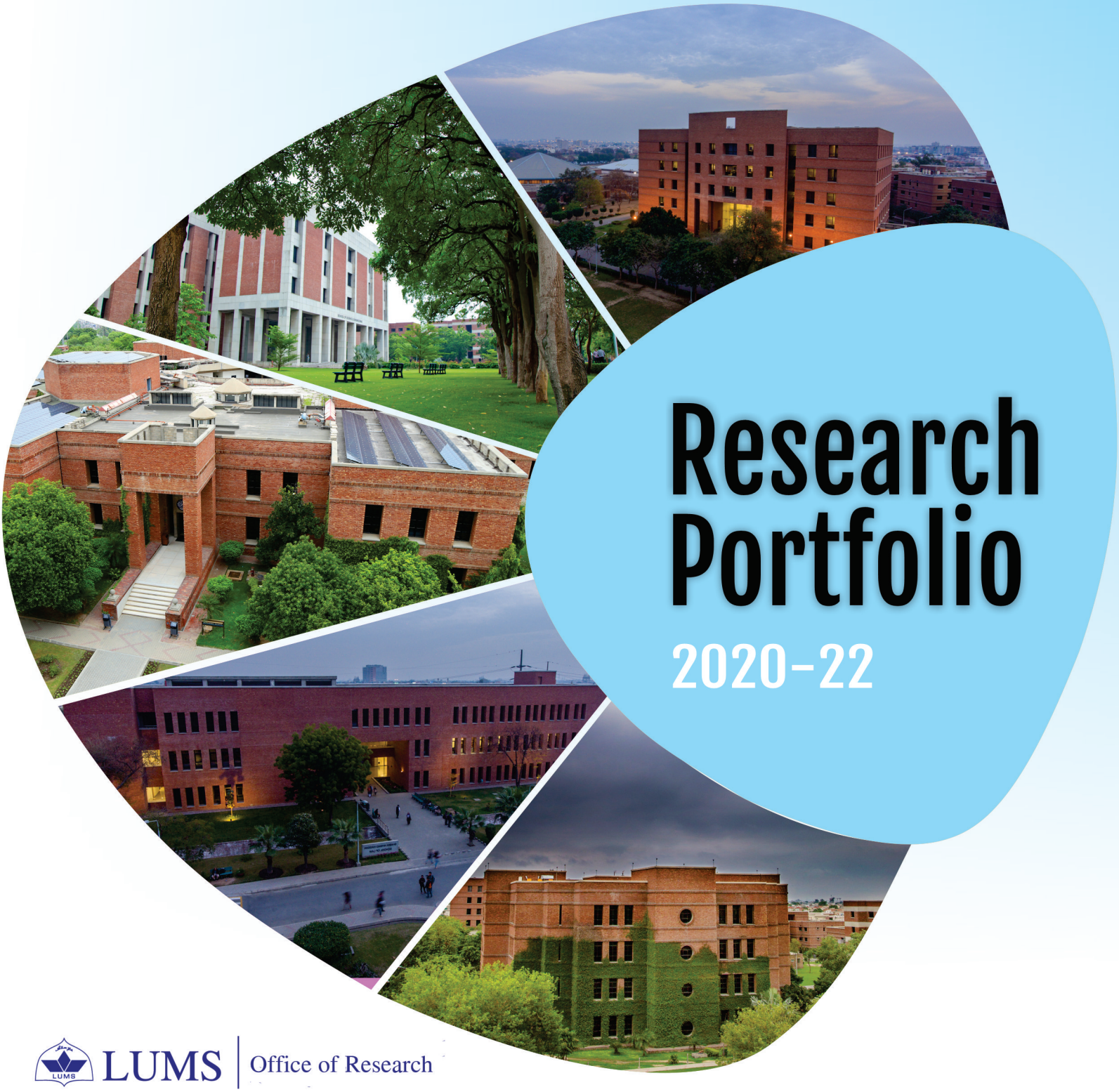
LUMS
A Not-for-Profit University

Learning Without Borders

Office of Research



Research Portfolio

2020-22

LUMS | Office of Research

Research Portfolio - An Annual Report by OR

Welcome to the annual report of the Office of Research (OR) at Lahore University of Management Sciences (LUMS), where we showcase the exceptional achievements and impactful contributions made in the realm of research and innovation. This report is a testament to LUMS' unwavering commitment to nurturing a thriving research culture and fostering collaboration among scholars, stakeholders, donors, and the wider research community.

