovation: From Clinics to Homes

A key strength of the SHIBBY–MESHY system lies in its accessibility. Unlike traditional laboratory-based systems, which are often expensive and location-bound, this integrated solution is designed to be:

- Portable
- Cost-effective
- Scalable

This makes it suitable not only for clinical environments, but also for supervised home use. Patients can be monitored more frequently and consistently, without the need for constant hospital visits.

Such accessibility opens the door to personalized rehabilitation pathways, where treatment plans evolve based on real, continuous data rather than occasional assessments.

Shaping the Future of Healthcare

As healthcare systems worldwide move toward digital transformation, innovations like SHIBBY and MESHY highlight what the future can look like: intelligent, connected, and centered on the patient.

This work also reflects the strength of interdisciplinary collaboration. By bringing together expertise in engineering, medicine, and applied sciences, the research team has created a solution that is both technologically advanced and clinically meaningful.

The involvement of students further underscores the importance of education in driving innovation. Through hands-on participation, the next generation of engineers and researchers is gaining the skills needed to tackle complex healthcare challenges.

Conclusion: Every Step, Measured and Understood

Rehabilitation is no longer confined to clinics or defined by occasional assessments. With SHIBBY and MESHY, it becomes a continuous, intelligent process—one that captures the full complexity of human movement.

In this new paradigm, data is not just collected; it is translated into understanding. Progress is not just observed—it is quantified and guided.

And most importantly, every step a patient takes becomes part of a larger story of recovery—one that can be measured, supported, and ultimately transformed.

In this future, every step is not only taken—but truly understood.

Designing Smarter Structures: From Topology Optimization to 3D Printing

Dr. Vagelis Plevris

Associate Professor, Department of Civil
and Environmental Engineering, College of
Engineering – Qatar University

Look carefully at a tree. Its trunk does not taper evenly from top to bottom; it thickens precisely where it needs to resist bending and splits into branches exactly where loads diverge. There is no wasted wood and no redundant material, only structure shaped by force. Now imagine applying that same principle to the beams, columns, and canopies of civil engineering. That is the promise of topology optimization, which formed the central focus of a recently completed research project at Qatar University.

In Qatar, where rapid infrastructure development meets a growing national commitment to sustainability, the question of how to build more with less material is not abstract. It is directly aligned with Qatar University's research priorities in Resource Sustainability and Digital Technology, and with Qatar's broader vision for efficient, innovation-driven development.

This idea is not only theoretical. The Qatar National Convention Centre, designed by the Japanese architect Arata Isozaki, is supported by a pair of enormous branching concrete columns inspired by the Sidra tree, Qatar's national symbol. The columns divide and subdivide in precisely the pattern that structural logic demands: widening where forces are greatest, branching where loads split. The result is a building that looks organic because it is structurally honest. What topology optimization



does is take that same intuition and make it computational, applicable to every beam, frame, and canopy we design.

What Is Topology Optimization?

In conventional structural design, an engineer starts with a shape, such as a rectangular beam or a solid column, and checks whether it is strong enough. Topology optimization reverses this logic. Given a space, a set of loads, and a target for how much material to use, the algorithm decides for itself where that material should go. As a result, material gathers along the paths that carry force and vanishes from regions that do not contribute to structural performance. The

structures that emerge look organic, almost biological, because they are governed by the same mechanical logic that shapes bones and shells.

This approach is not new in aerospace engineering, where every gram saved translates directly to performance and cost. But its systematic application to civil engineering structures, with a clear connection to how those structures can actually be built, remains an open frontier.

The Project: From Simple Beams to a Parking Shade

The project, titled “Empowering Research in Structural Engineering through Topology Optimization and Additive Manufacturing: A Hands-On Approach”, was funded by the Qatar National Research Fund through the Undergraduate Research Experience Program (UREP). It ran from January 2025 to January 2026 and involved six undergraduate students alongside academic mentors from the Department of Civil and Environmental Engineering.

The team investigated four structural systems of progressively increasing complexity: a cantilever

beam, a simply supported beam, a parking canopy element subjected to combined forces and moments, and finally a full three-dimensional parking shade structure—a configuration directly relevant to Qatar’s built environment.

For each structure, the team first established a reference design: a conventional solid geometry analyzed under realistic loading. Topology optimization was then applied, progressively reducing the amount of retained material from 70% down to 30% of the original volume, while tracking how structural performance responded to each reduction.

The Results: How Much Can You Remove?

The results were consistent and revealing across all cases. Material reductions of 40–50% were achievable without compromising structural safety or exceeding acceptable deformation limits. The algorithm reliably identified which parts of the structure were doing real work and which were not.

But the relationship between material reduction and structural performance is not linear. Moderate reductions (removing 30 to 40% of material) yield the most attractive trade-off: meaningful savings

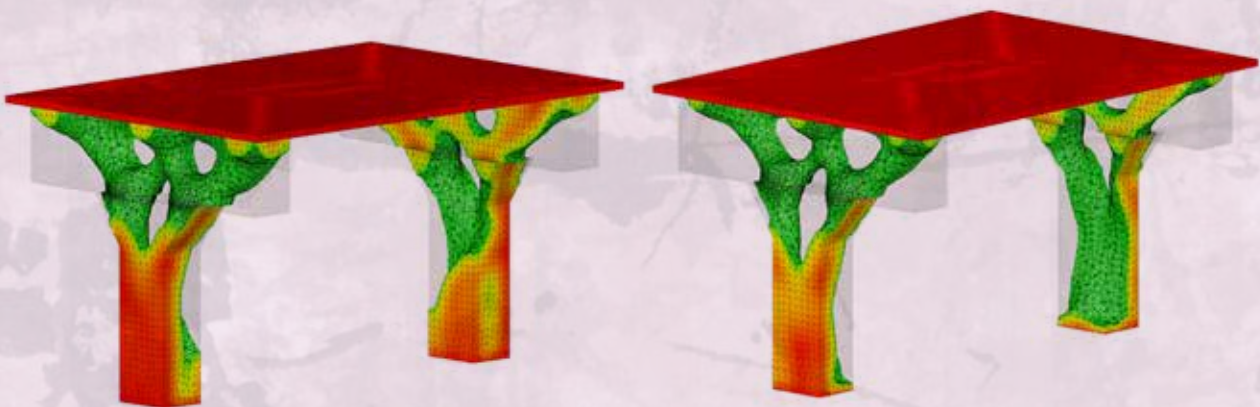


Figure 1: Topology optimization results for a 3D parking shade structure. At 60% retained mass (left) and 50% (right), material concentrates along dominant load-carrying paths while low-stress regions are hollowed out, producing organic, tree-like column forms.

with modest increases in stress and deflection. Push the reduction further, and the structure begins to strain. Safety margins narrow sharply, and deformations climb. The message from the data is clear: there is a sweet spot, and finding it requires careful analysis rather than aggressive optimization.

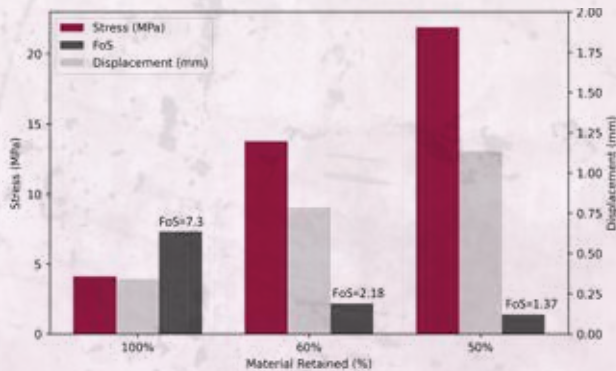


Figure 2: Structural performance of the parking shade structure at different levels of material reduction. As retained mass decreases from 100% to 50%, stress increases, displacement grows, and the factor of safety (FoS) drops, illustrating the trade-off that must be managed in practice.

From Screen to Object: The Role of 3D Printing

Topology-optimized geometries are often impossible to build using conventional fabrication methods. A structure shaped by load paths rather than straight lines cannot easily be cast in a mold or cut from a sheet. This is where additive manufacturing becomes essential. It imposes no geometric constraints: any form the algorithm generates can be printed, layer by layer, exactly as designed.

The team fabricated both the conventional and optimized versions of selected structures using polymer-based 3D printing. The physical models make the difference immediately visible in a way that no chart can: one version is blocky and uniform; the other is hollowed out and branching, carrying the same load with a fraction of the material.

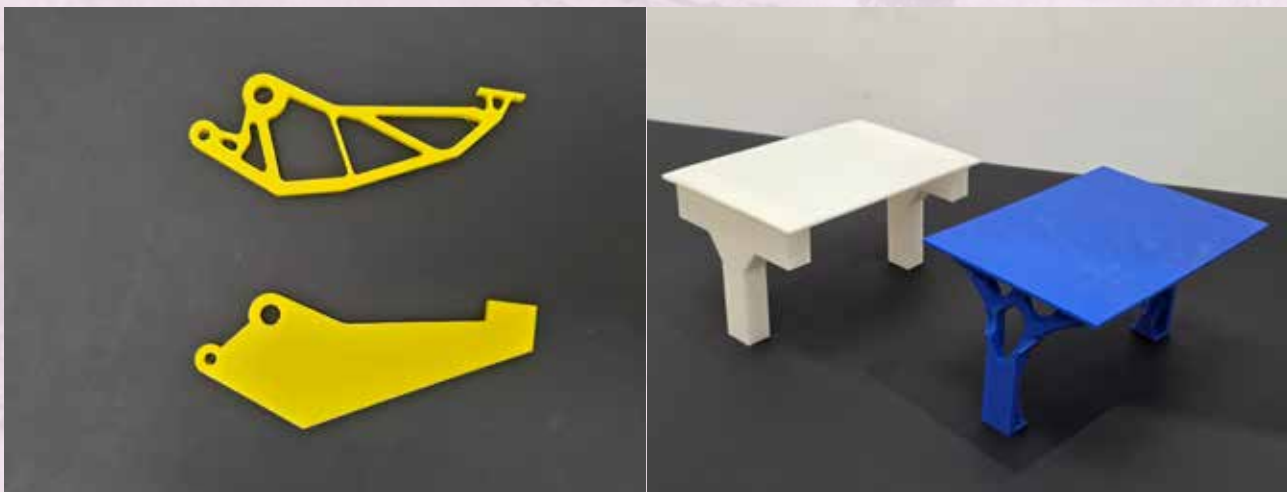


Figure 3: Physical prototypes produced by 3D printing. Left: the beam, showing the solid baseline (bottom) compared with the lightweight optimized design (top). Right: the parking shade structure: conventional solid design (white) beside the topology-optimized version (blue), with its characteristic branching column form.

To confirm that the results were not artifacts of a single software platform, the team ran parallel implementations: Autodesk Fusion 360 for commercial optimization, and custom MATLAB code for an independent algorithmic check. The two approaches agreed closely.

Learning by Doing: The UREP Experience

The UREP program is built on a straightforward but powerful idea: undergraduate students learn research by doing research. Over twelve months, the six students moved through the complete arc of a research investigation, from building computational models and running simulations to writing code and producing a physical object they had designed, optimized, and 3D-printed.

That last step—holding the object—matters more than it might seem. Abstract concepts like load paths and factors of safety become tangible when you can compare two printed structures that look radically different but carry the same load. The students developed proficiency in professional CAD and finite element software, in programming and algorithm implementation, and in the practical

realities of digital fabrication. They also learned how to work as a team, interpret data, and communicate technical findings, skills that will serve them well beyond any single project.

A New Way of Thinking About Structure

Topology optimization and additive manufacturing are not futuristic technologies; they are already available today. Qatar's infrastructure ambitions are large, and so is the opportunity to embed efficiency and sustainability into how structures are conceived from the outset. This project is a modest but concrete step in that direction, and it provides evidence that the next generation of engineers at Qatar University is already learning to build not just stronger structures, but smarter ones.

Acknowledgment

This project (UREP31043-2-139-) was made possible by a UREP award from the Qatar National Research Fund (QNRF), a member of Qatar Foundation. The findings are the sole responsibility of the authors.



Desert Power:

How Qatari Shale Rocks Are Revolutionizing Renewable Energy Materials

Prof. Khaled Youssef

Professor of Nanotechnology, Department of Physics and Materials Science, College of Arts and Sciences - Qatar University

In a world constantly searching for sustainable energy solutions, a remarkable discovery from Qatar University is attracting widespread attention. Researchers have found a way to significantly improve the performance of materials that convert waste heat into electricity, using an unlikely ingredient — common Qatari desert shale. This innovation could pave the way for cheaper and more widespread use of technology that harvests energy from sources all around us, from the heat of a car engine to the warmth of industrial machinery.

The technology at the heart of this research is thermoelectricity. Thermoelectric materials have a unique ability: when one side of the material is heated and the other is kept cool, they generate an electrical voltage. This effect can be harnessed to create devices that act as solid-state power generators, capturing heat that would otherwise be lost and turning it into useful electricity. For decades, a major hurdle for this technology has been the high cost and complicated manufacturing processes associated with the best-performing materials. The most effective additives used to boost their performance, such as graphene or carbon nanotubes, are expensive and difficult to produce on a large scale.



This is where the Qatari innovation comes in. The research team, led by Prof. Khaled Youssef at the Materials Science and Technology Graduate Program, Department of Physics and Materials Science, turned their attention to a material abundant in Qatar's Dukhan region: Eocene Midra Shale (EMS) (Figure 1). This unassuming shale, a type of clay rock, is a major component of Qatar's hydrocarbon reservoirs. What makes it special is its microscopic structure. It naturally contains tiny, needle-like nanofibers of the mineral palygorskite, along with other mineral flakes such as dolomite and illite (Figure 2).

The researchers had a groundbreaking idea: what if this low-cost, natural nanomaterial could replace the expensive, synthetic ones? They decided to test their theory by mixing a tiny amount of crushed EMS powder with a well-known thermoelectric alloy, $\text{Bi}_{2.2}^{\cdot 55}\text{Te}_{0.45}\text{Se}_{0.45}$. They prepared several batches, each with a different, very small

percentage of the shale, and pressed them into small pellets. The team found that adding a minuscule amount of the shale—just 0.05% of the total weight— resulted in a significant improvement. This small addition enhanced the material’s overall thermoelectric performance, measured by a key indicator called the “figure of merit” (ZT), by an impressive 19% compared to the pure alloy.

The secret to this success lies in the unique synergistic effect of the shale’s diverse mineral composition. The long, thin palygorskite nanofibers created perfect microscopic “highways,” allowing charge to flow more easily and improving conductivity. Simultaneously, the other irregular mineral flakes acted as disruptive “roadblocks” for heat, scattering heat waves (phonons) and lowering the material’s thermal conductivity. Improving electrical conductivity while reducing thermal conductivity is the goal in thermoelectric material design, a feat rarely achieved with a single additive.

Even more striking was the fact that the performance of their shale-enhanced composite surpassed that of other composites they created under the same conditions, using high-cost additives such as graphene, MXene, and carbon nanotubes. This demonstrates that the available Qatari shale is not just a cheaper alternative, but a better-performing one.

This breakthrough highlights the immense potential of using abundant, natural materials for advanced technological applications. By leveraging the unique properties of the Eocene Midra Shale, the researchers have created a pathway to make thermoelectric devices more economically viable and scalable. This could accelerate their adoption across various fields, from powering wireless sensors and wearable

electronics to recovering waste heat in the automotive and aerospace industries. This study is a powerful testament to how local natural resources can provide sustainable solutions to global energy challenges.



Figure 1: Qatari Eocene Midra Shale (EMS) in Dukhan region.

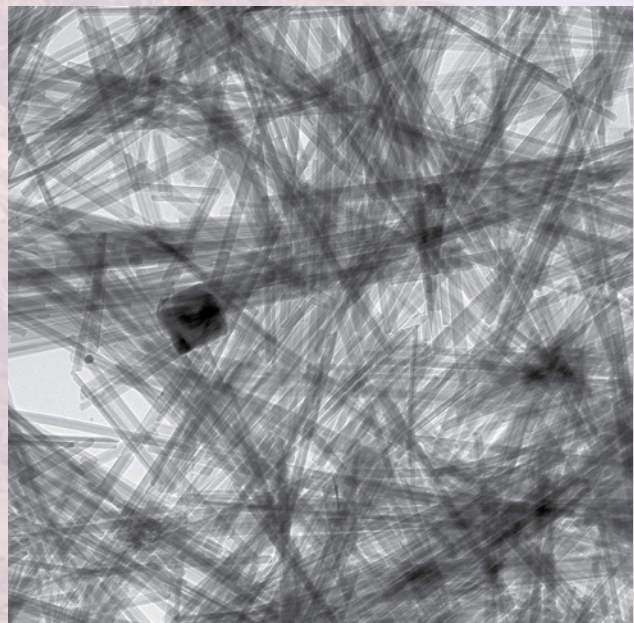


Figure 2: TEM image showing the nanostructure of the Qatari desert Eocene Midra Shale (EMS).

For more information about this research discovery, scan the QR code:



From Sunlight to Clean Hydrogen: A Qatar–Oman Research Collaboration Advancing Sustainable Energy

Prof. Majeda Khraisheh,

Professor of Chemical Engineering, Department
of Chemical Engineering, College of Engineering
- Qatar University

Collaborator: Prof. Rengaraj Selvaraj,

Professor of Analytical and Applied Environmental
Chemistry, Department of Chemistry, College
of Science, Sultan Qaboos University, Muscat,
Oman.

The global energy demand continues to grow rapidly as populations expand and economies develop. At the same time, concerns about climate change and environmental sustainability are pushing governments, industries, and researchers to rethink how energy is produced. Fossil fuels such as coal, oil, and natural gas have powered modern society for more than a century, but their environmental impact has become increasingly clear. As a result, the search for cleaner and more sustainable energy alternatives has become one of the most important scientific challenges of our time.

Among the many renewable energy solutions currently under investigation, hydrogen has emerged as one of the most promising candidates for the future energy system. Hydrogen is often referred to as a clean fuel because the only by-product produced during its use in fuel cells or combustion systems is water. In addition, hydrogen has a very high energy density, meaning



it can store and deliver large amounts of energy efficiently. These characteristics make hydrogen particularly attractive for applications ranging from transportation to electricity generation and energy storage.

Despite these advantages, the production of hydrogen remains a significant challenge. Today, most hydrogen is produced using fossil fuel-based

methods such as steam methane reforming, which releases large amounts of carbon dioxide. To fully realize hydrogen's potential as a clean energy carrier, scientists must develop new technologies capable of producing hydrogen in environmentally friendly ways. One of the most promising approaches is solar-driven photocatalysis, a process that uses sunlight and specialized materials to split water molecules into hydrogen and oxygen.

Photocatalysis relies on materials known as photocatalysts, which absorb light and use its energy to trigger chemical reactions (Figure 1). When sunlight strikes a photocatalyst, electrons within the material become excited and move to higher energy states. These excited electrons can then participate in chemical reactions that split water molecules and produce hydrogen gas. Because this process uses sunlight as the energy source and water as the raw material, it

offers a highly sustainable pathway for hydrogen production.

Carbon-based nanomaterials have attracted significant attention in energy and environmental research due to their unique electrical, optical, and catalytic properties. These materials can be classified according to their dimensional structure, including zero-dimensional (0D), one-dimensional (1D), and two-dimensional (2D) nanostructures. As illustrated in Figure 2, examples of these materials include carbon dots and fullerenes (0D), carbon nanotubes and carbon nanofibers (1D), and graphene and graphitic carbon nitride (2D). Each class of nanomaterials exhibits distinct structural characteristics that influence how electrons move through the material and how efficiently light energy can be utilized in photocatalytic reactions. Because of these properties, carbon nanomaterials are widely explored for applications in solar energy conversion, hydrogen production, sensing, and environmental remediation.

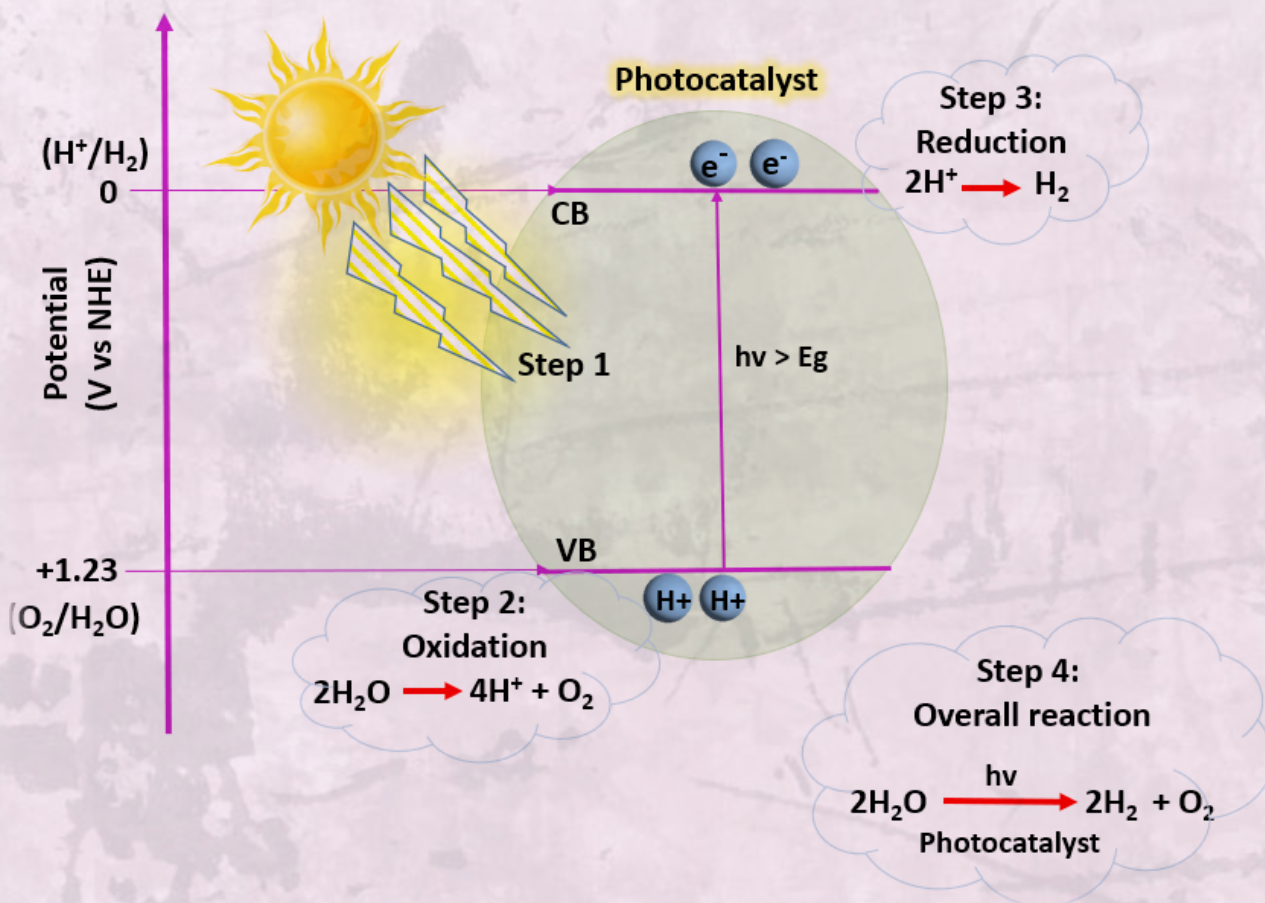


Figure 1: Schematic diagram showing the mechanism of hydrogen production using photocatalytic water splitting.

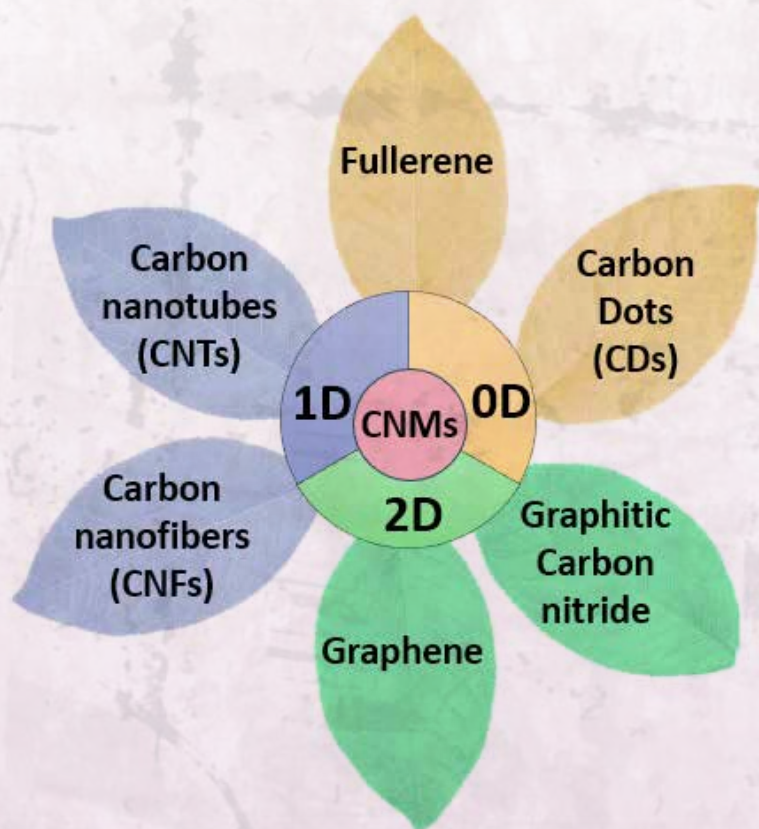


Figure 2: Dimensional classification of carbon nanomaterials.

The study focused on combining two well-known semiconductor materials: titanium dioxide (TiO_2) and graphitic carbon nitride ($\text{g-C}_3\text{N}_4$). Titanium dioxide is one of the most widely used photocatalysts because it is chemically stable, inexpensive, and environmentally friendly. However, it mainly absorbs ultraviolet light, which represents only a small fraction of sunlight that reaches the Earth's surface. Graphitic carbon nitride, on the other hand, can absorb visible light more effectively but suffers from rapid recombination of charge carriers, which reduces its catalytic efficiency.

To address these limitations, the researchers engineered a hybrid structure known as a heterojunction, in which

However, designing photocatalysts that are both efficient and stable remains a major scientific challenge. Many conventional photocatalysts either absorb only a small portion of the solar spectrum or experience rapid recombination of electrons and holes before the chemical reaction can occur. Overcoming these limitations requires the development of new materials and innovative strategies for improving light absorption and charge transfer.

In this context, researchers from Qatar University and Sultan Qaboos University in Oman collaborated on a research project aimed at developing advanced photocatalytic materials for hydrogen production. The project was supported by the Qatar University Internal Research Collaboration Grant (IRCC), which promotes scientific cooperation between Qatar University and international research partners. By combining expertise in materials science, nanotechnology, and chemical engineering, the research team sought to design a photocatalyst capable of efficiently producing hydrogen using natural sunlight.

nanoscale particles of titanium dioxide are anchored onto thin layers of graphitic carbon nitride. This design allows the two materials to work together in a complementary way. When sunlight excites electrons within the photocatalyst, the heterojunction structure promotes efficient movement of these electrons between the two materials, reducing energy losses and enhancing the photocatalytic reaction.

An additional innovation in the research was the use of a green synthesis approach for producing the titanium dioxide nanoparticles. Instead of using conventional chemical additives, the researchers employed a natural plant extract derived from Moringa leaves as a template during the synthesis process (Figure 3). This environmentally friendly method not only reduces the use of potentially harmful chemicals but also helps control the size and distribution of the nanoparticles, improving the overall performance of the photocatalyst.

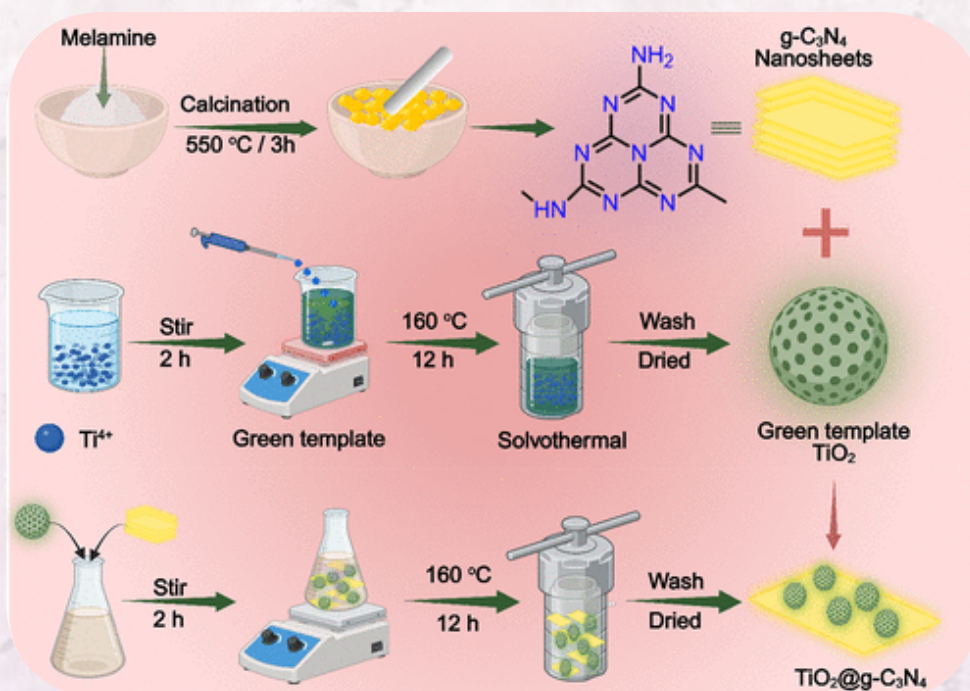


Figure 3: Schematic Illustration of the Synthesis of (g-C₃N₄), (Green TiO₂), and TiO₂@g-C₃N₄ Nanoheterojunction Photocatalysts.

The newly developed material was tested under natural sunlight to evaluate its ability to produce hydrogen. The results demonstrated a significant improvement compared with the individual materials used alone. The hybrid TiO₂@g-C₃N₄ photocatalyst produced hydrogen at a rate far higher than that achieved by either titanium dioxide or graphitic carbon nitride individually. This improvement is attributed to the strong interaction between the two materials, which enhances light absorption and facilitates efficient separation of photogenerated charges.

Another important aspect of the research is the stability of the photocatalyst. For practical energy applications, catalytic materials must maintain their performance over repeated reaction cycles. The experiments showed that the TiO₂@g-C₃N₄ heterostructure remains stable during multiple hydrogen production cycles, demonstrating its potential for long-term use in solar hydrogen generation systems.

Beyond the scientific findings, this project highlights the importance of international collaboration in advancing sustainable technologies. The partnership between Qatar University and Sultan Qaboos University brought together complementary expertise and resources, enabling the team to tackle complex research

challenges and develop innovative solutions. Such collaborations are essential for addressing global issues such as climate change and energy sustainability.

The research also reflects Qatar University's broader commitment to supporting cutting-edge research that contributes to global sustainability goals. By investing in innovative energy technologies and fostering collaboration with international partners, the university plays an important role in advancing scientific knowledge and developing solutions for the energy challenges of the future.

Looking ahead, further research will focus on improving the efficiency of photocatalytic materials and scaling up these technologies for real-world applications. While significant challenges remain, advances in materials science and nanotechnology continue to bring the vision of solar-driven hydrogen production closer to reality.

Harnessing sunlight to produce clean hydrogen fuel represents a powerful opportunity to transform the global energy landscape. Through continued innovation and collaboration, research initiatives such as this one are helping pave the way toward a more sustainable and environmentally responsible energy future.



Interview with an Inventor

Prof. Alaaldin Mohammad Alkilany

Professor of Pharmaceutics & Nanotechnology | CPH Research Coordinator
College of Pharmacy – Qatar University

The true value of scientific research goes beyond discovery; it lies in turning knowledge into real benefits for people and society. In this interview, Prof. Alaaldin Mohammad Alkilany, Professor of Pharmaceutics and Nanotechnology at Qatar University's College of Pharmacy, shares his philosophy of innovation and why translating science into practical solutions matters.

To begin, Prof. Alkilany, could you tell us about yourself and the key milestones that have shaped your career as a researcher and inventor?

I am a Professor of Pharmaceutics and Nanotechnology at the College of Pharmacy, Qatar University, where I also serve as the College's Research Coordinator. I earned my BSc in Pharmacy from Jordan University of Science and Technology and my PhD from the University of Illinois in 2006, followed by a postdoctoral fellowship at the University of Georgia, USA. My career has combined pharmaceutical product development in industry—within FDA-approved international companies—with academic research, leading me to focus on translational innovations in nanotechnology and drug delivery.

Among the milestones I am most proud of is my contribution to Q-Silvano® Gel, the first pharmaceutical product developed and commercialised from concept to market through a collaboration between Qatar University and a Qatari partner, QLife Pharma. I am also filing several innovation disclosures and patents. My research has been recognised internationally, including my listing among the top 2% most-cited scientists worldwide and the prestigious Alexander von Humboldt Fellowship in Germany.

What drives you to translate scientific research outcomes into innovations and applicable products?

My focus is on bridging the gap between advanced research and real, practical impact. Academic publication matters for advancing knowledge, but my ultimate goal is to translate the pharmaceutical sciences into products and solutions that meet real clinical and societal needs. This may mean safer, more effective wound-care products, gentler therapeutic alternatives for children, or solutions to

specialised challenges in veterinary medicine. I believe in “bench-to-bedside” and “bench-to-market” approaches: every project is a chance to design a solution that makes a direct, meaningful difference in people's lives.

Q-Silvano® Gel is one of your most prominent innovations and an important milestone for Qatar. Could you tell us about its concept and impact?

Q-Silvano® Gel is an advanced hydrogel enriched with silver nanoparticles, designed to treat complex wounds such as burns, traumatic injuries, and diabetic foot ulcers. It is a landmark success for Qatar: the first pharmaceutical product developed and commercialised from concept to market, and a rare example of a successful partnership between an academic institution—Qatar University—and a local industry partner,



QLife Pharma. Preparing silver nanoparticles in the laboratory at the 10–100 mL scale is fairly simple chemistry; scaling up to manufacture 500 kg, however, was a real challenge—one we solved, taking a Qatar University innovation to the local market.

The product is officially registered with the Ministry of Public Health, which we are very proud of. It also contributes directly to Qatar National Vision 2030 by strengthening national pharmaceutical security and showing the country's capabilities in innovation and local manufacturing.

Your innovations extend beyond wound care to promising drug-delivery and nanotechnology solutions. What are some of these?

Certainly. Beyond Q-Silvano®, one innovation under development is the Oromucosal Reservoir Drug Delivery System (ORDS)—a needle-free platform that delivers medications, such as lidocaine, directly into the oral cavity. It offers a more comfortable, less distressing alternative to conventional dental injections, especially for children and people with needle phobia, and it stays in place longer than ordinary oral gels. Further ORDS-based therapeutics are in progress, led by several talented postgraduate students at Qatar University.

In parallel, we have developed a stable metallic nanolabel technology that tackles a key challenge in nanomedicine: tracking drug-carrying nanoparticles inside the body. It allows accurate, high-resolution tracking of drug carriers, supporting more precise diagnostics and more effective targeted therapies.

For both innovations, provisional patent applications have been filed and approved by the Qatar University Innovation and Intellectual

Property Office, and we are working toward full patent registration.

We understand that you have a distinctive achievement in the field of falcon medicine. Could you share the details of this project?

This project shows how the pharmaceutical sciences can meet a unique national need. Falcons hold special cultural significance in Qatar and across the Gulf. Through our collaboration with the Oryx Falcon Veterinary Clinic, we identified an important clinical problem: veterinarians were preparing drug suspensions from human azithromycin capsules using water, which caused rapid sedimentation and a high risk of inaccurate dosing and chemical instability.

To solve this, we developed an optimised pharmaceutical vehicle using a combination of suspending agents. The formulation gives a stable, uniform suspension, prevents sedimentation and degradation, and ensures accurate, safe, and effective dosing every time. The same platform may also allow other therapeutics to be compounded for falcons.

What advice would you give to young researchers aspiring to enter the field of innovation?

Always start with the problem, not the technology—the true value of any invention lies in the solution it provides. Talk directly with end users, whether clinicians, patients, veterinarians, or community members, to understand their real needs. Design your research with a clear path toward practical use. And never hesitate to work across disciplines, because the most impactful innovations often emerge where different fields meet. I give my students the same advice about meaningful research: love it, live it, and translate it.

How important is Qatar University's research environment and innovation ecosystem in supporting inventors and helping them translate ideas into real-world applications that serve the labour market?

Qatar University has been a cornerstone of this journey—not only through advanced research infrastructure, but also by building an ecosystem that supports innovation and aligns it with labour-market needs. This support, particularly from the Research Support Office, gives researchers the confidence to turn their results into high-value applications and products that benefit society and the national economy. I should also mention the Innovation and Intellectual Property Office, which has helped evaluate promising ideas, protect intellectual property, and manage patent processes—strengthening opportunities for development and transfer to industry partners.

In light of these remarkable achievements, whom would you like to acknowledge for their support throughout this journey?

Innovation is rarely an individual effort. These achievements would not have been possible without the teamwork and contributions of researchers, students, and industry partners. I sincerely thank my colleagues Dr. Ousama Rachid, Dr. Salih Muhsin, and Dr. Khalid Alansari for their valuable, long-standing collaboration in Qatar.

I also thank our partners at QLife Pharma—especially the CEO, Dr. Ahmed Al-Mohannadi, together with Dr. Ali Al-Mohannadi and Dr. Omar Salim—who played a pivotal role in bringing Q-Silvano® to market. For our veterinary work, I am deeply grateful to Mr. Nasser Al-Jaber of the Oryx Falcon Veterinary Clinic.

I also acknowledge the supportive environment at Qatar University: the College of Pharmacy, the QU Health Sector, the Central Laboratories Unit, the Laboratory Animal Research Center, and the Research Support Office.

Finally, I thank Qatar University and the Qatar Research, Development, and Innovation (QRDI) Council for their vital financial support, which turned these ideas into reality.



Clarifex:

An Automated Membrane Filtration System
Engineered to Precisely Separate Fine Particles
from Liquids with Intelligent Process Control



Dr. Probir Das

Research Associate Professor,
Sustainable Development
Center, College of Arts and
Sciences – Qatar University

In an era when industrial efficiency and environmental sustainability are paramount, demand for high-precision, cost-effective technologies has never been higher. For decades, industries have relied on conventional manual membrane filtration—specifically microfiltration and ultrafiltration—to separate suspended or colloidal particles from liquids. While foundational to many sectors, these traditional methods face several operational inefficiencies, including heavy reliance on human intervention, inconsistent data collection, and disruptive maintenance cycles. To address these critical bottlenecks, a research team from the Center for Sustainable Development (CSD) at Qatar University has developed an automated solution that integrates Artificial Intelligence (AI), the Internet of Things (IoT), and membrane technology. A U.S. provisional patent, “Membrane-assisted automated colloidal or suspended particles separation from liquid” (No. US 63/733,369), was granted to the research team consisting of Dr. Probir Das, Shoyeb Khan, and Maryam Mohammed H A Al-Emadi.

The Innovation: Bridging the Market Gap

The core innovation of this patent lies in its transition from passive, manually operated hardware to an intelligent, self-regulating ecosystem. In conventional setups, managing multiple membrane units to process large volumes of liquid is cumbersome and error-prone. Operators must physically monitor the system, manually extract samples at infrequent intervals, and subjectively decide when to clean the membranes. This traditional approach creates several operational gaps: heavy reliance on manual labor, inconsistent data, an inability to perform continuous sampling, and a complete lack of remote monitoring capabilities. The Qatar University team’s invention introduces a paradigm shift by creating a fully autonomous

system that directly closes these gaps. Instead of relying on human operators, the system utilizes a sophisticated Python-based software architecture to control a network of IoT devices, including microcontrollers (Arduinos devices), precision flow sensors, pumps, and valves.

“This innovation transforms a conventional mechanical process into an intelligent and adaptive operation.” The system can independently monitor the liquid’s physical and chemical properties—such as turbidity, pH, and temperature—or even use computer vision to assess cellular characteristics in real time. By continuously analyzing this data, the system decides exactly when to initiate filtration, when to pause for maintenance, and when the process is complete. This entirely removes the guesswork and inconsistency of human intervention, providing high precision and highly repeatable results. Furthermore, upon completion of the process, an automated email containing process data is sent to the desired recipients.

Key Features of the Automated System

A pilot-scale prototype consisting of two large ultrafiltration membrane units (each 50 sq. m) was developed. Currently operating at a high Technology Readiness Level (TRL) of 6–7, the pilot-scale unit can process 2000 L of microalgal culture per hour (Figure 1). The prototype has the following (Table 1):



Figure 1: Pilot-scale prototype unit operation at Qatar University Algal Demonstration Facility (QUADF).

Table 1: Prototype features.

Key Feature	Technical Description	Operational Advantage
Intelligent Auto-Backwashing	Continuously monitors permeate flow rates. If the flow drops below a set threshold due to membrane fouling, the system automatically halts, backwashes the specific membrane, and resumes operation.	Prevents irreversible membrane damage, significantly extends membrane lifespan, and eliminates the need for disruptive manual cleaning.
Remote & Continuous Sampling	Utilizes an array of integrated sensors to constantly evaluate the liquid's dynamic properties without physical sample extraction.	Allows for deployment in hazardous or remote environments while ensuring decisions are made on real-time, high-frequency data.
Fault Tolerance & Isolation	Programmed to detect individual membrane unit failures. If a unit malfunctions, the software automatically isolates it and re-routes the workload to functional units.	Guarantees uninterrupted processing and prevents total system shutdowns, ensuring process reliability.
Automated Data Logging & GUI	Captures all operational events, pressures, and flow rates and exports them directly to organized Microsoft Excel files. A Graphical User Interface (GUI) displays real-time metrics.	Completely solves the issue of inconsistent data, providing stakeholders with transparent, actionable insights for optimization.
Automated Reporting & CIP	Upon completing a batch, the system initiates a Clean-In-Place (CIP) protocol to prepare for the next run and automatically emails a comprehensive summary report to designated personnel.	Drastically reduces turnaround time between batches and keeps management effortlessly informed.

Potential Applications across Industries

This AI-driven filtration system stands as a testament to Qatar University’s commitment to solving real-world challenges, promising a future in which industrial processes are fundamentally smarter, more profitable, and more sustainably integrated into the modern world. By introducing remote monitoring, high-precision control, and continuous sampling, the system’s commercial potential extends far beyond standard water filtration across multiple high-value sectors (Table 2):

Table 2: Industrial Sectors.

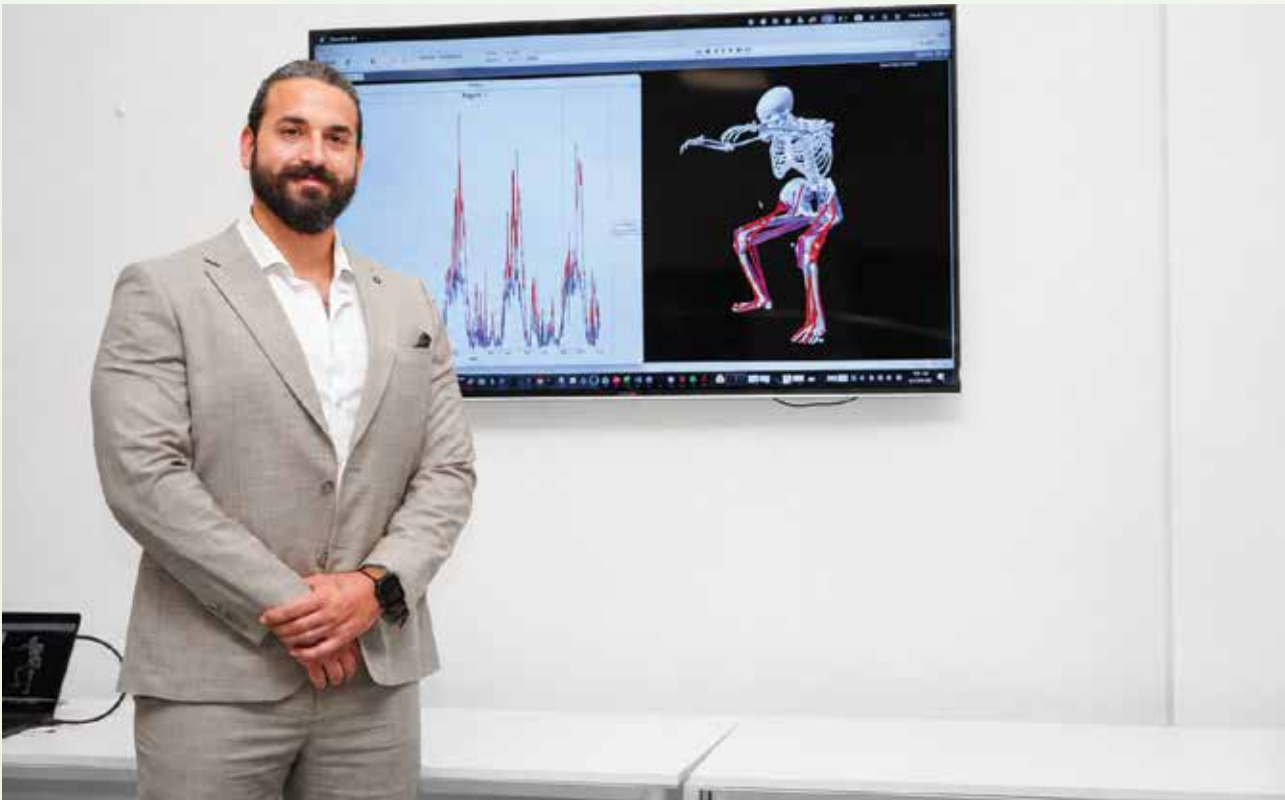
Industrial Sector	Specific Application	Value Add for the Industry
Biotechnology & Aquaculture	Harvesting and concentrating microalgae, bacteria, and sensitive enzymes.	Reduces the exorbitant costs of microalgal biomass harvesting, accelerating the development of sustainable feed and other bulk products.
Pharmaceuticals	Liquid-phase particle isolation and separation of delicate cellular components.	Ensures the strict purity and consistency that are non-negotiable in drug development, while reducing contamination risks through hands-free automation.
Industrial Processing	Recovery of valuable suspended materials, such as colloidal catalysts, from chemical mixtures.	Directly improves chemical yields, reduces industrial waste, and enhances the circularity of manufacturing processes.
Water Quality Monitoring	Automated, remote water quality sampling and the efficient removal of suspended impurities in natural bodies of water.	Enables continuous environmental protection efforts without requiring personnel to be stationed in remote or harsh locations.
Wastewater Treatment	Treating industrial and municipal wastewater for safe discharge or resource recovery.	Significantly reduces the energy footprint and operational costs of large-scale water purification.