Within these pages, you will find a comprehensive display of the remarkable outcomes and milestones achieved through a diverse range of externally and internally funded research grants over a two-year period, spanning from July 2020 to June 2022. Our esteemed Principal Investigators (PIs) stand as the driving force behind these innovative and transformative research projects. Through their dedication, expertise, and unwavering pursuit of knowledge, they have brought forth groundbreaking discoveries that address societal challenges and provide impactful solutions to real-world problems.

As you delve into this report, you will witness the breadth and depth of the research activities undertaken at LUMS. Each project represents a unique journey of inquiry, exploration, and discovery, with far-reaching implications across various academic disciplines and industry sectors. We invite you to embark on this journey of exploration and discovery as we celebrate the remarkable achievements and envision a future filled with limitless possibilities through research at LUMS.

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MESSAGE FROM THE
VICE CHANCELLOR

As impressive as the accomplishments of LUMS's Learning-Without-Borders initiatives are that speak to 46 academic programs in five of its schools, the National Outreach Program and the exciting work from its national interdisciplinary centres, a positive future will not magically unfold for LUMS, simply by doing more of the same.

More research and teaching alone will not lead universities or society to where we ultimately want and need them to go. With exploding populations in the East and the disruptive forces of the fourth industrial revolution already altering societies worldwide, often in unexpected and uninvited ways, only truly exceptional learning environments will generate the potential to foster meaningful change.

What should such learning look like 10 years from now? What is the purpose of higher education today and why is it even more important for the future than it has been in the past? These questions take on special meaning in young, rapidly developing, populous countries. Young universities in developing countries, quite literally, have the potential to shape our collective, global future on the planet.

Universities like LUMS are likely to follow very different growth trajectories from those enjoyed by universities that were established years ago in the West. There is little room for error. There is even less room for mediocrity or narrow self-interest. Such universities must therefore embrace exceptionally effective learning strategies if they are to capitalise on their unique opportunities, offer students what they deserve—the best possible education—and ultimately produce a transformational impact both at home and abroad.

LUMS has emerged as a model for how a small, young university, located in a country without the historic advantages of prosperity, can make a substantial, positive impact on a wide range of complex, inter-connected, global challenges. Like other universities striving to reach the next level of excellence, LUMS needs to integrate civil society, the private sector, and government more fully into the university's innovation, inquiry and learning systems. It can only do so by demonstrating the university's ability to create inclusive processes that ultimately improve lives.

As Pakistan's leading research-intensive university that excels in teaching, LUMS is positioning itself as a model for and providing high-impact solutions to grand challenges faced by South Asian countries and beyond. Cutting-edge work of its transdisciplinary centres addressing challenges of water, energy, gender, policy, and entrepreneurship offer a model of integrating our disciplinary expertise. Through the perspective of Learning-Without-Borders, collaborative research at LUMS is generated across schools, with other universities and with leading industry partners. This report showcases activities that encompass all research projects, significant research achievements, and recognition gained by the LUMS community since July 2020 to June 2022.

The Office of Research has been the backbone for supporting researchers internally and in their efforts to address the grand challenges faced by South Asia and beyond. The LUMS' faculty has played a brilliant role in carrying out meaningful research over the years and one of the most notable projects between 2020-2022 was carried out by Dr. Momin Ayub Uppal that focused on creating technological foundations for data-driven policy making for sustainable urban development. It received an outstanding funding of PKR 210,221,860 by HEC. The project aimed at enabling the use of technological innovations in data gathering, data analytics, and data-driven decision making for addressing problems that have plagued small and large cities of Pakistan. Another remarkable grant was awarded to Dr. Sikander Ahmed Shah by American Bar Association for protecting and promoting children's rights in Pakistan. The project was funded with PKR 24,550,620 and aimed to expand access of legal services for victims of child abuse and their families. We are honoured to be a part of this process which will play a promising role to benefit the justice system. Our researchers are focused on conducting thorough research and finding out the best possible solutions in every field by bagging national and international funding.