Expected Impact on Economy and Sustainability

The expected impact of this provisional patent is both economically significant and closely aligned with global sustainability goals, particularly Qatar's National Vision 2030. The innovation has the potential to transform wastewater treatment and advance the rapidly growing microalgae industry by integrating biomass production with wastewater bioremediation and nutrient recovery, thereby contributing to a sustainable circular economy. In addition, microalgae cultivation offers an effective pathway for carbon capture, as the production of every kilogram of algal biomass can utilize approximately 1.8 kilograms of CO₂. This breakthrough technology will enable automated, efficient, and cost-effective biomass harvesting, accelerating the wider application of microalgal biomass, as traditional harvesting is often a major bottleneck and can account for up to 40% of biomass production costs.

Beyond Steps and Heart Rate

A Wearable that Reveals What Muscles and Joints Endure



Dr. Rony Ibrahim,

Assistant Professor of Biomechanics, College of Sport Sciences - Qatar University

Prof. Uvais Qidwai,

Professor of Computer Engineering, College of Engineering - Qatar University

Modern fitness trackers and smartwatches have made it routine to count steps, measure heart rate, estimate calories burned, and assess recovery readiness based on cardiovascular metrics. None of these devices, however, answers a more fundamental question for anyone who moves, trains, or recovers from injury: how much mechanical load is actually passing through

the muscles, tendons, and joints during each movement? Nor can they determine whether the muscles have recovered and are ready for the next workout. That information has so far been confined to specialised biomechanics laboratories equipped with camera-based motion capture, force platforms, and trained analysts. A new wearable system developed at Qatar University

aims to bring that laboratory-grade insight onto the body, in real time.

The invention, recently published as a United States patent application (US20250352122A1), is the first of its kind to emerge from the College of Sport Sciences, developed in collaboration with the College of Engineering. It was invented by Dr. Rony Ibrahim of the College of Sport Sciences and Prof. Uvais Qidwai of the College of Engineering.

The problem of looking inside movement

The forces inside the body cannot be measured directly without invasive procedures. Biomechanists therefore estimate them indirectly, by combining how the body moves with the external forces acting on the body, and with how its muscles activate. Two complementary signals capture this. Inertial measurement units (IMUs), the same miniature accelerometers, gyroscopes, and magnetometers found in smartphones, track how each body segment accelerates and rotates. Surface electromyography (EMG) records the electrical signals that muscles emit when they contract. Together, motion and muscle activity provide the raw material from which external forces can be reconstructed and internal loading can be estimated.

The difficulty lies in placement. For an IMU to report clean orientation data, it should sit where the skin minimally deforms during contraction. For EMG electrodes to capture a strong, uncontaminated signal, they must sit directly over the belly of the muscle. Conventional integrated sensors force both components into a single housing at one location, which compromises one measurement in order to serve the other.

A design that separates to improve

The central innovation decouples the two



During user testing of the innovation.

sensors so that each can be positioned where it performs best, while keeping them part of one connected system. The EMG electrodes attach over the muscle belly, through detachable wires of adjustable length or wirelessly, while the IMU is placed on the same body segment at a site with minimal skin movement. For the thigh, for instance, the electrodes can read the vastus medialis at its belly while the IMU sits on the lateral mid-thigh, where the underlying tissue stays comparatively still. The result is cleaner data from both channels and a more accurate picture of what the limb is doing.

Turning signals into forces

Raw motion (IMU) and muscle (EMG) signals

are not, in themselves, measures of joint or tissue load. The innovation bridges that gap with machine learning. The model is first trained in the laboratory against gold-standard references: three-dimensional motion measured by optoelectronic camera systems, ground reaction forces measured by force platforms, and muscle activity recorded by EMG. These laboratory data are processed through a detailed musculoskeletal model in OpenSim, a widely used open-source simulation platform, to compute the internal loads that cannot be measured directly. Once trained, the model reproduces those same estimates from the wearable's field data alone ($r = 0.9$, RMSE = 0.08 N-m; Figure 1), scaling its predictions to the individual through inputs such as body mass, height, age, the movement being performed, and any external weight being lifted.

From these inputs, the system can report, in real time, a broad set of variables that matter clinically and athletically: muscle activation patterns, net joint torque and power, ground reaction forces, joint contact forces, individual muscle and

tendon forces, ligament tension, cartilage stress, intervertebral disc pressure, and bone strain. A live dashboard presents these values graphically, with colours that shift as readings approach preset thresholds, allowing a coach, clinician, or user to adjust technique or intensity during the activity rather than after it.

Where it can be used

The applications span several of Qatar University's research priorities in health and digital technology. In rehabilitation and physiotherapy, the system provides objective, continuous feedback on whether recovering joints are being loaded appropriately. In sport, it helps athletes refine movement and manage the loads associated with injury risk. For telehealth and remote care, it enables home-based monitoring of patients who cannot easily attend a clinic. Across all of these settings, the device shifts musculoskeletal assessment from occasional laboratory snapshots to continuous measurement in everyday life.

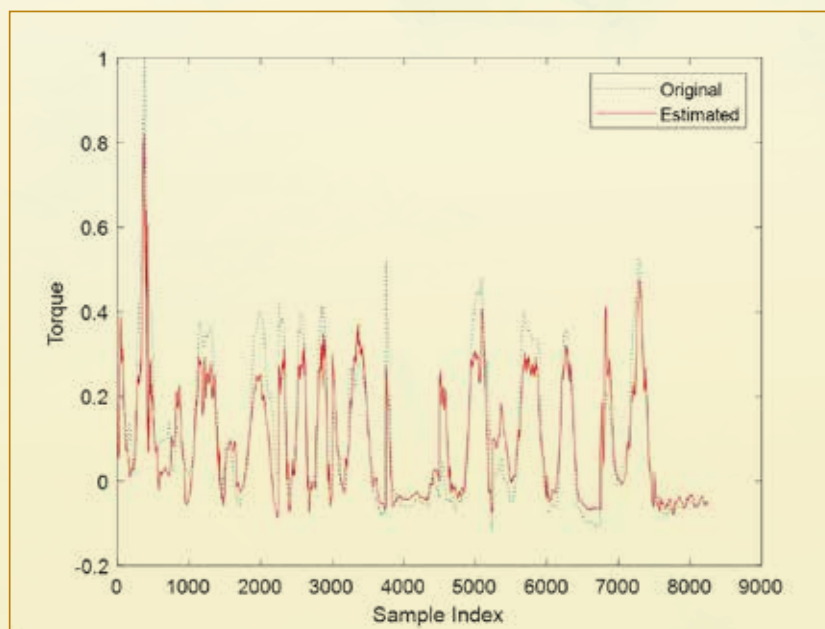


Figure 1: Original (Gold standard) and estimated knee joint torque (Nxm) in a bilateral squatting movement.

Inventor Business Card:

Prof. Serkan, we would like to begin with a brief introduction of yourself and your academic and research career, as well as your key scientific milestones.

I am Dr. Serkan Kiranyaz, Professor of Electrical Engineering at Qatar University, specializing in artificial intelligence, signal processing, and biomedical engineering. My research career has focused on developing adaptive and learning-based systems, particularly in real-time signal analysis and medical applications. Key milestones include pioneering self-organizing and evolutionary AI systems, advancing 1D and high-end deep learning paradigms, and translating these innovations into healthcare solutions—especially in cardiac diagnostics. My prior work has led to numerous high-impact publications, patents, and industrial collaborations.

What medical problem or clinical challenge does the CardioVision system aim to address?

CardioVision addresses the fundamental gap between accessibility and diagnostic quality in cardiac imaging. While echocardiography is widely available and cost-effective, it suffers from limited contrast, operator dependency, and artifacts. Cardiac MRI provides superior anatomical detail but is expensive, time-consuming, and not widely accessible. CardioVision aims to bridge this gap by delivering MRI-like diagnostic insight directly from ultrasound, improving diagnostic confidence without requiring additional hardware.

How does the CardioVision system, based on artificial intelligence, process cardiac imaging data and transform it into clinically meaningful diagnostic outputs?

CardioVision uses advanced deep learning models, including transformer-based architectures, to learn the relationship between ultrasound and MRI imaging domains. The system processes echocardiographic data through a pipeline involving preprocessing, feature extraction, and cross-modality transformation. The AI model enhances image quality by reducing artifacts, improving contrast, and reconstructing structural details. The output is a synthetic MRI-style image that provides clinically meaningful visualization, supporting improved interpretation and decision-making while maintaining the workflow of standard ultrasound.

What are your most significant research contributions and innovations in medical and industrial signal processing?



My research contributions span both medical and industrial signal processing. In healthcare, I have introduced novel methods for ECG analysis, arrhythmia detection, and real-time patient monitoring, often using adaptive and self-learning AI systems. I have also contributed to deep learning for time-series and low-latency data processing, with applications in wearable and remote health technologies. In industry, my work includes intelligent monitoring systems, predictive analytics, and embedded AI solutions. A key innovation theme is computational efficiency and real-time adaptability, enabling AI deployment in resource-constrained environments.

How do you describe the role of Qatar University in supporting research and innovation throughout your academic career?

Qatar University has played a pivotal role in supporting my research and innovation activities by providing a collaborative, interdisciplinary environment and strong institutional backing. The university facilitates access to funding, research infrastructure, and international collaborations. It actively promotes innovation, patenting, and technology transfer, which has been instrumental in advancing projects like CardioVision from an idea to proof-of-concept. This supportive ecosystem enables impactful research aligned with national and global healthcare priorities.

Interview with an Author

Prof. Hissa Mohammed Sadiq

Former Dean of the College of Education and Member of the
Board of Trustees at Qatar University

**On her book: “Education Policies in the State of Qatar:
From Inception to Education Reform 2002”
recently published by Qatar University Press**



Understanding the history of educational policies provides an essential gateway to envisioning the future of education and guiding its development. In this interview, we speak with Professor Hissa Mohammed Sadiq, former Dean of the College of Education and Member of the Board of Trustees at Qatar University, about her book, which documents the evolution of educational policies in the State of Qatar and offers an analytical

perspective on their challenges and future directions.

To begin, Prof. Hissa, how would you introduce yourself to our readers, and what key milestones have shaped your academic journey and research interests in education?

I currently serve as a Professor Emerita at Qatar University and previously had the privilege of serving as Dean of the College of Education, an experience that profoundly shaped my understanding of educational issues and challenges. I am also honored to serve as a member of Qatar University's Board of Trustees and the National Human Rights Committee, roles that have provided valuable opportunities to contribute to society and broader human development.

My research interests have focused on educational leadership, school administration, educational reform, and the professional development of educators. Throughout my career, I have been fortunate to receive several research grants from Qatar University and the Qatar National Research Fund. I have also published numerous scholarly works and participated in conferences, seminars, and workshops dedicated to improving and advancing education. One of the milestones I particularly value was receiving the State Encouragement Award in Education in 2005, in recognition of my contributions to the field of education. This recognition further strengthened my conviction that investing in people and improving the quality of education constitute the foundation of sustainable progress.

What motivated you to write this book, and why did you consider documenting educational policies in Qatar an academic and research necessity?

The motivation for this work arose while teaching the "Educational Policies" course in the Master of Educational Leadership program at Qatar University's College of Education. During course preparation, I noted the absence of a specialized reference text, as teaching relied on selected materials aligned with learning outcomes.

Although existing literature addresses educational policy broadly, there was no comprehensive source documenting the evolution of educational policies in Qatar within their historical and social contexts. This gap prompted the compilation of available materials into a scholarly reference to support graduate students, researchers, academics, and others interested in understanding the development of education in Qatar.

What are the key messages this book seeks to convey regarding the understanding and development of educational policies in Qatar?

The book aims to document the evolution of educational policies in Qatar and analyze the

factors that shaped them, based on the belief that envisioning the future of education begins with a thoughtful reading of its history and a clear understanding of both its successes and its challenges.

It also emphasizes that effective educational policies are not built upon idealized models or ready-made solutions; rather, their success depends on their relevance to the societal context and their capacity to be translated into actionable plans and practices subject to continuous evaluation.

Perhaps the book's most important message is that educational reform should be grounded in clear policy directions and overarching educational visions, with those policies undergoing regular review based on evidence and scientific data rather than individual preferences or assumptions.

Drawing on this historical analysis, what were the most significant factors that shaped educational policies in Qatar?

The factors influencing educational policy in Qatar have varied across different historical periods. During the era of the traditional kuttab schools, social and economic factors played the dominant role, as educational opportunities were closely tied to families' economic circumstances and social standing, as well as prevailing gender norms.

With the emergence of formal education in the 1950s, three major influences became apparent: governmental priorities emphasizing the preservation of religious and cultural identity; political developments across the Arab world, which affected curricula and educational orientations; and the indirect influence of British presence and the oil industry, both of which contributed to the expansion of vocational education and the preparation of a national workforce responsive to labor market needs.

Following independence, political stability and economic growth facilitated the development of educational legislation and the issuance of the country's first written education policy in 1982. This period witnessed a strong emphasis on investing in human capital, expanding higher education, and supporting scholarship opportunities abroad. As concerns emerged regarding the quality of educational outcomes and their alignment with labor market demands, comprehensive evaluations of the education system were undertaken. A new education policy was introduced in 2001, followed by the launch of the landmark "Education for a New Era" initiative

in 2002, which represented the most significant educational reform effort in Qatar's history. While the initiative achieved notable successes, it also underscored the continuing need for systematic review and evaluation to ensure sustainable improvement.

In light of your analysis of previous educational policies, what are the book's key recommendations for improving student learning and enhancing educational quality?

The book recommends reviewing several procedural policies affecting student learning across three principal areas.

First, at the level of educational leadership, the book calls for refining policies governing the selection of school principals through more comprehensive and transparent criteria, strengthening leadership preparation and professional development programs, reconsidering the scope of principals' authority by granting balanced autonomy and flexibility, improving performance evaluation mechanisms through realistic indicators, and introducing incentive systems that encourage innovation and educational initiatives.

Second, at the level of teachers, the book highlights the importance of revisiting admission policies for teacher preparation programs, strengthening pre-service preparation and assessment, enhancing the effectiveness of in-service professional development, promoting the meaningful integration of technology and artificial intelligence in education, and improving teacher evaluation through diversified assessment tools, qualified evaluators, and the effective use of evaluation data to support professional growth.

Third, at the curriculum level, the book emphasizes translating the competencies outlined in the National Curriculum Framework—such as critical and creative thinking, problem-solving, and inquiry skills—into concrete teaching practices, learning activities, and assessment methods. It also advocates for stronger collaboration between the Ministry of Education and the College of Education to prepare teachers capable of cultivating these competencies and improving student learning outcomes.

In your view, how can Qatar's education system further develop its curricula and programs to meet future needs and labor market demands?

Qatar's education system is among the leading

systems in the Arab region; however, continuous research and development are still essential to align education with national goals of economic diversification and a knowledge-based society. Key priorities include:

- Strengthening early childhood education programs due to their critical role in cognitive development and maximizing children's potential from an early age.
- Enhancing students' motivation to learn and raising awareness of their value as national assets contributing to national development.
- Expanding support for gifted and high-ability students through specialized schools and targeted programs to ensure effective investment in exceptional talent.
- Diversifying educational pathways to accommodate students' different abilities, interests, and aspirations.
- Introducing innovative and flexible educational models that go beyond traditional approaches, particularly for high-achieving and gifted learners.
- Promoting values of belonging, civic responsibility, and collective commitment, so education contributes to national development rather than being limited to employment outcomes.

In closing, what does this book contribute to Qatari and Arab scholarship, and how do you reflect on the experience of publishing it with Qatar University Press?

This book documents an important yet underexplored aspect of Qatar's educational history, focusing on the evolution of educational policies and the factors shaping them. It is intended as a reference for researchers, graduate students, and policymakers, while also contributing to comparative studies in the Arab world by highlighting the distinctive features and transformations of Qatar's educational experience.

Publishing this work with Qatar University Press has been both meaningful and rewarding, given its role in supporting rigorous scholarship and disseminating specialized knowledge. The Press helps document national academic expertise according to high publishing standards, and it is hoped that such efforts will continue to encourage scholars to turn their research into publications that enrich Qatari and Arab intellectual life and strengthen scholarly presence.



Exploring Possibilities for Leadership Development in Qatar's Government Schools: A Qualitative Study

Eman Ali Rafya, Master of Educational Leadership Program, Section Head of Co-Curricular Transcript, Leadership and Civic Engagement Department, Student Affairs - Qatar University

Khulood Haidarah, Master of Educational Leadership Program

Supervisor: Dr. Youmen Chaaban, Research Associate Professor

College of Education – Qatar University

Introduction

This study explored how school principals in Qatar's governmental schools perceive and experience their leadership development within the context of ongoing educational reform. Leadership is widely acknowledged as one of the most influential in-school factors affecting student learning outcomes, school improvement, and the implementation of educational reform.

While Qatar has introduced leadership standards, licensing requirements, and ministry-sponsored professional development initiatives, limited research has examined how principals themselves experience and make sense of their leadership development in practice.

The study responds to the need for a deeper understanding of how principals in Qatar develop their leadership capabilities within a highly

regulated and reform-oriented educational system. Specifically, the study explored the possibilities for principal leadership development in governmental schools in Qatar through the lived experiences of school principals themselves.

Methodology

The study employed a qualitative phenomenological approach to explore principals' lived experiences regarding leadership preparation and development within Qatar's governmental schools. Semi-structured interviews were conducted in Arabic with ten principals working in primary, preparatory, and secondary governmental schools in Qatar. Participants possessed extensive professional experience in education and school leadership, allowing the study to capture rich and contextually grounded insights into leadership development.

Data were analyzed using inductive thematic analysis guided by Braun and Clarke's framework. Through repeated readings, open coding, categorization, and thematic refinement, three major themes and several interconnected subthemes emerged from the data.

Findings

1. Pathways to Leadership

Participants described leadership development as a gradual and experience-driven process shaped through progression across multiple educational roles. Most principals followed a structured pathway beginning with classroom teaching and progressing through coordinator roles and vice principalship before assuming principalship. Participants considered this layered trajectory essential preparation for school leadership responsibilities and emphasized that leadership readiness develops cumulatively through practical engagement within educational settings.

Principals also stressed the importance of academic leadership experience before principalship. Many participants argued that effective principals require a strong understanding of curriculum, pedagogy, assessment, and

instructional supervision. Administrative experience alone was viewed as insufficient preparation for the academic dimensions of school leadership. Participants additionally acknowledged recent reforms introducing professional licensing, staged interviews, and formal eligibility criteria for principal appointments, although they noted inconsistencies in implementation and changing expectations across cohorts.

Another important finding involved nomination-based advancement into leadership roles. Several principals explained that their progression into principalship occurred through recommendations from former principals, supervisors, or ministry officials who recognized their leadership qualities and professional dedication. Leadership advancement was therefore perceived as recognition of sustained competence, professional commitment, and integrity within the educational sector.

Family support, mentorship, and professional relationships also emerged as influential factors in leadership development. Participants described mentorship as highly transformative, emphasizing how experienced principals modeled leadership practices, delegated responsibilities, and provided continuous guidance. Mentorship was largely relational and embedded in daily professional interactions rather than formal institutional structures.

2. Formal and Informal Leadership Development

Participants consistently identified ministry-sponsored leadership programs as important formal avenues for leadership preparation. Programs such as the School Leaders Program, Empowering New Leaders, and Aspiring Leaders were viewed positively because they combined lectures, assignments, field experiences, and exposure to experienced school leaders. Several participants also described ministry-funded international visits and workshops as valuable opportunities that broadened their perspectives on educational leadership and international school systems.

Despite the value of formal programs, participants repeatedly emphasized that field experience remained the most influential source of leadership development. Managing schools, handling conflicts, implementing policies, and responding to real-world challenges were described as irreplaceable learning experiences that refined leadership competence and judgment over time. Working in demanding school environments further strengthened participants' adaptability and leadership resilience.

Support networks and collaboration also played a significant role in principals' professional growth. Participants emphasized that leadership development is strengthened through teamwork, collective problem-solving, and professional dialogue. Internal collaboration with school teams and external communication with fellow principals provided important opportunities for reflection, consultation, and exchange of experiences.

Another prominent finding involved personal initiative and self-directed learning. Participants demonstrated strong agency in pursuing their own professional development through workshops, independent reading, online platforms, and external leadership programs. Several principals viewed leadership development as a personal responsibility that extends beyond ministry-provided opportunities.

3. Overcoming Challenges to Leadership Development

The transition to principalship was described as a challenging yet formative stage of leadership development. Participants highlighted difficulties related to managing interpersonal relationships, resistance to change, balancing authority with empathy, and adapting to complex school environments. Several principals described the emotional and social demands associated with leadership responsibilities, particularly when leading former colleagues within the same school context.

Systemic and policy-related challenges also emerged prominently throughout the interviews.

Participants discussed frequent policy changes, inconsistent leadership programs, unclear appointment criteria, and limited institutional support during transitions into principalship. Some principals emphasized the absence of structured induction and handover processes, forcing them to rely heavily on accumulated field experience to navigate leadership responsibilities. Nevertheless, participants viewed these challenges as experiences that strengthened their adaptability, problem-solving abilities, and leadership resilience.

Participants additionally proposed several future possibilities for improving leadership development in Qatar. They emphasized the importance of practice-based training, structured shadowing experiences, mentorship from experienced principals, formal handover procedures, and sustained professional support following appointment to principalship. They also highlighted the value of international exposure and learning from global educational practices while adapting these experiences to Qatar's local educational context.

Conclusion

Overall, the study demonstrates that leadership development within Qatar's governmental schools is a multidimensional and contextually grounded process shaped by formal structures, experiential learning, mentorship, collaboration, and personal initiative. The findings contribute to the growing literature on educational leadership in the Gulf region by providing a contextually grounded understanding of how principals navigate opportunities and challenges in their professional growth. The study ultimately highlights the importance of leadership systems that integrate structured preparation, field-based learning, mentorship, and collaborative professional support to strengthen the sustainability and effectiveness of school leadership within Qatar and similar educational contexts.

When Knowledge Becomes an Intelligent Assistant:

A Qatari Study Connecting Artificial Intelligence with Sustainable Project Management

Awad Yousef Alomari, PhD in Engineering Management, and Head of Strategic Planning and Portfolio Team, Project Affairs, Public Works Authority “Ashghal”, State of Qatar

Supervisor: Prof. Murat Gunduz, Professor of Civil Engineering

Co-Supervisor:

Dr. Khalid Kamal Naji, Associate Professor of Civil Engineering, and **Prof. Amr Mohamed**, Department Head of Computer Science and Engineering, College of Engineering – Qatar University



The Knowledge Gap in Large Organizations

In large organizations, the challenge does not always arise from a lack of knowledge, but from its volume and distribution across documents, systems, departments, and accumulated experience. An organization may possess thousands of pages of manuals, specifications, procedures, contracts, and reports, yet accessing the right information at the right time remains a daily challenge.

In the infrastructure sector, this challenge becomes more sensitive. Decisions are linked not only to time and cost, but also to quality, sustainability, compliance, and data confidentiality. Lengthy manual searches or reliance on unverified information may delay decisions, create inconsistent interpretations, and weaken institutional traceability.

This challenge motivated the doctoral research of Dr. Awad Yousef Alomari, completed at Qatar University in 2026. The study asked a central question: how can artificial intelligence help large organizations transform dispersed knowledge into reliable answers while preserving data security and the confidentiality of institutional knowledge?

An Intelligent Library within the Organization

The dissertation is based on Retrieval-Augmented Generation, or RAG. The concept can be understood as an intelligent library operating within the organization. When an employee asks a question, the system does not merely generate a general response. It first searches approved documents, retrieves the relevant information, and then formulates a clear answer.

This distinction is important in enterprise environments. General-purpose artificial intelligence may be fast, but its answers are not always grounded in the organization's own documents and policies. A retrieval-augmented system begins with sources selected and governed by the organization, making it more suitable for governance, auditing, and information protection.

For institutions such as the Public Works Authority “Ashghal”, which manages technical, contractual, regulatory, and procedural documents, the value is not limited to speed. The response must also be controlled, traceable, and secure within the boundaries of institutional knowledge.

How Was the Bridge Built?

The researcher followed a multi-stage methodology. The study began with a broad scientific review of trends and challenges in the use of Generative AI for sustainable project management. It then developed a knowledge-based model to support access to sustainability requirements and related specifications within the built environment.

The research subsequently compared three solution types: a general-purpose language model, a retrieval-augmented system, and a domain-specific fine-tuned model. The evaluation was not limited to technical performance. Actual users assessed the responses in terms of clarity, completeness, and correctness, thereby combining technical design, comparative testing, and end-user judgment.

Mosaed: From Research to Application

The practical value of the dissertation extended beyond academic research into a real institutional experience through the “Mosaed” system at Ashghal. Mosaed was developed through local expertise within the Information Systems Department under the leadership of Dr. Abeer Al Hajri. It was further enhanced through collaboration with the Office of the Director of Project Affairs, under the leadership of Eng. Khalid Al Khayareen, Director of Project Affairs.

Mosaed is an enterprise knowledge platform that uses artificial intelligence to help employees access approved information more quickly and reliably, positioning it as a knowledge companion that supports daily work and decision-making across the Authority.

The Mosaed success story demonstrates how scientific research can be translated into tangible institutional value. It also provides an important model of collaboration between academic research and the government sector, where knowledge does not remain confined to dissertations but is converted into tools that can be applied in the workplace.

The development of Mosaed expanded the institutional knowledge base and linked it to approved technical, contractual, procedural,

and regulatory documents. The system was also strengthened with search capabilities that understand the meaning of a question, not only its words, and with mechanisms that connect answers to relevant sources. In this way, dispersed documents are transformed into a secure intelligent platform.

A core advantage of retrieval-augmented systems is that they enable organizations to benefit from artificial intelligence without relinquishing control over their data. Instead of depending on public tools that may not suit sensitive information, the system operates within a controlled institutional environment, preserves confidentiality, and reduces the risk of sharing data outside the approved setting.

Faster Answers and More Secure Knowledge

Mosaed has become a practical model for transforming institutional knowledge into a daily service. It helps employees access policies, procedures, specifications, and technical guidance more quickly, while reducing manual search, improving information accuracy, and increasing confidence in the answers provided.

In large organizations, a convincing answer is not enough. It must be verifiable at source, aligned with approved documents, and governed by clear security controls. Retrieval-augmented artificial intelligence therefore offers more than speed. It provides a responsible model for institutional knowledge management.

It also supports knowledge sharing across departments. Rather than allowing expertise to remain fragmented among individuals, files, and systems, knowledge becomes available in an organized form while preserving governance and confidentiality. This strengthens institutional continuity and reduces the effects of knowledge loss or limited accessibility.

What Did the Research Demonstrate?

The dissertation showed that the architecture selected for an artificial intelligence solution directly affects decision quality and suitability for enterprise use. The retrieval-augmented system demonstrated a clear advantage for

questions requiring sources, procedures, and reliable explanation, particularly when answers were connected to sustainability or compliance requirements.

General-purpose models may remain useful for summarization and broad inference, but they are less suitable when the organization requires an answer linked to a clear source. The study also demonstrated that training a specialized model is not sufficient on its own unless it is supported by high-quality data and stable controls.

From a sustainability perspective, these systems help project teams access environmental and technical requirements more quickly, supporting more consistent decisions concerning materials, energy, water, documentation, and compliance.

Research That Serves Society

The experience of Dr. Alomari and the Mosaed system provides a model that can be adapted by other organizations in Qatar and beyond. Every large organization possesses substantial

knowledge, but it requires an intelligent and secure method to convert that knowledge into a daily capability that supports employees.

This experience reflects the integration between Qatar University and the Public Works Authority “Ashghal” in applying artificial intelligence to support sustainability while safeguarding data security (Figure 1).

This direction is aligned with Qatar National Vision 2030, which places innovation and digital transformation at the heart of sustainable development. True digital transformation is not only the adoption of new tools. It is the establishment of trusted systems that protect knowledge, improve efficiency, support decision-making, and serve society.

“The true value of artificial intelligence does not appear when it merely answers quickly, but when it helps an organization make a reliable, secure, traceable decision that benefits society.” ... Dr. Awad Alomari

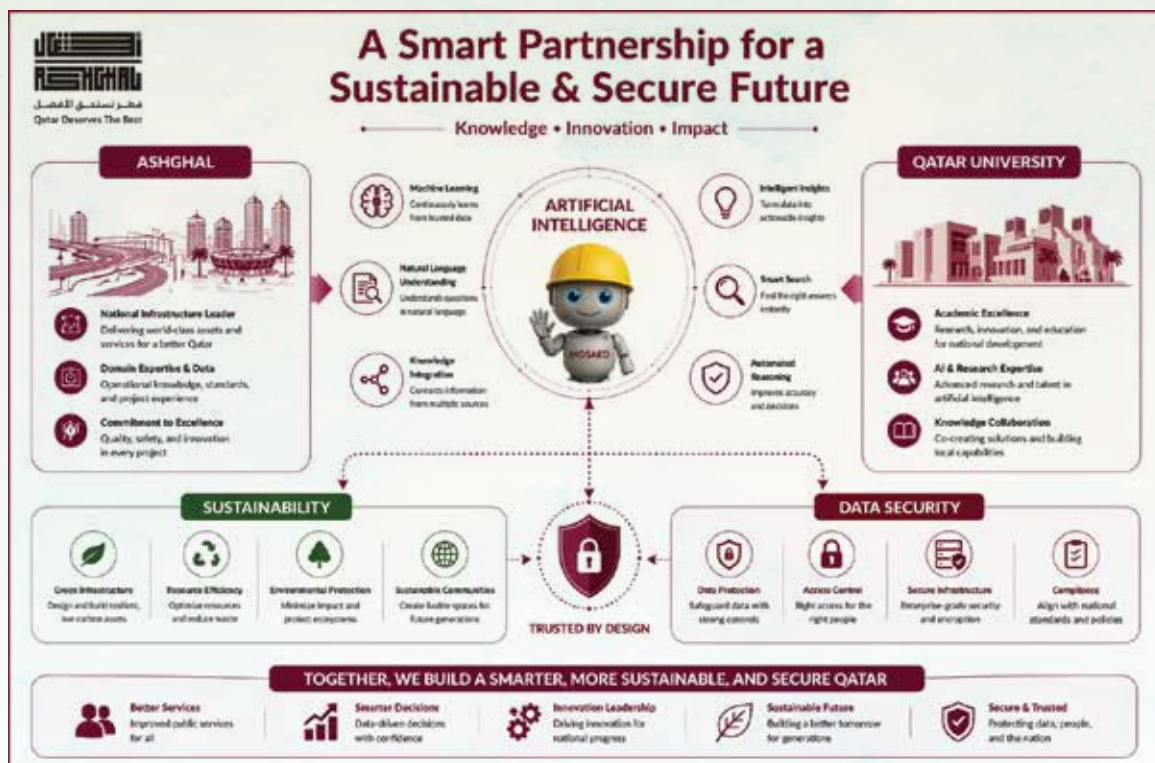


Figure 1: A diagram connecting Qatar University, Ashghal, artificial intelligence, sustainability, and data security.

In the Digital Shadows:

Electronic Money Laundering Under Scrutiny

Mohammed Meteb AlHajri, Master of Public Law,

Supervisor: Dr. Ayad Haroon Mohammed, Assistant Professor of Criminal Law College of Law –
Qatar University

Money laundering is no longer merely a traditional financial crime that can be adequately addressed within classical legal frameworks. Rather, in the digital environment, it has evolved into a concealed activity that transcends borders and eludes conventional tracking mechanisms. Technology has not only accelerated the movement of funds but has also reshaped the very logic of the crime itself, situating it within a non-physical space characterized by complexity and decentralization.

Accordingly, the issue is no longer confined to the criminalization of the act itself. It also concerns the ability of the law to keep pace with a crime that evolves more rapidly than legislation while maintaining a balance between effective enforcement and the guarantees of criminal justice.

The Conceptual Transformation of Money Laundering in the Digital Environment

The traditional structure of money laundering consists of three successive stages: the placement of illicit funds into the financial system, the layering of transactions to conceal their origin, and finally their integration into the legitimate economy. However, despite the continued relevance of this framework, it faces significant challenges in the digital environment, where these stages may overlap or even disappear due to the speed of digital transactions and operational

complexity.

A single electronic transaction may involve a chain of cross-border transfers passing through multiple systems, with encrypted data that hinders effective tracing. This undermines the traditional assumption that financial flows can be tracked through a clear temporal and spatial trajectory.

Moreover, the decentralized nature of certain technologies-particularly cryptocurrencies-raises a fundamental legal question concerning the object of the crime itself: whether it should be understood as money in its traditional form or as digital value that may not fall under any centralized legal system. This reflects a profound transformation in the concept of money, necessitating renewed doctrinal analysis.

The Problem of Legal Qualification in the Context of Electronic Means

Money laundering through electronic means raises a complex issue of legal qualification, particularly in cases where lawful technological tools are used for unlawful purposes. Electronic payment systems, digital currencies, and financial platforms are, in principle, legitimate instruments and constitute a cornerstone of modern economic activity.

However, their use in facilitating illicit financial flows raises a critical question: does the mere use of such tools in suspicious transactions suffice to

establish the commission of the offense, or must specific criminal intent-namely knowledge of the illicit origin of the funds-be established?

Criminal law doctrine generally requires the existence of such specific intent as an essential element of the offense. Nevertheless, proving this intent in the digital environment presents practical difficulties, given the reliance on automated systems and the absence of direct interaction between parties. This may result in an expansion of criminal liability in a manner that risks undermining the principle of legality.

Digital Evidence between Evidentiary Freedom and Guarantees of Justice

Proof issues represent one of the most complex challenges in cases of money laundering through electronic means, as such crimes rely on digital evidence that may be susceptible to tampering, concealment, or destruction.

Although modern legal systems have increasingly recognized the admissibility of digital evidence, this does not fully resolve the issue. Questions remain regarding the adequacy of safeguards ensuring the integrity and reliability of such evidence, particularly considering the advanced technologies involved, which may not be fully comprehensible to judicial authorities.

Furthermore, the collection of digital evidence raises concerns related to privacy, as it may require access to personal or financial data across borders. This necessitates a careful balance between the requirements of investigation and the protection of rights and freedoms.

Between Legislative Flexibility and Ambiguity in Application

The Qatari legislator has adopted a broad definition of money laundering, allowing for the inclusion of its various forms. This approach provides legislative flexibility and adaptability to evolving realities. However, such breadth may, in certain cases, lead to ambiguity in

legal qualification, particularly in the absence of detailed regulation addressing the technical specificities of electronic means.

Despite its comprehensiveness, the existing legal framework may benefit from more precise standards for addressing emerging phenomena such as digital assets and decentralized platforms. Nor does it establish a clear procedural framework governing the collection and evaluation of digital evidence, which may affect the consistency of judicial application.

This challenge is further compounded by the technical nature of these crimes, where distinguishing between lawful technological use and criminal conduct is often difficult, thereby raising significant issues concerning the scope and proof of criminal intent.

From a doctrinal perspective, reliance on broadly formulated provisions, while ensuring flexibility, may raise concerns regarding legal certainty, which requires that criminal norms be clear and foreseeable, in order to prevent overly expansive interpretations that could undermine the principle of legality.

Thus, the challenge lies not in the breadth of criminalization, but in achieving sufficient legislative precision to clearly delineate the boundary between lawful and unlawful conduct in a rapidly evolving digital environment.

Limits of National Responses in the Face of Transnational Crime

Money laundering through electronic means reveals the limitations of purely national approaches, as a single transaction may span multiple jurisdictions, thereby weakening the effectiveness of traditional rules of jurisdiction.

Accordingly, effective enforcement becomes contingent upon the effectiveness of international cooperation, particularly in the exchange of information and the coordination of procedures, despite the challenges posed by legal divergence and considerations of sovereignty.

In this context, the Singaporean model provides a useful comparative reference for combating money laundering in the digital environment. It adopts an integrated approach that combines effective domestic regulation with active engagement in international cooperation mechanisms, while imposing precise regulatory obligations on digital financial activities, thereby enhancing the ability to trace cross-border transactions.

Thus, the challenge is no longer confined to territorial jurisdiction but rather lies in the ability of legal systems to adapt to the inherently transnational nature of such crimes.

Conclusion

The analysis demonstrates that the core challenge in combating money laundering through electronic means does not lie in the absence of criminalization, but in the adequacy of legal and procedural tools to address a rapidly evolving digital environment. Accordingly, the development of the Qatari legal framework should aim at enhancing specialization and precision without undermining flexibility.

In this regard, it is essential for the legislator to adopt a clearer regulatory approach to electronic financial activities by establishing precise definitions of emerging financial practices and identifying the legal obligations of digital asset service providers, thereby reducing ambiguity in legal qualification and enhancing enforceability.

Equally important is the need to develop procedural rules governing digital evidence by establishing clear standards that balance evidentiary flexibility with guarantees of justice, alongside strengthening the technical capacities of judicial authorities.

Moreover, reinforcing institutional infrastructure, particularly by equipping financial intelligence units with advanced technological tools and

enhancing coordination among relevant authorities, remains crucial to ensuring effective response and analysis.

Finally, strengthening engagement with the international anti-money laundering framework is essential, not only through compliance with global standards, but also through active participation in their development, to ensure an effective response to a form of crime that evolves faster than the law itself.



Making Sustainability Measurable: An Accounting Framework for the MENA Region



Mohammed M. Hattab, Master's in Accounting,
College of Business and Economics – Qatar
University



Supervisor: Prof. Ghassan H. Mardini,
Professor of Accounting, College of Business and
Economics – Qatar University

The Middle East and North Africa region faces a complex environmental challenge. It is one of the regions most affected by water scarcity and climate-related pressures, yet it also has significant opportunities to advance renewable energy, improve resource efficiency, and build more sustainable economies. The key question is no longer whether these challenges exist, but how they can be translated into clear, measurable, and useful information that supports better decision-making by governments, businesses, and society.

This is where accounting can play a much broader role. Traditionally, accounting has been associated with financial records, profit, cost, and performance. However, accounting can also serve as a language for organizing environmental realities. It can help transform complex issues such as water stress, carbon

emissions, renewable energy and waste into indicators, responsibilities and reports that support accountability and action.

In our published research on environmental sustainability accounting in the MENA region, we propose a theoretical framework built around a simple but powerful idea: what cannot be measured is difficult to manage. Sustainability reporting in many parts of the region remains developing, fragmented and often voluntary. In many cases, environmental reporting still relies heavily on broad narratives rather than consistent, comparable and decision-useful metrics. The challenge, therefore, is not only to produce more sustainability reports, but to develop a clearer way of deciding what should be measured, who should provide the data and how the results should inform decisions.

The proposed framework focuses on four environmental dimensions that are particularly relevant to the MENA context: water scarcity, carbon emissions, renewable energy and circular economy practices. These issues are not isolated environmental concerns. They are directly connected to food security, energy transition, urban planning, investment, governance and long-term resilience. By placing these four dimensions within an accounting framework, the study seeks to make them measurable, comparable and actionable.

The framework operates through three interconnected stages. The first stage is detachment, where a specific sustainability issue is identified and separated into measurable data points. For example, this may include water consumption, emissions levels, renewable energy capacity, or waste flows. The second stage is transformation, where the data is organized and interpreted using accounting tools. Two tools are especially important: natural capital accounting, which helps assess the condition and value of natural resources, and input-output analysis, which traces the movement of materials, energy and waste across economic systems. The third stage is extraction, where the information is converted into useful outputs such as environmental reports, performance indicators, dashboards and policy insights.

The value of this framework lies in its ability to move sustainability from general aspiration to structured information. When water is treated as a limited natural asset, organizations and governments can better assess how efficiently it is used across agriculture, industry and urban systems. When carbon emissions are classified and linked to economic activities, it becomes easier to identify their sources and design reduction strategies. When renewable energy is measured through installed capacity, energy generation and avoided emissions, green investment can be connected to both environmental and economic value. Similarly, tracking material and waste flows can support circular economy policies and reduce unnecessary resource loss.

Importantly, the framework is not intended solely for corporate organizations. It depends

on a wider institutional ecosystem that includes environmental ministries, national statistics offices, regulators, firms and regional bodies. Reliable sustainability accounting requires consistent data, shared standards and collaboration across institutions. This is essential because environmental challenges do not stop at the boundary of a company, a sector or even a country. Water, emissions, energy and waste are cross-cutting issues that require coordinated responses.

The study's central message is that accounting can become part of the environmental solution in the MENA region. Rather than viewing accounting as a narrow financial practice, the framework positions it as a tool for measuring sustainability, supporting policy development and strengthening institutional accountability. In this sense, accounting can act as a bridge between global sustainability goals and the specific realities of the region.

Nevertheless, several practical challenges remain. Institutional capacity varies across the region, environmental data are not always harmonized, and reporting systems differ between countries and sectors. However, these challenges do not weaken the framework. Instead, they highlight the need for gradual implementation, beginning with core indicators and expanding as data quality, institutional coordination and regulatory capacity improve.

Sustainability in the MENA region requires more than ambition. It requires measurement, accountability and practical tools that can turn environmental complexity into informed action. Through this framework, accounting can help make environmental challenges more visible, decisions more evidence-based and the region's sustainability journey more effective.

To view the research, please scan the QR code.





Interview with a Student

Mohammed Al-Hor

Bachelor of Medicine, College of Medicine – Qatar University

In this issue, we are pleased to host one of the graduates of the College of Medicine at Qatar University, who has managed throughout his academic journey to combine academic excellence, scientific research, innovation, and community engagement. His interests span dermatology, modern medical technologies, and medical education, in addition to his passion for leadership and public communication. In this interview, medical student Mohammed Al-Hor from the College of Medicine at Qatar University takes us through his journey from the lecture halls to the horizons of scientific research and professional excellence, as well as his aspirations for the future.

Mohammed, tell us about yourself and how your journey in medicine began. What motivated you to choose this path?

I am a medical doctor and an incoming Dermatology Resident at Hamad Medical Corporation (HMC), having recently graduated from Qatar University. My journey in medicine began with a desire to find a career that balanced intellectual challenge with a deep, humanitarian purpose. My family played a massive role in this; their constant support and guidance showed me how much of a positive, life-changing impact a doctor can have on individuals and the wider community. Inspired by the long history of medicine and, more importantly, the core values of Islam, I chose this path to combine the precision of modern science with genuine human empathy.

When did you discover your passion for scientific research? What was the first research experience that significantly impacted your journey?

I discovered my passion for research early in my medical training when I realized that clinical practice tells us “What” to do, but research answers “why” and “how” we can do it better. The first experience that truly impacted my journey was working on a project that eventually won a Gold Medal at the Euro-Invent Young Scientists competition in Romania in 2021. Seeing our ideas recognized on an international stage made me realize that even as a young student, I could

contribute meaningful knowledge to the global medical community.

Which international experience do you consider a turning point, and what did you learn from it?