It brings me great pride to see LUMS set the highest standards in research, innovation, and commercialisation, while continuing to make a real difference in the communities we serve.

Dr. Arshad Ahmad

Vice Chancellor

MESSAGE FROM THE PROVOST

It gives me great pleasure to recognise the outstanding work of our faculty catalogued in this annual report. The range and nature of the projects undertaken are testament to LUMS being Pakistan's leading research-intensive university truly embodying the "Learning Without Borders" perspective. The report showcases the wide range of significant projects in health, technology, energy, policy, gender, climate, business and economy, culture and heritage, rural and urban development, in addition to natural and behavioural sciences all funded through the generous support of both international and local donors.

A key objective of research at LUMS is create impact - both locally and regionally by addressing the challenges of the 21st century. This entails tackling critical issues including depleting energy and water resources, poverty and inequality, global economic crises, disease, as well as colossal challenges in health and education.

Since its inception, the Office of Research (OR) has played a pivotal role in providing institutional support to faculty through the entire life cycle of research projects. They administer both the Faculty Initiative Fund (FIF) and Faculty Travel Grants (FTG) as a source of funds for undertaking exploratory research seeding greater grants as well as the means to present results at international conferences.

The provost office is committed to furthering scholarship at LUMS by enabling an environment conducive to research. We sincerely appreciate the commendable efforts of the Office of Research in compiling this report and once again, are delighted to share the remarkable work done by our immensely talented colleagues.

Dr. Tariq Jadoon

Provost

MESSAGE FROM THE
DIRECTOR, OR

It brings me immense pleasure to present to you the 'LUMS Office of Research (OR) Report 2020-22' which is a compilation of the funded research endeavours of the LUMS community in the past two years. The university won 193 external grants worth PKR 1.2 billion during this period. In the same period, LUMS awarded 258 internal grants worth PKR 155 million to its faculty conducting research in a variety of disciplines including, Business, Social Sciences, Humanities, Law, Education, Sciences, Technology and Engineering. Over the years, LUMS has earned the reputation of being an outstanding academic and research institution. Many of the accolades that we have received are due to the rigorous, relevant, and impactful research of our faculty.

The environment at LUMS enables the schools and the faculty to develop strategic relationships with some of the best universities and researchers around the world. It is heartening to see that during these two years we collaborated with locally based as well as international research partners. You would also find in this report that we have a strong network of collaborations with local universities, institutions, and organisations. This allows us to work on problems that pertain to our country and the society we live in. Hence, our research remains locally relevant yet globally recognised. There are many other areas of research that are important from a societal perspective which our researchers have made significant contributions to. The response of the research community to the flood relief efforts which had devastated the country was particularly impressive.

In this report, we highlight the excellent accomplishments and achievements of our faculty who through their efforts have made LUMS an institution which is globally recognised for its contribution to research and scholarship. The readers will be delighted to see that despite the significant weight of reality, the ideas emerging from LUMS continue to flourish.

Dr. Saad Azmat
Director, Office of Research (OR)

LUMS AT A GLANCE

- 5 Schools
- 13 Centres
- 2 Incubation Centres
- 45 Academic Programmes
- 200+ PhD Faculty
- 5,000+ Students
- Ranked #45 in the 'World's Best Small Universities' by Times Higher Education 2022
- Ranked among 201-250 in Times Higher Education Asia University Ranking 2022
- SDSB is the only AACSB International Accredited Business School in Pakistan
- Consistently Achieved W Category in HEC's Annual ORIC Performance
- Linkages with 500+ Local and International Donors
- 1,000+ Research Projects Approved by External Donors (FY2011- FY2022)
- 1,500+ Internal Research Grants Awarded by LUMS (FY2011- FY2022)
- Won Externally Funded Research Grants worth PKR 7.6 billion (FY2011- FY2022)
- PKR 885 million awarded by LUMS internally for research (FY2011- FY2022)
- 16 Approved Research Related Policies
- State-of-the-art Makers Lab for Innovation
- 2,900+ Publications since 2013 (As per Scopus)
- 1.13 Publications per Faculty since 2013 (As per Scopus)
- 50+ IP Negotiations Initiated