The true turning point for me was winning second place for a research poster presentation at the Abu Dhabi International Conference in Dermatology and Aesthetics (AIDA). It was a turning point because it pushed me directly into the international dermatology community, a specialty I am heavily interested and invested in. I learned that data and research are universal languages. Connecting with top international experts taught me that achieving excellence requires looking beyond your local environment and being open to global collaboration.

What drew you to dermatology, and how do you envision your future in this field?

Dermatology completely fascinated me because the skin acts as a visible window into the entire body. I love the visual, diagnostic nature of the specialty and how closely it connects to a patient’s quality of life and mental well-being. Looking ahead, I envision myself as an active clinician and academic. I want to provide top-tier care to my patients at HMC while continuing to publish impactful research, specifically focusing on how internal conditions manifest on the skin.

How do you view the role of modern technologies and AI in advancing medical education and practice?

Technology is completely reshaping medicine. Having contributed to publishing a study on using Virtual Reality (VR) for anatomy education, I have seen firsthand how immersive tech can make complex concepts easier to understand and practice safely. AI and modern tech are not here to replace doctors, but to make us better and to enhance patient care. In medical education, it creates interactive, personalized learning. In daily practice, AI can handle heavy data analysis and help spot patterns, freeing up doctors to focus on what matters most: spending time with the patient and providing empathetic care.

How have leadership, communication, and event hosting shaped your personality?

Stepping into leadership roles and frequently hosting major health and technology events as a Master of Ceremonies has been just as important as my clinical training. These experiences forced me out of the library and took me away from my comfort zone. They taught me how to communicate complex medical ideas in simple terms, how to act under pressure, and how to speak confidently in public. It taught me that a great doctor cannot just be good with information; you must be an excellent communicator and a strong leader as well.

What challenges did you face, and how did you balance studies, research, and extracurriculars?

The biggest challenge was time management. Medical school alone is exhausting and time-consuming, so adding international research, leadership roles, and public speaking sometimes felt overwhelming. I managed this by treating my time like a budget. I prioritized tasks strictly, stayed organized, and made sure to protect my personal time, like playing tennis to clear my head. It wasn't about finding more time but being fully present in whatever I was doing.

What advice would you give to students who aspire to engage in research and achieve excellence?

My biggest advice is, do not wait for the perfect opportunity; go out and create it. Find a mentor whose work inspires you, ask questions, and do not be afraid to start small. I never intended to be part of a research group in dermatology; it was only when I took initiative and expressed my interest in the field, that I got these opportunities. Excellence does not happen overnight; it comes from consistency and being curious about the things around you. Most importantly, do not put yourself in a box. You can be a brilliant student, an innovative researcher, and a great leader at all at the same time. Trust your abilities, stay curious, and enjoy the process.

To begin with, Moza, could you introduce yourself and tell us about your academic and professional journey, and the key milestones that shaped your research interests?

I am Dr. Moza Abdullah Al-Kuwari, a PhD holder in Engineering Management from Qatar University and Assistant Director of the Quality and Conformity Department at the Qatar General Organization for Standardization. My career combines quality, conformity assessment, and standardization with a strong research interest. Exposure to challenges facing the industrial sector inspired me to focus on sustainability, decision-making, and practical research-based solutions.

You obtained a PhD in Engineering Management. What motivated you to choose this specialization, and how has it influenced your academic and professional path?

I chose Engineering Management because it combines engineering, management, and decision-making, all of which are closely related to my professional role. The specialization strengthened my analytical and research skills and enabled me to address challenges from technical, economic, environmental, and social perspectives.

Through your experience in managing national conformity programs, what are the key achievements or initiatives you are most proud to have contributed to?

One of the initiatives I am most proud of was my participation in a project linked to Qatar's National Manufacturing Strategy 2023–2027, which focused on assessing the quality infrastructure of national factories. During 2023, I participated in field visits to manufacturing facilities to collect data, evaluate the implementation of quality and conformity requirements, and identify challenges and opportunities to enhance industrial competitiveness. These visits generated valuable indicators on manufacturers' needs for standardization, conformity assessment, accreditation, and metrology, supporting initiatives to strengthen Qatar's national quality infrastructure.

Your research focuses on performance indicators for carbon capture technologies. What is the idea behind this research? What are its key findings, and how can its outcomes contribute to sustainability and decision-making in the industrial sector?



The core idea of my research is to develop a localized multi-criteria decision-support framework for carbon capture, utilization, and storage (CCUS) technologies, which are among the most important solutions for reducing emissions in heavy industries. The study involved experts from government, academia, and industry in Qatar to identify priorities and challenges associated with implementing these technologies.

The findings showed that technology selection should not rely solely on economic or technical considerations but must also account for environmental and social factors, as well as supply chain readiness. As a result, an integrated framework was developed to help decision-makers evaluate different technology options according to the specific needs of each industrial sector. To enhance the practical relevance of the research, I also proposed a regulatory framework for CCUS-related standards, supporting the development of a national standardization approach and contributing to sustainability goals and the transition to a low-carbon economy.

What are your future academic and professional aspirations, and what message or advice would you like to give to students and young researchers who aim to use scientific research to serve society and create a positive impact?

I aspire to continue contributing to sustainability and environmental research while promoting collaboration between academia, government, and industry to develop practical solutions.

My advice to young researchers is to focus on real-world challenges, remain persistent, embrace continuous learning, and collaborate across disciplines to create meaningful and lasting impact.

Leadership for Social Justice:

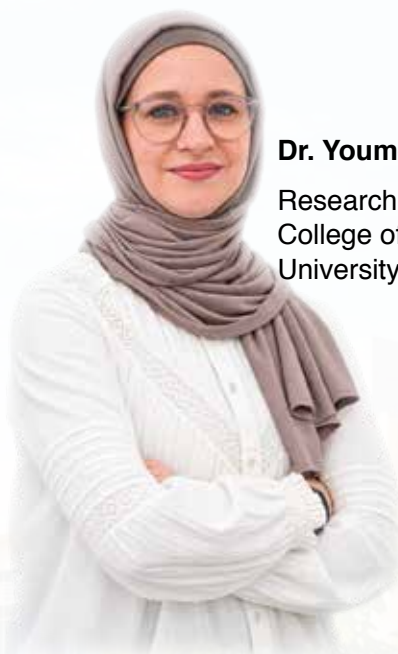
How School Principals Practice Equity and Inclusion?

What does it take to build schools where every student is seen, valued, and supported?

This question sits at the heart of a recent study by Youmen Chaaban from Qatar University with her colleagues, Khawla Badwan from the University of Manchester, and Khalid Arar from Texas State University. The study reviews a decade of global research on educational leadership for social justice and brings together evidence from 124 studies published between 2014 and 2024. The goal is to offer a better understanding of how school principals can create inclusive and equitable learning environments for all students. The findings show both progress toward social justice in international literature but also identify many gaps that point to important areas for change.

Why social justice?

Schools do more than teach subjects. They shape students' identities, opportunities and futures. Yet many educational systems still reproduce inequality, as students from marginalized backgrounds often face barriers linked to language, culture, or ability. These barriers are not accidental; they are built into the system's policies and everyday practices that are meant to eliminate them. Social justice in education, as reflected in the reviewed studies, goes beyond equal access. It focuses on equity, recognition, and participation. This means ensuring fair distribution of resources, valuing diversity and creating meaningful opportunities for all students to succeed and belong. This is where educational leadership plays a defining role. School principals make decisions that affect teaching, curriculum and school culture. They have the power to either reinforce inequality or challenge it. The study thus argues that leadership for social justice is not



Dr. Youmen Chaaban

Research Associate Professor,
College of Education - Qatar
University

optional, but a responsibility. It requires principals to actively address unfair structures and support all students.

What the research shows?

The review highlights several clear trends in recent research. First, most studies rely on qualitative methods such as case studies and interviews, with researchers focusing on the real-life experiences of school principals. While this approach provides rich and in-depth insights into how leadership for social justice is understood and practiced, it also limits the ability to generalize findings across different contexts. Second, the research is concentrated in a few countries. The United States leads by a wide margin, followed by Australia, Canada, and New Zealand, and there is limited representation from the Global South. This creates a narrow view of how leadership for social justice is understood and practiced. Third, interest in this field has fluctuated. Research output increased around 2020 and 2021, then declined slightly. This pattern may reflect broader

global disruptions in education, as well as shifting research and policy priorities.

Key themes shaping leadership for social justice

Despite differences in context, several themes emerge from an in-depth analysis of the included studies.

Theme 1: Through the lens of culturally responsive leadership

Effective principals recognize and value students' cultural and linguistic backgrounds, and they move beyond one-size-fits-all approaches by adapting teaching, policies, and school practices to reflect the diversity of their communities. This work also includes challenging deficit views of students and replacing them with strengths-based perspectives, where students' cultural backgrounds, languages, and experiences are seen as resources for learning rather than barriers. Principals play an active role in shaping inclusive school cultures by supporting teachers, revising curricula, and fostering strong relationships with families and communities. In doing so, they create environments where diversity is treated as an asset, which helps students feel included and improves both engagement and learning outcomes.

Theme 2: Leadership rooted in personal identity

A principal's personal and professional identity shapes their decisions, as beliefs, values, and lived experiences influence how they respond to inequality and injustice in their schools. The research shows that leadership for social justice requires ongoing critical self-awareness, where principals reflect on their own assumptions, biases, and positions of power and consider how these may affect their practices and interactions. This process is not static, but develops over time through experience, dialogue, and reflection. Principals who engage in this work are better equipped to act with intention, challenge discriminatory practices and build more equitable school environments that support fairness and inclusion for all students.

Theme 3: Navigating tensions between policy and practice

School principals often face pressure to meet policy demands while addressing social justice issues, as these goals do not always align. For example, standardized testing may conflict with inclusive and culturally responsive teaching practices, while accountability systems may prioritize measurable performance over equity and student well-being. Principals must navigate these tensions carefully by interpreting policies in ways that respond to their local contexts and the needs of their students. This often requires balancing competing priorities, advocating for more equitable practices, and making difficult decisions that reflect both policy expectations and a commitment to social justice.

A call to action

The study makes a strong case for rethinking how we prepare and support school principals.

Professional learning programs should go beyond management skills and focus on:

- Building critical awareness of inequality.
- Developing inclusive and equity-driven leadership practices.
- Engaging with diverse communities in meaningful ways.
- Challenging dominant assumptions about knowledge, learning, and success.

Leadership for social justice is not a one-time effort; it requires ongoing reflection and action. Principals must be willing to question existing systems and imagine new possibilities for their schools. Creating equitable education systems is a complex challenge that demands commitment at every level. School principals are at the front line, and their choices influence daily experiences for students and teachers. This research shows that change is possible, but requires intention, courage, and continuous effort. For universities, policymakers, and educators, the message is clear: invest in leadership that puts social justice at the center and support principals who are ready to challenge the status quo and work toward more inclusive and equitable schools for all students.

Transforming Windows into Active Energy Systems in a Hot Built Environment:

Msheireb Downtown Doha as a Case Study



Haneen Nsair, PhD Candidate in Architecture,

Supervisor: Dr. Abdulla Alnuaimi,

Department Head of Architecture and Urban Planning,
College of Engineering - Qatar University

As cities in hot-climate regions continue to expand, the built environment faces increasing pressure to reduce energy consumption while maintaining high levels of indoor comfort. In countries such as Qatar, where cooling demand accounts for the majority of electricity use, climate-responsive architectural design has become an urgent priority rather than a design preference. Addressing this challenge requires innovative solutions that simultaneously improve energy efficiency, occupant well-being, and environmental performance.

This research explores one such solution: the transformation of conventional windows into active energy-generating systems through the integration of semi-transparent photovoltaic

(STPV) technologies. Unlike traditional opaque solar panels, STPV systems are embedded within glazing, allowing facades to generate electricity while maintaining daylight access and visual connectivity. This dual functionality makes STPV windows a promising solution for dense urban environments (Figure 1), where building facades represent a largely untapped source of renewable energy.

The findings presented here are grounded in three complementary peer-reviewed studies that collectively examine STPV performance across indoor, building, and urban scales. Together, these studies provide a comprehensive framework for their application in Qatar's hot desert climate.

At the indoor scale, the first study [1] investigates the relationship between daylighting performance and visual comfort in office environments. In hot climates, excessive solar radiation often leads to glare and visual discomfort, negatively affecting occupant productivity and well-being. Using advanced simulation tools, including Grasshopper for Rhino and Radiance, the study evaluates how variations in window-to-wall ratio (WWR) and visible light transmittance (VLT) influence daylight distribution and glare levels.

The results demonstrate that these two parameters are critical in achieving a balanced indoor environment. A configuration of 60% WWR with 0.3 VLT was identified as the optimal solution, providing sufficient daylight while effectively controlling glare and minimizing reliance on artificial lighting. Alternatively, a 40% WWR with 0.4 VLT also performs well but may require supplemental lighting under certain seasonal conditions. These findings offer practical design guidelines tailored to Qatar's climatic context and highlight the importance of integrating daylight optimization strategies into facade design. Importantly, the study addresses a key research gap by providing localized data for desert environments, contributing to both regional and global discussions on sustainable building design.

At the building scale, the second study [2] examines the energy and thermal performance of STPV windows as part of an integrated building system. By filtering solar radiation, STPV glazing reduces unwanted heat gain, which directly lowers cooling demand—an essential benefit in Qatar's high-temperature environment. At the same time, these systems generate renewable electricity on-site, contributing to the building's energy supply.

The findings indicate that STPV windows can reduce cooling loads by up to 25%, while generating approximately 10–20% of a building's electricity needs, depending on factors such as facade orientation, glazing properties, and system integration. This dual performance underscores the value of STPV as both a passive and active design element. The study further emphasizes that the effectiveness of these systems depends on careful design optimization, including material selection and facade configuration, to balance thermal performance with daylighting and energy generation.

Expanding beyond individual buildings, the urban-scale analysis proposes a framework for integrating STPV technologies into sustainable

city development. Using Msheireb Downtown Doha as a case study (Figure 2), the research demonstrates how combining facade-integrated STPV systems with rooftop photovoltaic installations can create a synergistic energy strategy. While rooftop systems maximize solar exposure and electricity generation, STPV windows activate vertical surfaces, enhancing energy production in high-density urban areas where roof space is limited.

This integrated approach not only improves overall energy efficiency but also enhances urban resilience by reducing reliance on centralized energy systems. Additionally, it contributes to social sustainability by improving indoor environmental quality and promoting access to clean energy solutions within urban communities. The framework provides actionable guidance for architects, planners, and policymakers seeking to align urban development with Qatar's sustainability goals.

Complementing these applied studies, the third paper [3] offers a comprehensive review of STPV technologies and their role in advancing sustainable urban design in hot climates. The review examines key aspects of STPV systems, including material innovations such as perovskite-based photovoltaics, performance metrics related to energy generation and thermal behaviour, and strategies for architectural integration. It also highlights emerging trends, including AI-driven energy management systems and adaptive facades capable of dynamically responding to environmental conditions.

However, the review also identifies several challenges that must be addressed to enable widespread adoption. These include issues related to dust accumulation, which can significantly reduce system efficiency in desert environments, as well as concerns regarding material durability, long-term performance, and economic feasibility. Furthermore, the lack of standardized simulation methods and real-world validation studies presents a barrier to scaling these technologies. Addressing these challenges requires interdisciplinary collaboration and context-specific research tailored to the unique environmental conditions of regions like Qatar.

Across all three studies, a consistent theme emerges: the need to balance multiple performance criteria energy efficiency, visual comfort, and thermal regulation—within a single integrated system. STPV windows offer a unique

opportunity to achieve this balance by combining renewable energy generation with advanced facade design. However, their successful implementation depends on careful optimization, informed by both simulation-based analysis and real-world testing.

Looking ahead, the integration of smart technologies presents new opportunities for enhancing STPV performance. Future facades could incorporate adaptive features such as dynamic shading, variable transparency, and real-time energy management systems powered by artificial intelligence. These innovations would enable buildings to respond dynamically to changing environmental conditions, further improving energy efficiency and occupant comfort.

In conclusion, this research demonstrates that semi-transparent photovoltaic windows are more than a technological innovation; they represent a transformative approach to sustainable architecture in hot climates. By converting building facades into active energy systems, STPV technologies contribute to reducing cooling demand, generating renewable energy, and improving indoor environmental quality. In doing so, they support Qatar's broader vision for sustainable development and resilient urban growth.

As cities continue to evolve, the integration of such technologies will be essential in shaping a future where buildings are not merely consumers of energy but active contributors to a more sustainable and energy-efficient urban environment.

To view the published research outputs, please click the link or scan the QR code:

[1] <https://doi.org/10.13189/cea.2025.130304>



[2] <https://doi.org/10.13189/cea.2025.130441>



[3] <https://doi.org/10.70917/fce-2026-001>

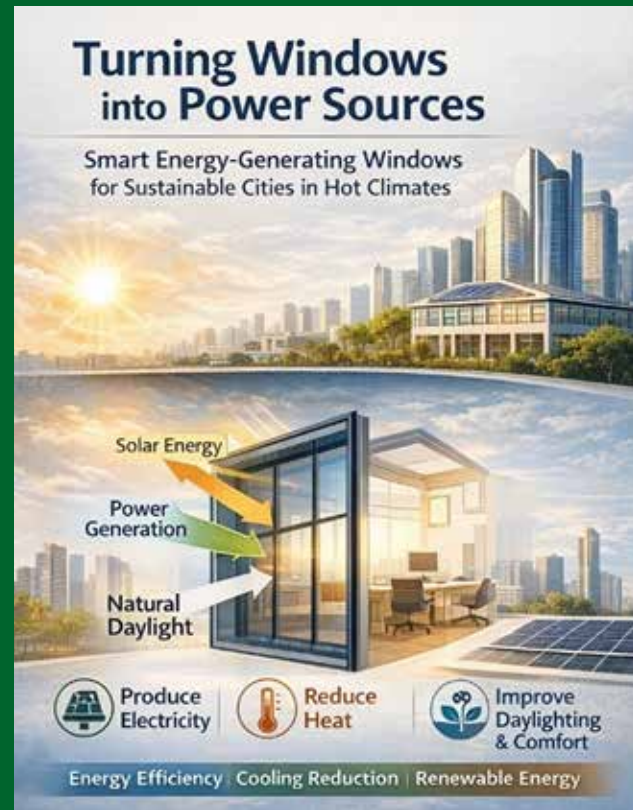


Figure 1: Solar windows for sustainable cities in hot climates.

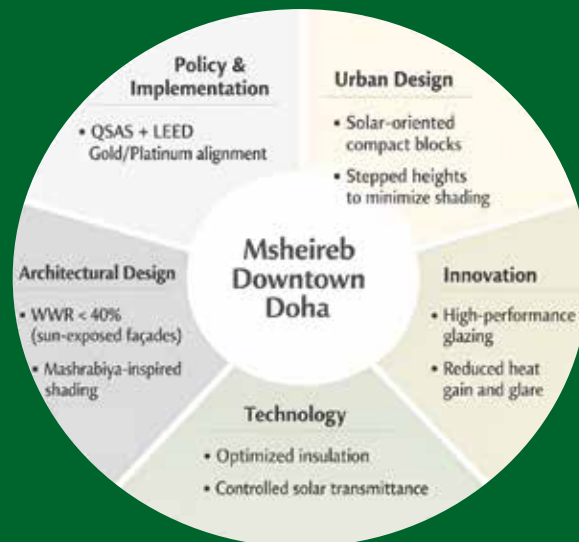
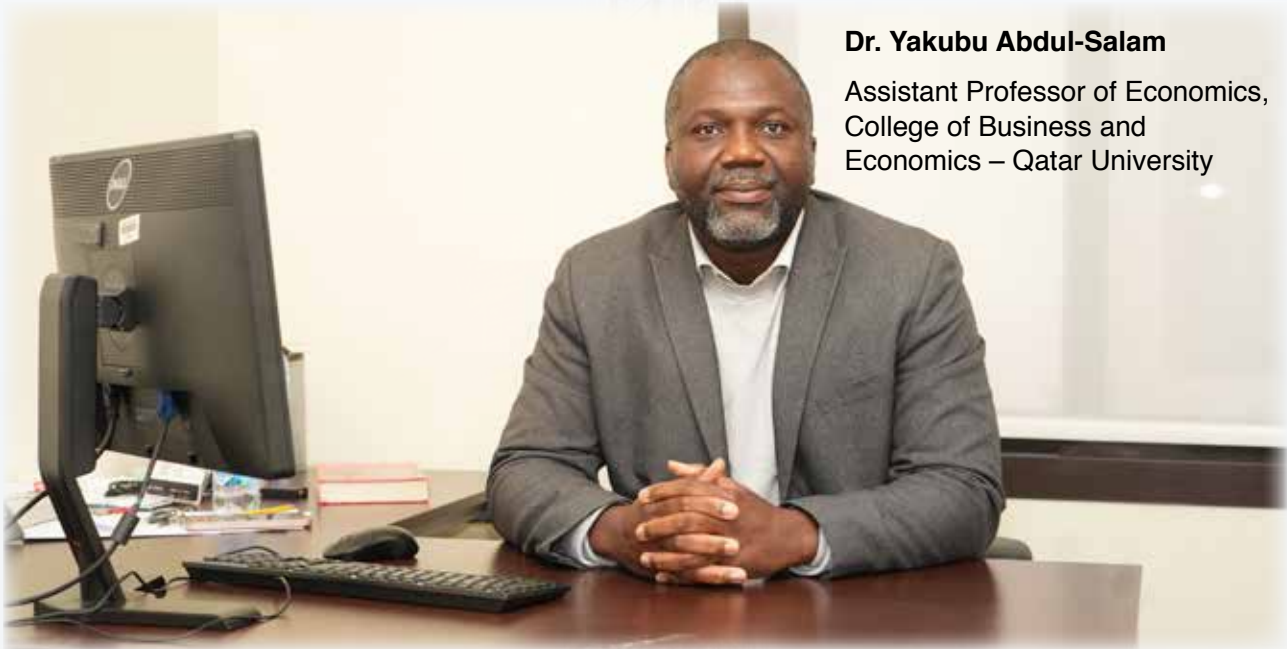


Figure 2: The alignment of the proposed framework with Msheireb case study.

Qatar's LNG Exports:

Advancing Efficiency in Electricity Generation and Reducing Carbon Emissions in the Global Energy Transition



Dr. Yakubu Abdul-Salam

Assistant Professor of Economics,
College of Business and
Economics – Qatar University

As countries around the world seek to balance economic development, energy security, and climate change mitigation, the role of natural gas in the global energy transition has become increasingly important. While renewable energy sources such as solar and wind are expanding rapidly, many economies continue to rely heavily on fossil fuels to meet electricity demand. In this context, liquefied natural gas (LNG) has emerged as an important transitional fuel because it can generate electricity more efficiently and with lower carbon emissions than coal and oil.

Qatar is one of the world's leading LNG exporters and plays a central role in global energy markets. Since beginning LNG exports in 1997, Qatar has steadily expanded its trade relationships across Asia, Europe, and other regions (see Figure 1). Countries such as Japan, South Korea, India,

China, Belgium, Italy, and the United Kingdom have relied on Qatari LNG to support electricity generation and diversify their energy systems. As global climate goals intensify, understanding the environmental and efficiency implications of these exports has become increasingly important.

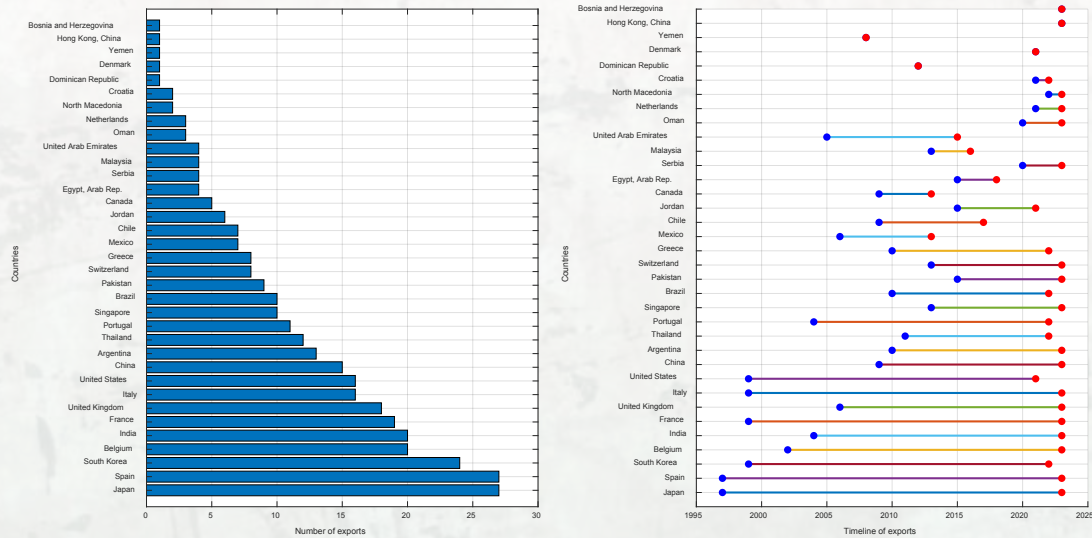


Figure 1: Frequency and timeline of LNG exports from Qatar to importing countries (Source: author plot using data from World Bank WITS Database, 2024).

* The left plot shows the frequency of LNG exports from Qatar to various countries, while the plot to the right depicts the timeline of these exports over the observed period (1997 – 2023)

A recent study at Qatar University examined the contribution of Qatari LNG exports to the global energy transition, focusing on two key dimensions: (1) improvements in electricity generation efficiency and (2) reductions in carbon dioxide (CO₂) emissions. The study combined econometric modelling with counterfactual scenario analysis to evaluate how Qatari LNG has affected electricity systems across importing countries between 1997 and 2022.

The first part of the study investigates whether increased use of Qatari LNG improves the efficiency of thermal electricity generation. Electricity generation efficiency refers to the amount of electricity produced relative to the amount of fuel combusted. More efficient systems require less fuel to generate the same quantity of electricity, reducing both waste and environmental damage.

Using panel data econometric techniques applied to 33 importing countries, the study finds strong evidence that Qatari LNG has significantly improved power generation efficiency. Natural gas-fired electricity generation is generally

more efficient than coal- and oil-fired generation because natural gas plants, especially combined-cycle gas turbine systems, convert fuel into electricity more effectively.

The findings show that countries with higher shares of Qatari LNG in their electricity generation mix experienced significant improvements in electricity generation efficiency. However, the results also indicate diminishing marginal returns at very high levels of LNG penetration. In other words, the largest efficiency gains occur during the early stages of replacing coal and oil with Qatari LNG. As electricity systems become increasingly optimized, additional efficiency improvements become smaller over time.

The study also highlights important regional examples of fuel substitution. In Japan and South Korea, Qatari LNG played an important role in reducing dependence on oil in electricity generation. In countries such as Belgium, Italy, and the United Kingdom, Qatari LNG contributed to the gradual replacement of coal in power systems. These transitions improved electricity generation performance while supporting broader decarbonization objectives.

The second component of the study focused on carbon emissions reductions. To estimate the environmental contribution of Qatari LNG exports, the analysis develops a counterfactual scenario framework. This framework compares actual electricity generation systems, where Qatari LNG was used, and a hypothetical scenario in which coal and oil continued to dominate electricity generation.

The results reveal substantial emissions reductions attributable to Qatari LNG exports. Between 1997 and 2022, Qatari LNG exports avoided an estimated 3,525.66 million tonnes of CO₂ emissions through the substitution of coal and oil in electricity generation (see Figure 2). To place this in perspective, the cumulative emissions reductions are equivalent to approximately 10% of total global energy-related CO₂ emissions recorded in 2022.

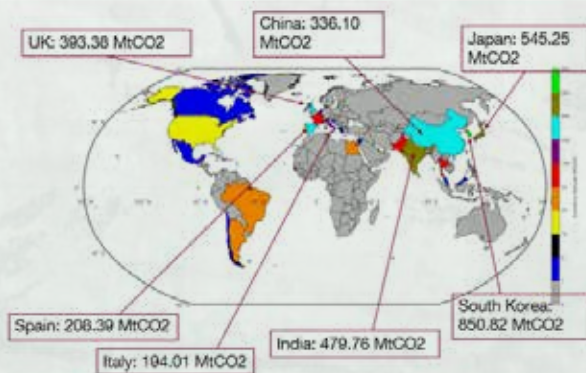


Figure 2: Cumulative end-use emissions reductions due to Qatari LNG exports, by country.

In recent years, annual avoided emissions associated with Qatari LNG stabilized at approximately 235 million tons of CO₂ per year. This exceeds the total annual energy-related emissions of several advanced economies, including Spain and the Netherlands. The study also estimates that these emissions reductions correspond to an annual global environmental benefit valued at approximately 41 billion US dollars.

The results demonstrate that Qatari LNG has

made an important contribution to improving electricity generation efficiency and reducing emissions across importing countries. By facilitating the substitution of coal and oil with natural gas, Qatari LNG has supported cleaner and more efficient power generation systems while enhancing energy security in multiple countries and regions.

At the same time, the study points to the limitations of LNG within long-term decarbonization strategies. Although natural gas emits less carbon dioxide than coal and oil, it remains a fossil fuel. Excessive long-term reliance on LNG could create “carbon lock-in,” where countries continue investing in fossil fuel infrastructure instead of accelerating the transition to renewable energy systems. Furthermore, methane leakage across the natural gas supply chain remains an important environmental concern.

Consequently, the study concludes that while Qatari LNG can play a critical transitional role in the global energy transition, it should complement rather than replace long-term investments in renewable energy, energy storage technologies, and carbon abatement systems. In the short to medium term, Qatari LNG offers a practical pathway for reducing emissions and improving efficiency in countries that continue to depend on thermal electricity generation. Over the longer term, however, sustainable decarbonization will require a broader transformation toward low-carbon and renewable energy systems.

Overall, the findings reinforce Qatar’s strategic importance in the evolving global energy landscape. Beyond its economic significance, Qatari LNG exports have contributed meaningfully to cleaner electricity generation and climate change mitigation efforts across multiple countries. As the world navigates the complex transition toward more sustainable energy systems, Qatar’s LNG sector continues to play an influential role in supporting global energy security while contributing to emissions reduction.

How Is Qatar Leveraging International Law to Develop Actionable Solutions for Language, Technology, and the Environment?

In a fast-changing world, research must address urgent global issues while considering local priorities. Dr. Darina Saliba's latest research focuses on cultural preservation, technological equity, and environmental sustainability through legal scholarship that links international frameworks to Middle Eastern policies.

Preserving Linguistic Diversity: When International Rights Frameworks Fall Short

Language extinction is an urgent crisis, with a language disappearing every two weeks, taking cultural knowledge with it. UNESCO warns that approximately 3,000 languages may vanish soon, at a rate faster than species loss. International law mainly treats language as a communication tool rather than as cultural heritage, offering weak protection. The research, published in the International Journal of Cultural Property by Cambridge University Press (2025), titled "When Rights Are Not Enough: Bridging International Legal Frameworks and Endangered Language Preservation through Middle Eastern Policy Models," compares Qatar, Lebanon, and Morocco, revealing different strategies. Qatar's Law No. 7 of 2019 provides a robust legal framework, promoting Arabic while supporting diversity through international treaty commitments. This model helps threatened languages and offers a global blueprint.



Dr. Darina Saliba Abi Chedid

Assistant Professor of Public Law, College of Law - Qatar University



Ensuring Gender Equity in Qatar's Digital Future

As Qatar advances toward National Vision 2030 goals of economic diversification and knowledge development, ensuring that technological progress benefits all citizens is crucial. The research, published in *The Journal of Artificial Intelligence and Human Sciences* (2025), titled “Artificial Intelligence and Gender Inequality: Mitigation Strategies and Governance Insights from Qatar,” highlights artificial intelligence (AI)’s role in gender equality in Qatar. The study shows how AI can reinforce gender inequalities via hiring biases from historical data, gender stereotypes in education, and biased decision systems. It reviews four bias-reduction strategies: balancing training data, tuning for fairness, improving the representation of underrepresented genders in training datasets, and modeling hidden discrimination. Nonetheless, technical fixes must be paired with policies and regulations. The researcher proposes a national strategy aligned with Vision 2030 that adopts international best practices tailored to Qatar’s context, including the establishment of standards, bias audits, policy development, and educational initiatives to promote gender-inclusive AI. This supports Qatar’s Digital Technology priority and social goals of gender equality and inclusion.



Environmental Compliance in the Arab World: From Commitments to Action

Climate change and environmental degradation pose existential threats requiring coordinated global action. However, the gap between international environmental agreements and actual state compliance remains vast. The research, published in the *Chinese Journal of Environmental Law* by Brill (2025), titled “The Arab States’ Green Path: Navigating Challenges

and Compliance with International Environmental Agreements,” examines how Arab states, including Qatar, navigate the complex landscape of international environmental law.

The study reviews the adherence of Arab countries to major international environmental agreements, such as the Paris Agreement and the Kyoto Protocol, as well as regional frameworks. It finds that, although these agreements have been ratified, their implementation is hindered by limited funding, competing priorities, capacity gaps, and coordination issues. Qatar serves as a key case study, balancing its hydrocarbon dependence with sustainable development through strategies such as renewable energy investments and economic diversification. Successful compliance relies on political will, finance, capacity building, monitoring, and civil society involvement. Policy suggestions include improving institutional coordination, data systems, green investments, public education, and regional cooperation. The research supports Qatar’s Resource Sustainability goal by demonstrating how legal frameworks and international commitments can drive effective domestic climate policies when backed by resources, political will, and institutional capacity.



Collective Impact: Advancing Qatar's Research Priorities

These publications showcase Qatar University’s dedication to tackling global challenges through rigorous, locally relevant research. They support key pillars: Society, protecting linguistic heritage and promoting gender equality to strengthen social cohesion; Digital Technology, creating fair AI systems to ensure equitable digital growth; and Resource Sustainability, ensuring compliance with international commitments and pursuing sustainable development.

Can We Be Circular and Digital Without Creating Social Blind Spots?

A Policy Perspective for Sustainable Transformation in Qatar and the GCC

Dr. Saad Zighan

Associate Professor of Management, College of Business and Economics – Qatar University

Circularity and digitalization are increasingly shaping the architecture of modern supply chains. Across industries, firms are encouraged to repair rather than discard, trace rather than estimate, and optimize rather than overconsume. Circular economy strategies aim to reduce waste and improve resource efficiency, while advanced digital technologies, such as artificial intelligence, blockchain, the Internet of Things (IoT), and data analytics, enable real-time visibility and predictive control. Theoretically, this convergence appears highly beneficial: cleaner systems, greater transparency, and stronger competitiveness.

However, implementation reveals a more complex reality. The critical question is no longer whether circular and digital transformation is desirable, but whether it can advance without generating new social vulnerabilities. This concern underpins a recent study co-authored with Professor Salomé Ruel, Professor of supply chain management at EMLV (De Vinci Higher Education – De Vinci Research Center), titled “*Managing Social Sustainability Paradoxes in the Digitalized Supply Chains for the Circular Economy*” and published in the *Journal of Purchasing and Supply Management*:



The Journal of Purchasing and Supply Management is a leading international, peer-



reviewed journal in the field of purchasing and supply management published by Elsevier. It has an Impact Factor of 8.7, is ranked Q1 in its subject category, and is classified as “A” in the ABDC Journal List. The research also attracted practitioner attention through a feature article in the French logistics magazine Voxlog, underscoring its relevance to both academic and managerial audiences:



The study examines Circular Digitalized Supply Chains (CDSCs), which integrate circular practices (reduce, reuse, remanufacture, recycle)

with advanced digital infrastructure. While much of the existing literature emphasizes environmental gains and operational efficiency, this research centers on social sustainability: employment stability, fair working conditions, workforce inclusion, supplier equity, and equitable access to digital capabilities. Its central premise is that environmental and technological progress do not automatically ensure social progress.

Drawing on qualitative interviews with 22 senior managers across four sectors—food processing, consumer electronics, chemicals and materials, and fashion—the study identifies structural tensions that arise when circular and digital initiatives unfold simultaneously. Rather than viewing these tensions as temporary obstacles, they are conceptualized as persistent paradoxes requiring deliberate management. Four interrelated paradoxes emerge: progress, efficiency, control, and governance.

Paradox #1: Progress - when “green” innovation shifts social risk

The progress paradox highlights the dual nature of technological innovation. Digital tools enable reverse logistics, predictive maintenance, smart sorting, and enhanced traceability, all of which are core enablers of circularity. However, automation and data-driven systems may displace certain job categories, intensify uncertainty, and marginalize suppliers or workers with limited digital readiness, contributing to the emergence of two-speed supply networks. Innovation intended to promote sustainability may therefore redistribute social risk rather than eliminate it. Addressing this tension requires embedding workforce upskilling and SME digital enablement within transformation strategies and incorporating social indicators, such as employability and digital literacy, into performance dashboards alongside environmental and financial metrics.

Paradox #2: Efficiency - optimizing without compromising fairness

The efficiency paradox reflects the enduring performance logic of supply chain management. Cost reduction, inventory optimization, and speed remain dominant priorities, even within circular initiatives. These pressures can conflict with commitments to fair labor practices, inclusive procurement, and long-term supplier development. Because social objectives are often less immediately quantifiable than financial targets, they risk marginalization during implementation. Institutionalizing social performance through explicit key performance indicators within procurement and supplier evaluation systems is therefore essential. Responsible sourcing must be operationalized through measurable criteria rather than articulated solely as an aspiration.

Paradox #3: Control - digital transparency versus confidentiality and dignity

The control paradox concerns transparency and power dynamics. Digital technologies enhance visibility across supply networks; blockchain systems, IoT tracking, and digital audits can expose labor violations or environmental non-compliance. While such transparency strengthens accountability, it may also raise concerns regarding surveillance, data ownership, and power asymmetries, particularly for smaller suppliers. Transparency thus becomes inherently paradoxical: it promotes responsibility while potentially undermining trust. Effective transformation requires governance frameworks that clarify data ownership, define safeguards, and involve stakeholders in the co-design of monitoring mechanisms, ensuring that transparency protects dignity and fosters collaboration.

Paradox #4: Governance - too many social objectives and not enough explicit trade-offs

The governance paradox reflects the growing complexity of sustainability management. Social sustainability spans human rights,

occupational safety, inclusion, ethical sourcing, and community impact. As circular and digital initiatives expand, reporting requirements and performance indicators proliferate, leading to increased fragmentation and organizational fatigue. Without integration, sustainability risks becoming a collection of disconnected initiatives managed in silos. Addressing this challenge demands coordinated leadership and alignment across procurement, human resources, IT, and operations, supported by structured dialogue around trade-offs rather than isolated functional optimization.

These tensions cannot be resolved; they can only be managed through learning. The study reaches a pragmatic conclusion: these paradoxes will not disappear through more sophisticated reporting or simply by adopting a newer tool. They call for dynamic management based on the genuine commitment of stakeholders (suppliers, service providers, affected regions, and employees), on unwavering transparency—including when it highlights what is unsettling or resistant—and on a constant capacity for innovation and learning. Above all, this management requires the ability to coordinate strategies that are sometimes sequential, addressing certain aspects successively rather than simultaneously, without ever relegating social sustainability to a mere variable.

In short, the circular, digitalized supply chain will only be truly sustainable if it is also socially sustainable, and this will not happen as a side effect. It must be desired, designed, measured, and balanced.

Relevance for Qatar and the GCC

These findings are particularly relevant within the context of Qatar's accelerated digital transformation and economic diversification agenda. The research aligns closely with the pillars of Qatar National Vision 2030 (QNV 2030): economic development, human development,

social development, and environmental sustainability. As Qatar advances smart infrastructure, digitally enabled logistics, and sustainability-driven industrial policy, supply chains are becoming increasingly sophisticated. At the same time, they depend on diverse labor forces and SME ecosystems that may exhibit varying levels of digital readiness. Without deliberate social alignment, digital acceleration risks widening capability gaps across firms and workforce segments. At the same time, this transition presents a significant strategic opportunity. Embedding social safeguards within procurement frameworks, SME digital support initiatives, and workforce reskilling programs from the outset can prevent the emergence of unequal “two-speed” supply networks. The framework developed in this study offers policymakers and industry leaders a diagnostic tool for anticipating tensions and designing inclusive digital strategies before unintended consequences materialize.

Circular and digital transformation does not inherently produce social sustainability. The paradoxes of progress, efficiency, control, and governance are structural features of systems undergoing simultaneous technological and environmental change. Managing them requires transparent recognition of trade-offs, stakeholder engagement, integrated measurement systems, and coordinated leadership. Environmental and technological advances must be balanced with workforce stability, supplier inclusion, and social cohesion.

The strategic challenge is therefore not whether circular and digital supply chains can be built—they can—but whether they can be developed without creating new forms of social invisibility. For rapidly transforming economies such as Qatar and the wider GCC, ensuring that sustainability remains socially grounded is not merely desirable; it is essential for long-term resilience and inclusive growth.



Professor Juhaina Sultan Saif Al-Issa: The First Qatari Faculty Member at Qatar University

Higher education in the State of Qatar began with the establishment of the College of Education for males and females in 1973, which is considered the first nucleus upon which Qatar University was founded pursuant to its founding law issued in 1977. At the graduation ceremony of the first cohort of students from the College of Education, which was held on June 11, 1977, the graduates' certificates were issued in the name of Qatar University, in a symbolic and institutional indication of the transition of the educational project from the stage of independent colleges to the stage of the national university. In the press conference held by Dr. Mohammed Ibrahim Kazim, Dean of the College of Education at Qatar University at the time, on September 26, 1978, he explained that in its sixth year the University would receive around 550 male and female students, bringing the total number to approximately 1,800 male and female students, in addition to nearly 400 male and female graduates.

Qatar University began its first academic year in (1977/1978) with four colleges: Education, Humanities and Social Sciences, Science, and



Prof. Ahmed Ibrahim Abu Shouk,
Professor of Modern History, Department of
Humanities College of Arts and Sciences – Qatar
University

Sharia, Law and Islamic Studies. Within this foundational academic context, Juhaina Al-Issa joined as a teaching assistant at the College of Education, and later at the Department of Sociology in the College of Humanities and Social Sciences, beginning an academic and

professional journey that became closely associated with projects of social modernization in the State of Qatar and with the study of the structural transformations witnessed by Qatari society during the modern developmental boom. Since the 1970s, the name of Juhaina Al-Issa has emerged as one of the pioneers in the field of sociology and social studies in Qatar and the Arabian Gulf, as she contributed to the establishment of academic social research and linked sociological studies to issues of development and social and cultural policies, in addition to her institutional role in developing higher education and strengthening the presence of Qatari women in the academic and research fields.

Academic Background and Establishment

Juhaina Al-Issa belongs to the Qatari generation that witnessed the beginnings of the modern educational and cultural transformation in Qatar. She chose early on to specialize in sociology, which at that time was considered one of the rare specializations for Gulf women, giving her experience an early pioneering and intellectual dimension. She obtained a Bachelor's degree in Sociology from Cairo University in 1968, then earned a master's degree in 1975, followed by a doctorate in the Philosophy of Sociology in 1978 from the same university. This academic formation in Cairo, which at the time was considered one of the principal incubators of Arab social thought, provided a solid intellectual foundation that later contributed to shaping her research project related to the study of Qatari society and its modern transformations.

Academic Journey

Dr. Juhaina Al-Issa joined the College of Education as a teaching assistant in 1973 and then as an Assistant Lecturer in the Humanities and Social Sciences Program. In 1978, she was promoted to a Lecturer in the Department of Sociology, College of Humanities and Social Sciences at Qatar University. She was subsequently promoted to a Professor of Sociology in 1990. In 1997, she assumed the position of Head of the Department of Sociology and contributed significantly to the establishment and development of social studies within the University.

She also held several important academic and administrative positions, including:

- Academic Affairs Advisor for Qatar University in Washington.

- Head of the Social and Economic Research Unit at the Center for Documentation and Human Studies.
- Head of the Department of Sociology.
- Member of the Qatar University Council.
- Chair of the Scholarships Committee at Qatar University.

She also worked as a visiting professor at Georgetown University (1980) and George Mason University (1994), which allowed her to engage with Western sociological schools and connect local experience with global contexts in the social sciences. In her speech delivered at the graduation ceremony of the fifth cohort in the 1981 academic year, Dr. Juhaina stated that achieving the University's mission requires that "the University be an instrument for development, and the citizen be a member of society, not merely an individual seeking self-actualization. Loyalty is only one aspect of the citizen's sense of belonging to this homeland, and an attempt to invest their energies in serving their society. In conclusion, the University's mission must be associated with the idea of development; that is, the University's mission is a developmental one. When we develop the human being, we help them achieve self-realization in service of their country, and the human being is, in fact, the most important factor in comprehensive development."

Contributions to the Study of Qatari Society

Juhaina Al-Issa's intellectual project was closely linked to an effort to understand the social transformations experienced by Qatari society during the oil boom and the emergence of the modern state of Qatar. Her work focused on issues such as:

- Social modernization.
- Urbanization and urban growth.
- Value and cultural transformations.
- Qatari social identity.
- Social development.
- Labor and localization (Qatarization) issues.
- Family, women, and education.

Amongst her contributions:

- Modernization in Contemporary Qatari Society, Kuwait: Kazma Publishing, Distribution and Translation Company, 1979.
- Qatari Society: An Analytical Study of the

Features of Contemporary Social Change, Cairo: Sijill al-Arab, 1982.

- Doha: The City-State: A Field Study on Urbanization in the City of Doha (co-authored), Doha: Qatar University Center for Documentation and Humanities Studies, 1985.

These studies and others alike were characterized by an attempt to bridge theoretical analysis with fieldwork, with a focus on the specificity of Gulf society and the rapid transformations imposed by economic development.

Women's Leadership and Community Engagement

Professor Juhaina Al-Issa represents a model of the Qatari academic woman who combined scholarly work with institutional and community participation. She participated as a member in several national committees and bodies, including:

- The Supreme Council for Education.
- The Preparatory Committee for the elections of the Central Municipal Council.
- The Women's Affairs Committee at the Supreme Council for Family Affairs.
- The Board of Directors of the General Retirement and Pension Authority.
- The American Sociological Association.
- Vice President of the Supreme Council for Family Affairs.
- Vice President of the Qatar Social Work Foundation.

Her name was also associated with issues of women's empowerment, education, and social development. She was among the voices calling for expanding Qatari women's participation in public life, within a framework that preserves the cultural specificity of society. She expressed this orientation early in her speech delivered at the graduation ceremony of the fifth cohort of the 1981 academic year: "Today, what the Qatari woman needs is for us to cultivate in her an aware mind, develop in her an open conscience, grant her confidence, and deepen in her a sense of responsibility, so that, God willing, through her many of the achievements we hope for this society may be realized"

Intellectual Approach and Sociological Orientation

Juhaina Al-Issa's work can be classified within

the developmental sociological school, which focused on analyzing the relationship between economic modernization and social transformation in Gulf societies. Her academic discourse was characterized by several features:

- A focus on the structural transformations of society.
- Linking development with cultural identity.
- An emphasis on field-based studies.
- Employing sociology to understand public policy.
- Openness to comparative approaches in the study of Gulf societies.

Her writings contributed to the formation of an important knowledge archive on Qatari society during its transition from a traditional to a modern urban society.

Awards and Scientific Recognition

Professor Al-Issa received several awards and honors, most notably:

- Ideal Woman Award, General Authority for Youth, Doha Youth Center, 1996.
- GCC-level Community Service Award, Umm Al Mu'minin Women's Association (Ajman), 2002.
- State Award for Scientific Excellence in Social Sciences, State of Qatar, 2006.

This recognition reflects the scientific and social standing enjoyed by Professor Juhaina Al-Issa as one of the founding figures of social research in Qatar.

Impact on Qatari Intellectual Life

The importance of Dr. Juhaina Al-Issa is not limited to her academic production; it extends to her contribution to establishing institutional traditions of social research in Qatar and linking the University with issues of society and development. She is also considered part of the generation that contributed to building women's academic presence in the Gulf and opening the way for subsequent generations of female researchers and academics. She was described by the program On the Shores of Doha (Qatar Radio), in an interview conducted with her on August 24, 2024, as having "an unlimited passion for knowledge. She captured the beauty of every turning point in life and embraced it, casting the shadows of modernization over Qatari society," in reference to her intellectual and social role in keeping pace with the country's modern transformations.

Preparing for Pregnancy: An Early Decision for Better Outcomes

Promoting Preconception Health in Qatar

Prof. Hanan Abdul Rahim

Professor of Public Health (Epidemiology), College of Health Sciences
- Qatar University

Many people think that health begins at birth, but research shows that it starts much earlier. Before a baby is born, and even before pregnancy occurs, the foundations of health are quietly being laid. For example, parents' nutrition and lifestyle before pregnancy strongly influence children's development and their risk of developing diseases (Jahan-Mihan et al., 2024). This critical stage, known as the preconception phase, has been the focus of our research study.

In collaboration with the Primary Health Care Corporation (PHCC), the research team at Qatar University (QU) consisting of Prof. Hanan Abdul Rahim, Professor of Public Health (Epidemiology), Dr. Ghadir Al-Jayyousi, Assistant Professor of Public Health, and MPH students Abdullah M. A. Ananzeh and Maaira Shahbaz are conducting a study aimed at enhancing the understanding, measurement, and support of preconception health in Qatar by developing a core set of monitoring indicators that enable the health system to monitor, analyze and improve the health of men and women before pregnancy. The study is supported by a Collaborative Grant from Qatar University (QUCG-CHS-25/26-725).

The importance of having a core set of indicators

A strong public health system relies on accurate and consistent measurement of health events. Without clear measurement indicators that are regularly collected, it is difficult to assess the current situation or to make decisions on what needs to be improved.

The study seeks to identify a set of preconception health indicators that are:



- **Holistic:** Reflecting the most important aspects of pre-pregnancy health.
- **Sensitive:** Able to detect important changes over time.
- **Planning-oriented:** Assists decision-makers in developing policies and programs that respond to actual needs.
- **Feasible:** Can be easily collected and followed within the health system in the State of Qatar.

For example, these indicators may include the proportion of women who take folic acid before pregnancy, the percentage of young people who maintain a healthy weight, and the level of demand for genetic counseling among couples and others. Regular tracking of these indicators also allows health authorities to identify gaps, monitor trends, and design targeted interventions that contribute to improving the health of current and future generations.

Study Methodology

The study follows an integrated methodology that combines review of the scientific literature with input from healthcare professionals and

community members, to ensure that the proposed indicators are effective and applicable. The stages of the study include:

- 1. Scoping review:** to map the global and regional literature and identify potential preconception health indicators. The review focused on countries of the Eastern Mediterranean Region (EMR).
- 2. Qualitative interviews:** Exploring the perspectives of members of the public to understand their views, priorities, and preferences regarding preconception care
- 3. A Delphi survey:** Building consensus among experts and community representatives on the final set of indicators.
- 4. Implementation and Feasibility Assessment:** Evaluating the acceptability, feasibility, and organizational readiness for integrating the finalized indicator set into Qatar's primary healthcare system through consultations with healthcare providers and decision-makers.

Progress to Date

The first phase of the study has been successfully completed through a comprehensive scoping review of the international and regional literature on preconception health indicators. The review identified a wide range of indicators currently used across countries and highlighted considerable variation in how preconception health is monitored, underscoring the need for a standardized core indicator set. The review also found that preconception care in the EMR remains biomedical and screening- focused with limited integration of psychosocial and health system determinants.

These findings provided the scientific foundation for the subsequent phases of the study, including rounds of stakeholder consultations, expert consensus, and feasibility assessment within Qatar's primary healthcare system.

An International Collaboration

This study is part of an international movement and global studies to advance preconception health.

Qatar has contributed to this effort through the International Core Indicators for Preconception Health (iCIPHE) Alliance led by Dr Danielle

Schoenaker from the University of Southampton and Professor Judith Stevenson from the Institute of Child Health at University College London (UCL) since 2022.

The researchers at Qatar University are part of this alliance, and Dr. Ghadeer Al-Jayyousi is a member of its core working team, which developed the protocol for identifying a unified set of indicators applicable in high, middle, and low income countries (Schoenaker et al., 2026a).

In 2024, Dr. Ghadeer Al-Jayyousi participated in the WHO meeting in Geneva entitled "Reshaping Care Services to Improve Preconception Health", where the meeting discussed global evidence and identified key care standards and gaps to guide future policies and programs (WHO, 2024).

The work of the iCIPHE, including the contribution from the Qatar study team, were recently published in the renowned medical journal, the Lancet (Schoenaker et al., 2026b). Through this international cooperation, Qatar is contributing to shaping the global dialogue on preconception health and has ensured that its national efforts are aligned with the highest scientific and practical standards.

Why it Matters

The future of health lies in prevention. Waiting until illness appears is often too late, too costly, or too complex. By acting earlier, we can shape healthier generations.

In Qatar, which is characterized by a young and growing demographic, this study aims to support young people in adopting healthy habits and empower them to reduce risk factors, help couples plan consciously, and encourage parents to lead by example to their children.

This study is more than just scientific research, it is a national and societal commitment to recognize that health begins long before birth, through the daily choices we make.

At Qatar University, in collaboration with the Primary Health Care Corporation (PHCC), and within the framework of the World Health Organization (WHO) vision, the research team is working to promote preconception health to become a key pillar of health policies and community practices in Qatar.

Green Chemistry and Functional Nanomaterials: Sustainable Innovation at Qatar University

Dr. Mohamed F. Mady

Assistant Professor of Organic Chemistry, Department of Chemistry and Earth Sciences, College of Arts and Sciences - Qatar University

Introduction

Sustainability has become one of the defining scientific challenges of our time. Modern industries increasingly require materials and technologies that are not only efficient and high-performing but also environmentally responsible. From water treatment and energy production to healthcare and industrial processing, researchers worldwide are seeking greener alternatives that reduce waste, minimize environmental impact, and support long-term sustainability.



Figure 1: Overview of the major research themes in Green Chemistry Laboratory at Qatar University.

At Qatar University, our research group focuses on developing advanced functional materials and sustainable chemical technologies inspired by the principles of green chemistry. By integrating nanotechnology, materials science, polymer chemistry, and surface engineering, we aim to design smart systems that address real-world challenges in oil and gas, environmental remediation, water purification, food security, and precision medicine (Figure 1).

The Lab's Role in Green and Sustainable Chemistry

Our research focuses on the design of environmentally friendly materials with enhanced functionality, stability, and recyclability. A major part of our work involves developing biodegradable polymers, phosphonate-functionalized materials, magnetic nanocomposites, and mesoporous nanostructures

for sustainable industrial and biomedical applications.

The group works extensively with superparamagnetic iron oxide nanoparticles (SPIONs), mesoporous silica nanoparticles, phosphonated polymers, amino acid-based inhibitors, and bio-derived polysaccharides such as alginic acid and inulin. These materials offer tunable surface chemistry, high adsorption capacity, magnetic responsiveness, and improved environmental compatibility compared to many conventional chemical systems.

Through interdisciplinary collaboration, our goal is to bridge advanced materials research with practical technologies that contribute to cleaner industrial processes, reduced chemical waste, and more sustainable engineering solutions. Representative research activities and laboratory-developed materials are shown in Figure 2.

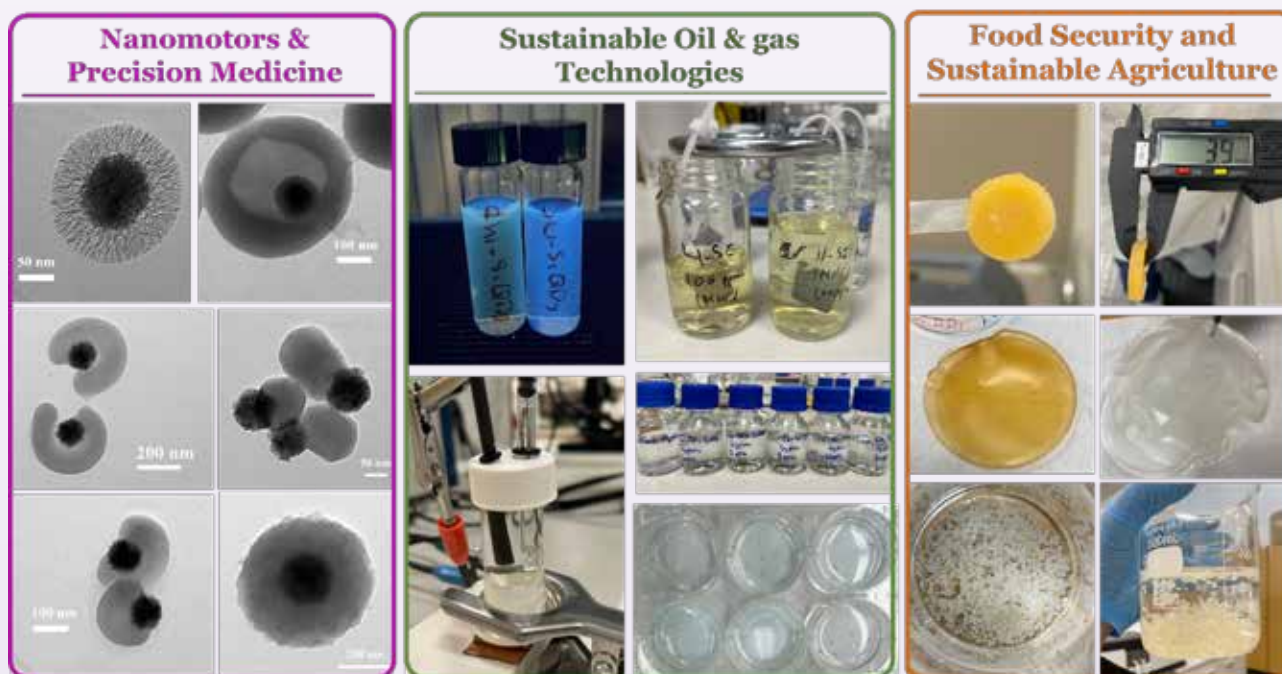
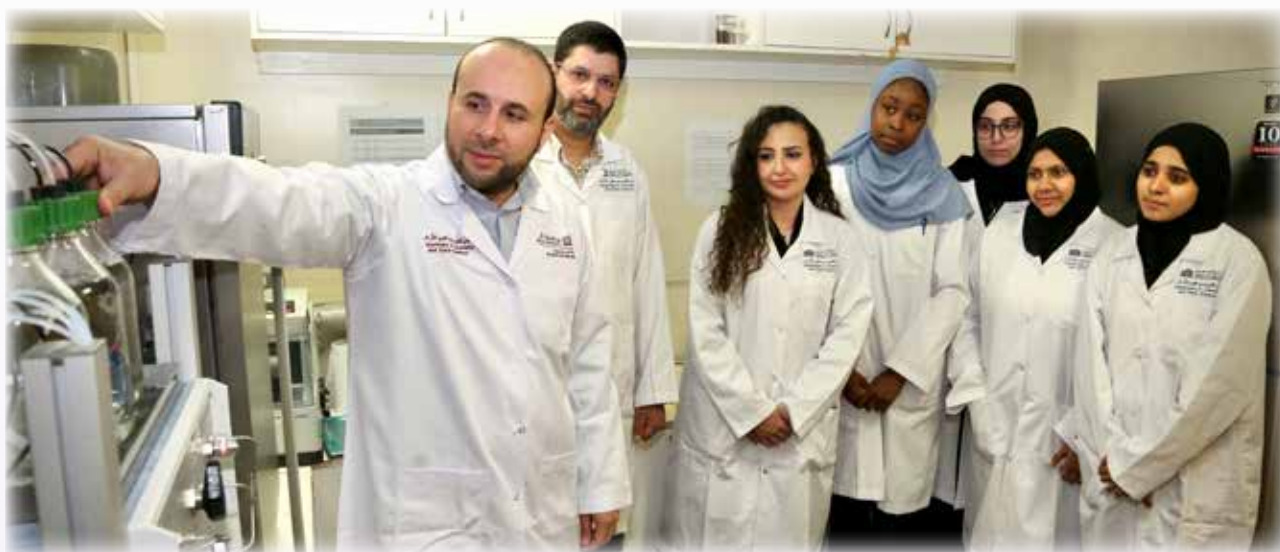


Figure 2: Representative images highlighting ongoing research activities in the laboratory, including mesoporous nanostructures, sustainable oil and gas technologies, and food security and sustainable agriculture applications developed at Qatar University.



Research team members at Qatar University during laboratory activities.

From left to right: Dr. Mohamed Mady, Dr. Showkat Jani, Ranim Eyad, Adilla Pires, Maha Abouseeda, Rinsha Basheer, and Shana Farhath.

Sustainable Oil and Gas Technologies

One of the major research directions of the Green Chemistry Laboratory focuses on environmentally friendly technologies for the oil and gas industry. Mineral scale deposition and corrosion remain among the most significant operational challenges affecting pipelines, desalination systems, and industrial equipment. Conventional inhibitors are often associated with limited biodegradability and long-term environmental persistence, motivating the search for greener alternatives.

To address these challenges, our group developed several biodegradable and dual-functional materials capable of simultaneously controlling scale formation and corrosion. These include dicarboxylated alginic acid, dicarboxylated inulin, phosphonated inulin, and phosphonate-functionalized amino acids designed for harsh industrial environments.

These materials demonstrated effective inhibition against carbonate, sulfate, and silicate scales while also improving corrosion protection under saline conditions. Compared to conventional oilfield chemicals, these systems offer improved environmental compatibility and support more sustainable industrial operations.

Another important direction involves recyclable magnetic nanomaterials based on SPIONs coated with environmentally friendly polymers such as polyaspartate and poly (4-styrenesulfonic

acid-co-maleic acid). These magnetic systems can be separated and recovered using external magnetic fields, reducing chemical discharge and supporting circular process strategies.

Our group also investigates mesoporous silica and silica nanoparticles functionalized with phosphonate-based inhibitors for improved gypsum and calcite management. These studies highlighted the importance of nanostructure design and surface chemistry in enhancing inhibitor performance and long-term process stability.

This research direction is led by Dr. Mohamed F. Mady and Dr. Showkat Ali Ganie, with contributions from Adilla Pires and Zainab Baloochi, focusing on sustainable oilfield chemistry, scale and corrosion control, and the development of environmentally friendly inhibitor systems.

Smart Materials for Environmental Sustainability

Beyond oilfield chemistry, our research explores multifunctional nanomaterials for environmental remediation and sustainable water treatment. We develop magnetic nanocomposites capable of removing heavy metals and contaminants from water through adsorption and magnetic separation processes.

These materials combine a high surface area, tunable surface functionality, and magnetic

recoverability, enabling efficient pollutant removal while minimizing secondary waste generation. Our work additionally includes ecotoxicity studies to evaluate the environmental safety and biological compatibility of newly developed nanomaterials.

We also developed bio-derived antimicrobial materials based on quaternary ammonium-functionalized cellulose with enhanced antimicrobial activity, thermal stability, and free radical scavenging capability. Such polymeric systems offer promising opportunities for environmentally safer industrial and biomedical applications.

Research in this area includes contributions from Rinsha and Shana, with a focus on environmental nanotechnology, smart materials, and polymer-modified systems.

Food Security and Sustainable Agriculture

Our laboratory develops sustainable materials for food security and agriculture, particularly for water-scarce environments. Our research focuses on green artificial soil systems based on biodegradable chitosan, Qatari nanoclay, and smart functional coatings to improve water retention and crop productivity.

We developed environmentally friendly nanoclay-polymer systems with enhanced moisture retention, mechanical stability, and potential applications in sustainable agriculture and precision farming. Our work also includes smart humidity-responsive coatings and biodegradable composite materials for advanced agricultural and environmental applications.

Zainab Baloochi and Dr. Farah El-Makaty contribute to the development of environmentally friendly nanosystems and smart materials for sustainable agriculture and food security applications.

Nanomotors and Precision Medicine

The Green Chemistry Laboratory is also actively investigating mesoporous silica micro/nanomotors for advanced biomedical and precision medicine applications. These smart nanosystems combine controlled motion, cargo-loading capability, and multifunctional surface engineering for targeted therapeutic delivery.

Mesoporous silica nanomotors possess highly tunable pore structures and large surface areas that allow efficient loading of drugs and functional

molecules. By integrating magnetic components and responsive surface modifications, these systems may contribute to future precision nanomedicine technologies and controlled therapeutic delivery platforms.

In parallel, our research explores engineered mesoporous nanostructures with tailored architectures for multifunctional applications across healthcare, catalysis, and advanced materials engineering.

Research on nanomotors and mesoporous nanostructures is conducted collaboratively within the group, with contributions from Dr. Farah El-Makaty and Ranim Eyad, focusing on advanced nanomaterials and precision medicine applications.

Looking Ahead

Figure 3 showcases selected research directions and recent scientific contributions from our group. The included QR codes provide direct access to representative publications for further exploration of the research. Through the integration of green chemistry, advanced nanotechnology, and materials engineering, our research focuses on developing sustainable solutions for challenges related to energy, water treatment, healthcare, food security, and environmental sustainability. Together, these studies reflect our ongoing commitment at Qatar University to advancing environmentally responsible materials and innovative technologies for a more sustainable future.

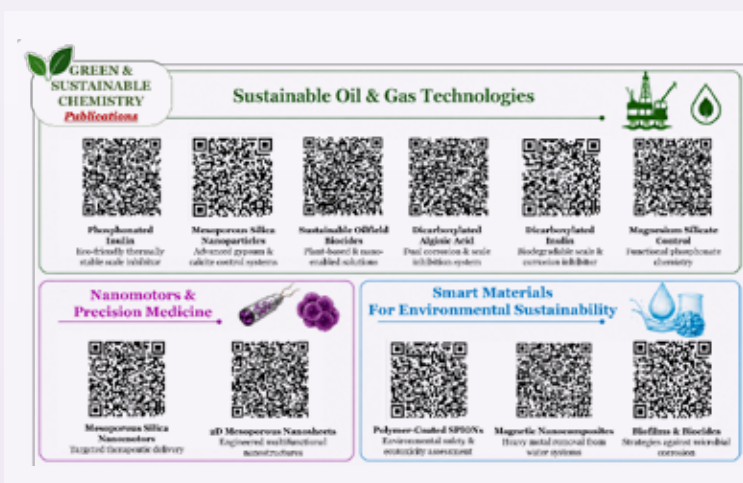


Figure 3: Selected recent publications from the research team, organized according to major research themes, including sustainable oil and gas technologies, nanomotors and precision medicine, and smart materials for environmental sustainability.

Exploring the Role of Marketing Strategies in Enhancing Local Professional Football League Attendance after Hosting the FIFA World Cup



Dr. Saad Alshamari,

Lecturer of Sport Management /Sport marketing,
Sport Management Department College of Sport
Sciences - Qatar University



Dr. Stephen L. Shapiro,

Department of Sport and Entertainment
Management, University of South Carolina,
Columbia, South Carolina, USA

Beyond the World Cup: Building a Lasting Football Culture in Qatar

Can a global event like the FIFA World Cup create lasting local changes? This research explores how Qatar can transform World Cup excitement into a sustainable football culture by bridging the gap between global influence and local identity.

A Nation Inspired by Football

When Qatar hosted the FIFA World Cup 2022, the country became the center of global attention. Stadiums were full, communities were united, and football became part of everyday life.

But once the tournament ended, a critical question remained:

Can this excitement continue within Qatar's local football league?

This research explores how the World Cup influenced fan behavior and what it takes to build a lasting football culture in Qatar.

From First-Time Fans to Future Supporters

The World Cup introduced football to new audiences across Qatar. Many people, especially women, youth people, and families, attended matches for the first time and became engaged with the sport. For many, this was not just entertainment, but a new social experience. Football became a shared activity, discussed in homes and communities. However, this rise in interest did not automatically lead to regular attendance at local league matches.

The Gap Between Interest and Attendance

Despite increased awareness, many fans continue to follow international leagues rather than local teams. Local matches are often seen as less exciting compared to global competitions. This creates a key challenge: How can local football maintain relevance in a globalized sports environment? The findings show that interest alone is not enough; fans need strong emotional connections and engaging experiences to attend regularly.

Culture at the Heart of the Game

Football in Qatar is shaped by culture, identity, and social norms. Family influence, traditions, and community values all play a role in shaping fan behavior. One major positive outcome of the World Cup was increased female participation. Women became more visible as fans and active participants in football culture. However, this increase in participation has not been fully sustained at local league matches, due to cultural expectations and social perceptions. This highlights the importance of culturally aware strategies that balance tradition with inclusion.

Rethinking Football Marketing

Football clubs in Qatar are working to build on the World Cup's success through:

- Community outreach initiatives
- Partnerships with schools and universities
- Social media and digital campaigns
- Improved match-day experiences

These strategies aim to make football more accessible and engaging. However, several challenges remain:

- Limited marketing resources
- Lack of long-term planning
- Weak connection with local culture
- Short-term approaches that do not build loyalty

In some cases, artificial attendance strategies have reduced authenticity, making fans less engaged.

Building a Strong Local Identity

A key insight from this research is that football success depends on identity. Many fans in Qatar feel more strongly connected to international teams due to global media exposure.

To strengthen local support, clubs must:

- Create emotional connections with fans
- Promote local stories and heritage
- Design experiences that reflect Qatari culture

When fans feel connected, they are more likely to support their local teams consistently.

Turning Legacy into Sustainable Impact

The FIFA World Cup left Qatar with world-class infrastructure and a new generation of football fans. But legacy requires action. To build long-term success, this research recommends:

- Developing culturally relevant marketing strategies
- Investing in youth and community engagement
- Creating inclusive environments for families and women
- Enhancing the stadium experience

These steps can transform short-term excitement into lasting engagement.

Conclusion: A Future Beyond the World Cup

The World Cup was a historic milestone, but it is only the beginning. Qatar now can build a sustainable football culture that reflects its identity and engages its community. With the right strategies, the legacy of 2022 can continue to grow, turning global inspiration into local passion.

To read the research article, please scan the QR code:



Culture is a Cornerstone of Language Teaching: Incorporating Culture into Arabic Language Classes for Non-Native Speakers

Culture offers tremendous opportunities for language education by presenting, discussing, and translating language into real-life situations that are relevant to students and reflect the details of daily life. The researcher examined the presentation of Arab culture in Arabic as a second language classrooms, using modern, specific strategies that balance theoretical and practical aspects. The research addressed culture, its scope, its importance, the purpose of teaching it, and its close relationship with teaching Arabic as a second language; the strength of this relationship is reflected in the fact that culture is a vibrant element that seamlessly bridges the learning process to acquisition.

The study then addressed the latest strategies for teaching culture and detailed how to apply them in the classroom. The study concluded that it is important to address culture in Arabic language classrooms for non-native speakers, and that teachers must be familiar with the various cultural intersections and differences, given their significant impact on enhancing learners' communicative and intellectual competence. It also emphasized the need to equip learners with diverse educational skills that extend beyond language to its social and cultural dimensions.

Why is culture important, and why should it be included in linguistic content?

Every person has his own system of expression and communication. We see that people gradually adopt certain modes of expression and verbal and physical gestures until they become a distinctive characteristic of those people compared to others. This system becomes a source of fascination or aversion for other people. As teachers, we cannot ignore these aspects, for they form the foundation on which the target language is built during the learning journey. This foundation offers the language learner significant benefits, saving them considerable time and effort in the learning process, and revealing a profound insight into the life cycle of the language—an insight that cannot



Samah Younis Al-Khateeb

Teaching Assistant of Arabic Language,
Arabic for Non-Native Speakers Center,
College of Arts and Sciences – Qatar
University

be attained without knowledge and understanding of these cultural cues.

Thus, no matter how many hours the learner spends studying the language and practicing its skills, they will not be able to sense the spirit of the texts they read and hear or reach their true essence. Claire Kramsch (A leading scholar in the fields of applied linguistics and foreign language teaching) expressed this point precisely when she said: "Culture is a potential source of conflict; in the context of language learning, it is not a fifth skill that can be dispensed with in the teaching of speaking, listening, reading, and writing."

The relationship between culture and language manifests in mutual influence, which is reflected in linguistic, physical, and intellectual communication; culture enhances communicative

competence and makes the learner a living part of the language they are learning, connected to it, capable of grasping concepts and vocabulary by decoding their cultural symbols.

How Should Culture Be Introduced in Arabic Language Classes for Non-Native Speakers?

The Arabic language is characterized by its cultural diversity and authenticity, which must serve as a foundation when discussing the presentation of cultural aspects in Arabic language classes for non-native speakers. It is worth noting the distinctiveness of Arab-Islamic culture and its unique characteristics, which necessitate that a set of objectives be prioritized when teaching Arabic as a second language.

It is essential to consider how to present culture to learners in a way that mirrors the social reality of the Arab people, their rich history, and the civilizations that have flourished on their land, as well as the intellectual and religious diversity that enriches and strengthens society. These methods must therefore leverage the sociocultural context in language instruction to facilitate learning, with the primary focus on educational situations that serve this purpose.

These methods include activities such as field visits to markets, homes, and workplaces, as well as visiting patients or nursing homes. We find that some people enter homes without removing their shoes, while in other homes shoes must be removed at the door; both practices reflect a culture interpreted according to the linguistic group, particularly the second type, which aims to maintain the purity of the home during prayer, and attending events, including houses of mourning, weddings, and religious and national holidays, as well as role-playing, where the learner engages in cultural tasks such as offering congratulations at a wedding, or during religious holidays and personal occasions, and offering sympathy and condolences in cases of death.

Another approach is inquiry-based learning, where learners are tasked with researching a specific issue in society while considering the social norms of that community and one of the beautiful preconceptions that I find distinctive is the preconception test, in which learners are asked to write a description of the culture they are studying—such as Arab family relationships—and

each learner records their observations, and then we ask them to investigate all these perceptions from their sources using available reliable resources, and then we ask them to compare the perceptions they have gathered on those issues.

What are the most important strategies for introducing culture in Arabic language classes for non-native speakers?

- 1. Use authentic texts and materials.** These texts or materials must be drawn from the daily life of the target language community, as if the learners were living naturally within it and encountering the language spontaneously.
- 2. Encouraging students to discuss culture.** The best method for this strategy might involve showing a short video clip and asking students to write down words related to the topic, then moving on to a discussion of the ideas presented, drawing on their prior knowledge to produce language in a natural context.
- 3. Bridging the cultural gap.** The teacher should take specific steps to reduce misunderstandings arising from the concepts and ideas conveyed by educational curricula and other resources presented to the learner.
- 4. Cross-cultural comparison.** Leveraging the learner's cultural background and knowledge of the customs and traditions associated with their native language to create a shared approach across different cultures enhances second language learning.
- 5. Role-playing.** Role-playing ensures that learners engage closely with cultural situations, leading to a deeper understanding of social concepts and practices.

In conclusion, to strengthen this relationship between culture and language, which is a requirement in the field of teaching Arabic to non-native speakers, it was necessary to focus on strategies for conveying and presenting them to the learner in a way that is closer to natural acquisition. This ensures that the learning process achieves linguistic and cultural immersion—a goal sought in most second-language learning programs—without which the learner cannot achieve communicative competence in the community of that language.



Advancing Youth Health and Wellbeing at a Health-Promoting University: The QU Health Research Network Group

Members from QU Health:

Dr. Hanan Abdul Rahim; Dr. Reema Tayyem; Dr. Manar Elhassan; Dr. Elham Abu Alhaija; Dr. Hanan Khalil; Dr. Banan Mukhalalati; Dr. Alla El-Awaisi; Dr. Mujahed Shraim; Dr. Maria Isabel Ferreira; Dr. Maguy ElHajj; Dr. Rafif Mohmood; Dr. Fadi Khraim; Dr. Nivein Abu Rmilah; Dr. Manal Musallam; Dr. Diana Maddah; Dr. Dima Arafah; Dr. Diana Hassan; Ms. Jennifer Allen; Ms. Taysier Elgaili; Ms. Rula El Chami; Ms. Hanin Daas.

Mission

The mission of the Youth Wellbeing Research Network (RNG) is to foster a collaborative research ecosystem that produces scientific evidence, contextual data, and best practices to promote the holistic wellbeing of young people. Through a multidisciplinary approach, the network conducts comprehensive studies on the multiple factors affecting youth health and contributes to the advancement of global scientific knowledge.

The Youth Wellbeing Research Network (RNG) was established in 2021 and comprises 22 faculty members from the health sector at



Dr. Ghadir Fakhri Al-Jayyousi

Assistant Professor of Public Health, College of Health Sciences – Qatar University

Qatar University, along with colleagues from the university's Student Counseling Center and partners from Hamad Medical Corporation. The group began its work by assessing the health

status and needs of Qatar University students, using a comprehensive and integrated definition of health based on the perspectives of students, faculty, and key stakeholders on campus.

The group aims to enrich evidence-based policies, programs, and services that seek to improve the physical and mental health of young people, particularly Qatar University students, both nationally and internationally.

Goals

Objective 1: Assess the needs of Qatar University students by gathering the views of students and key informants, including identifying health challenges and gaps in resources to guide future interventions.

Objective 2: Conduct a systematic survey of the physical environment at the university and review relevant policies to identify the supporting factors and gaps that affect student health.

Objective 3: Develop and propose evidence-based interventions that respond directly to specific needs, in line with the pillars of the “Healthy University”.

To achieve these objectives, an explanatory sequential mixed-methods study design was adopted, where quantitative data were first collected and analyzed, followed by a qualitative data collection phase to provide a deeper understanding of the health priorities and needs of the population. This design enabled the triangulation of data in both phases, enhancing the credibility, reliability, and objectivity of the results.

A multidisciplinary team developed a health questionnaire to assess the health status and needs and assets of university students through six axes:

1. Demographic data.
2. Physical and mental health.
3. Lifestyle (including physical activity, diet, and smoking.)
4. Oral health and quality of life.
5. Health Literacy
6. Use of healthcare services.

Results

- The applied validated tools included the University Student Health Questionnaire (2021, University of Minnesota), the International Physical Activity Questionnaire (IPAQ-SF), the Oral Health Impact Scale on Quality of Life (OHIP-5), the European Health Awareness Questionnaire (HLS-EU-Q16,) and the YHCSUN questionnaire.
- 904 students from QU participated in the quantitative assessment through an electronic questionnaire conducted between 2021 and 2022, and the data was cleaned and processed in 2023 to ensure that it is representative of the university's students.
- This was followed by data analysis to answer specific research questions aimed at understanding the health needs and assets of university students. Ongoing analyses included descriptive analysis (e.g., prevalence of risk factors and health behaviors) and correlational or comparative analysis (e.g., the relationship between demographic factors and health behaviors).
- About six scientific papers have been prepared, of which two papers dealing with mental health and dietary patterns have been accepted for publication.
- Of the 812 participants (mean age 21.4 years, 84.6% female) 45.5% reported a history of mental illness, most notably anxiety (38.2%,) and depression (27.9%.) A dose-response relationship was also observed between the number of life events and the likelihood of mental illness diagnosis . However, only 7.6 % of students received psychological counseling, suggesting the need for strategies to promote resilience and mental well-being.

Based on these findings, the group conducted qualitative research to explore the factors influencing mental health literacy and help-seeking behavior among Qatar University students. This research used a constructive interpretive framework and relied on semi structured interviews with the students. This work formed the basis of the 2024 Graduation in Public Health project for students Maryam Al-Sulaiti,

Moudi Al-Kuwari, Rahaf Al-Kuwari, and It was supervised by Dr. Ghadir Al-Jayyousi, and was titled **“Contextualizing Mental Health Literacy and Help-Seeking Behavior of University Students in Qatar: A Conceptual Framework,”** which won first place in the poster category at the Fourth Health Literacy Conference at Sidra Medicine.

In order to achieve the second objective related to the environmental survey within the needs assessment, students Aisha Al-Ahmad and Fatima Al-Habshi, under the supervision of Dr. Ghadir Al-Jayyousi and Dr. Lily Ohara, carried out the project **“Assessing the characteristics of outdoor green spaces at the Qatar University campus,”** which was submitted for publication.

Additional Achievements of the Youth Wellbeing Research Group

The group supports the Qatar University Health Project by providing data that reflects healthy campus indicators. The results of the Youth Wellbeing Initiative contribute to the review of ongoing policies and the development of pro-health strategies at the university level. The initiative was presented to the WHO team during their visit to the Qatar University campus to assess and follow up on these indicators.

The group also hosted notable speakers, including Dr. Catherine Lust (Director of Research at Boynton Health Center, University of Minnesota), developer of the University Student Health Survey, and Dr. Mohammed Siddiq Maghzoub, Acting Director of the Student Advising Center at Qatar University.

The initiative has been presented at prestigious international conferences, including:

- International Conference of Health-Promoting Universities 2025 – University of Limerick, Ireland.
- 25th International Union for Health Promotion and Health Education (IUHPE) World Congress – Abu Dhabi
- World Nutrition and Public Health Conference 2024 – London

It has also been presented at local conferences, such as the Ministry of Public Health’s Healthy

Cities Project and the MENARAT Regional Initiative for Adolescent Health Research and Training in the Middle East and North Africa.

Currently, machine learning models are being applied to data to predict health and well-being, in collaboration with Al-Quds University in Palestine. The group also obtained data from Qatar Biobank (QBB) to study the health and well-being of young people aged 18 to 36 years in Qatar. This resulted in a master’s thesis in Public Health titled **“A Machine-Learning Model for Predicting Depression Symptoms Severity in a Sample of Young Adults: A Cross-sectional Study from Qatar Biobank (QBB),”** by Maryam Al-Yafei, supervised by Dr. Ghadir Al-Jayyousi and co-supervised by Dr. Radwan Qasrawi from Al-Quds University.

The Plan Ahead

Based on the results of the mixed assessment of Qatar University student health, the team is currently working on the project **“A Participatory Evaluation of the Design and Implementation of a University Student-Centered Mental Health and Wellbeing Program: The QU Wellbeing Advocate Program,”** led by Dr. Jennifer Allen, Lecturer in Physical Therapy, and Ms. Tayseer Al-Jili, Senior Advisor at the Student Advising Center at Qatar University, which aims to improve and support mental health and well-being of QU students.

The project aims to design and evaluate a culturally appropriate student-centered program that addresses priority health needs as expressed by students at QU. Furthermore, the participatory assessment approach will contribute to formulating policy recommendations based on direct feedback from students and stakeholders, thereby enhancing the relevance and effectiveness of future mental health policies and programs at the university.

For more information about the protocol published for this initiative, scan the QR code:



Story of Knowledge Platform

Center for Entrepreneurship

College of Business and Economics – Qatar University



In light of the growing role of entrepreneurship and innovation in supporting a knowledge-based economy, the Center for Entrepreneurship at Qatar University continues its efforts to empower innovators and entrepreneurs while supporting researchers and students in transforming their ideas and research outputs into projects with sustainable economic and societal impact.

To learn more about the center's vision, objectives, programs, achievements, and its role in supporting researchers and strengthening the entrepreneurship and innovation ecosystem in Qatar, we met with Dr. Khalid Al Hashimi, Director of the Center and Associate Dean for Research and Graduate Studies at the College of Business and Economics, in this interview.



Some of the Center's Activities.

To begin, Dr. Al-Hashimi, could you introduce us to the Center for Entrepreneurship at Qatar University and its key objectives and role in supporting the innovation and entrepreneurship ecosystem?

The Center for Entrepreneurship (CfE) at the College of Business and Economics, Qatar University, serves as a dynamic platform for fostering entrepreneurship, innovation, and entrepreneurial thinking among students, researchers, faculty members, and the wider community. Established in 2013, the center bridges academic knowledge with real-world application through experiential learning, startup support, and ecosystem engagement. It has evolved into an integrated hub combining entrepreneurial learning, pre-incubation support, and cross-sector collaboration, contributing to Qatar's innovation ecosystem and economic diversification.

CfE demonstrated significant impact in 2025 across multiple dimensions. Key achievements include reaching 4,512 total participants and engaging 2,605 Qatar University students. Additionally, 19 initiatives were delivered, including 11 newly launched programs, and 16

joint initiatives were executed with partners. The center also supported 101 startup teams and contributed to thought leadership through participation in 6 International and National conferences and forums.

What are the main programs and initiatives offered by the center to foster entrepreneurial culture and innovation skills among Qatar University students?

The center delivers a comprehensive portfolio of initiatives through its Entrepreneurial Learning and Pre-Incubation sections. These include: Startup and SME Clinic, Shell Intilaaqah-Qatar Program, Al-Fikra National Entrepreneurship Competition for Higher Education, The Deal: Cash Catch, the Foundation Showcase Competition, Qatar Entrepreneurship Award, and Inspirational Talks. These programs provide experiential learning opportunities, competitions, mentoring, and workshops that equip students with skills in creativity, problem-solving, teamwork, and business development, enabling them to transform ideas into viable ventures.

How does the center support students in exploring entrepreneurial opportunities and transforming their ideas into viable ventures?

The center supports students through a structured entrepreneurial journey from idea generation to venture development. Through initiatives such as the Startup & SME Clinic, students receive one-on-one advisory support in business model development, prototyping, market validation, and pitching. The Clinic serves over 200 participants annually, highlighting the strong demand for practical entrepreneurial guidance.

Students also engage in experiential learning through programs such as The Deal: Cash Catch, which involves around 155 students, and the Foundation Program Showcase, which attracts over 500 students each year. In addition, Shell Intilaaqah received 421 applications from Qatar University and graduated 283 students, demonstrating the scale and impact of the center's entrepreneurship initiatives.

At the national level, the Al-Fikra National Entrepreneurship Competition for Higher Education attracted 117 applications from 409 participants across 8 universities in 2025, while the 2026 edition expanded to approximately 750 participants from 14 universities. The Health Tech Hackathon further engaged over 420 participants and 52 multidisciplinary teams, providing opportunities for innovation and real-world problem-solving.

By combining advisory services, experiential learning, competitions, and ecosystem engagement, the center helps students develop market-ready solutions with economic and societal impact. It also promotes student ventures through platforms such as the Qatar Entrepreneurship Award and supports leadership development through the Innovation & Entrepreneurship Student Association.

What are some of the center's most notable local and international partnerships, and what impact have they had?

The center collaborates with a wide network of strategic partners including Shell Qatar, Qatar Development Bank, Qatar Science & Technology Park, the Ministry of Communications and Information Technology, Ooredoo, Nama Center, QNB, QIIB, Al Rayan Bank, Dolphin Energy, Visit Qatar, and Snoonu. These partnerships enhance the center's programs, provide access to mentorship and funding opportunities, and strengthen collaboration between academia

and industry, contributing to the advancement of Qatar's entrepreneurship ecosystem.

Could you share some success stories or outstanding examples of individuals or projects that have benefited from the center's services?

Through its programs and collaborations within Qatar's entrepreneurship ecosystem, the center has supported a wide range of student-led innovative projects that have progressed beyond the university setting.

For instance, through national platforms such as Al-Fikra National Entrepreneurship Competition for Higher Education, which is one of Qatar's leading entrepreneurship competitions for higher education, participating teams have developed high-potential startup concepts across sectors such as fintech, sustainability, and digital solutions, with several progressing to further support programs offered by entities such as Snoonu and Qatar Science & Technology Park (QSTP). These pathways typically lead to incubation, funding opportunities, and continued startup development. In addition, the winning teams of Al-Fikra are directly entered into the National Hult Prize shortlist, enabling them to compete globally and pitch their ideas internationally. Similarly, the Shell Intilaaqah program, delivered in collaboration with Shell Qatar, is widely recognized in the local ecosystem for nurturing early-stage entrepreneurs. Across Qatar, Shell Intilaaqah Alumni were also given the chance to be part of the Shell LiveWire Impact Award 2026.

At the university level, students participating in initiatives such as The Deal: Cash Catch have created and tested real business ideas in live environments—ranging from e-commerce concepts and campus-based services to digital platforms—gaining hands-on experience in revenue generation, customer engagement, and venture execution. This competition results in prize money for the winning teams, with a total of around 30,000 QAR for six teams

What challenges do students face when transforming their ideas into real business, and how does the center help them overcome these challenges?

The Center assists Qatar University students from the earliest stages through the Clinic,

competitions, workshops, and other initiatives. Students may join the entire entrepreneurial journey or participate in selected stages. The challenges they face are common among aspiring entrepreneurs worldwide, as we are a very diverse community of around 30,000 students at QU. Examples of challenges faced include limited experience in developing business models, difficulty validating ideas, and lack of exposure to real entrepreneurial environments. Here, our role in the center is taking care of the students as well as leveraging the ecosystem network and exposure so they can also get incubated!

The center addresses these challenges through a structured, hands-on approach. For example, through national platforms like Al-Fikra National Entrepreneurship Competition for Higher Education, 39 teams advanced to the competition stage and 6 finalists reached Demo Day, gaining direct exposure to expert feedback and venture development opportunities.

Additionally, the Business Readiness Mastery Program supported 85 students in building practical skills in areas such as innovation

management, marketing, and resilience.

Also, we provide customized on-demand workshops for Colleges and Programs, for example: Arabic for non-native speakers, College of Engineering, Health Cluster.

The center also promotes social entrepreneurship through collaboration with NAMA, exposing students to real societal challenges and solutions.

Following the successes achieved by the center, what accomplishments are you most proud of, and what is your vision for the next phase?

The center is proud of building a comprehensive entrepreneurial pipeline that supports individuals from idea generation to market readiness. Key achievements include increased participation, stronger partnerships, and improved quality of entrepreneurial ventures. Moving forward, the center aims to expand its programs, enhance research commercialization, strengthen partnerships, and further position itself as a leading hub for entrepreneurship and innovation, as we serve around 5,000 participants per year.



The Entrepreneurship Center Team at the College of Business and Economics.