ABOUT LUMS

Established in 1985 as a private, not-for-profit university, LUMS is one of South Asia's top academic institutions known for its commitment to outstanding learning, research intensity, and teaching excellence. It is renowned for its exceptional academics and quality, emphasising access, relevance, and collaboration, with an increasing focus on tackling the major challenges confronting the Global South. LUMS now offers undergraduate, graduate, and doctoral programmes through its five schools: Suleman Dawood School of Business, Mushtaq Ahmad Gurmani School of Humanities and Social Sciences, Syed Babar Ali School of Science and Engineering, Shaikh Ahmad Hassan School of Law, and Syed Ahsan Ali and Syed Maratib Ali School of Education.

LUMS offers a distinctive academic experience through its 'Learning Without Borders' philosophy, providing an integrated core curriculum across disciplines. LUMS is home to a dozen transdisciplinary centres. These centres engage faculty and students and collaborate with external institutions to address society's grand challenges.

With faculty that is dedicated to teaching and creation of knowledge, the University hosts an enriching and seamless experience through multidisciplinary research and teaching, emphasising integrative learning, critical thinking, and creative problem-solving.

SCHOOLS AT LUMS

Syed Babar Ali School of Science and Engineering (SBASSE)

Practising a 'no-boundaries' philosophy, SBASSE is making significant strides in the experimentation of teaching and learning, while celebrating the novelty of research. Through innovative and impactful contributions to science and technology, SBASSE is nurturing future leaders with the potential to impact society. SBASSE faculty and students conduct ground-breaking research and develop solutions to the most complex local and global problems. The curriculum is designed to encourage cross-disciplinary collaborations between the various disciplines at SBASSE, as well as those offered by other schools at LUMS. SBASSE offers four-year undergraduate Bachelor of Science degrees in basic sciences as well as Computer Science, Electrical Engineering, Mathematics, and Chemical Engineering. It also offers a joint major in Economics and Mathematics. The school has robust MS and PhD programmes in various disciplines-all designed to train an ambitious group of scientists and researchers.

Suleman Dawood School of Business (SDSB)

SDSB has gained international acclaim over three decades. As Pakistan's first and only business school to have earned the Association to Advance Collegiate Schools of Business (AACSB) international accreditation, SDSB offers its students leading-edge business and management education. AACSB has featured SDSB in its Innovations That Inspire member spotlight programme. The school has received this honourable recognition for its Women's Scholarship Initiative, which offers a 50% tuition fee waiver to all women admitted to its graduate programmes. The initiative has also been awarded the Best of Asia Pacific in the Leadership - Diversity, Equity, and Inclusion Initiative by the Council for Advancement and Support of Education based in Washington. SDSB, through this initiative, aims to promote gender diversity and produce highly skilled graduates who can lead, transform, and create a long-lasting impact in business and society.

Pioneer of the case method of learning in Pakistan, SDSB adds blended and experiential learning to its pedagogy. The school is also a Harvard Publishing Content Partner and has one of the largest collections of indigenous business case studies in South Asia.

Mushtaq Ahmad Gurmani School of Humanities and Social Sciences (MGSHSS)

MGSHSS is reshaping the way social sciences and humanities are taught in Pakistan. The school offers a comprehensive liberal arts curriculum. It consists of two departments: Economics, and Humanities and Social Sciences. The Department of Economics at MGSHSS is one of the most established in Pakistan, with 21 faculty members who hold PhDs. The school also has a partnership with the University of East Anglia for a joint PhD programme in Economics. The innovative curriculum at MGSHSS provides a broad foundation of knowledge to its students as they delve into works on politics, scientific reasoning, sociology, economics, culture, religion, art, literature, and aesthetics. Equipped with a diverse set of transferable skills, students are able to overcome challenges in a rapidly changing world, whether they have to work in the public sector, the private sector, for non-governmental organisations, or in academia.

The international reputation of the school continues to grow and gain recognition through its research. Its faculty members have authored over 40 academic publications and five books in the past year.

Shaikh Ahmad Hassan School of Law (SAHSOL)

The 5-year BA-LL. B degree at SAHSOL is conceded by the Pakistan Bar Council and the Higher Education Commission, Pakistan. The two-year BA phase of the degree is interdisciplinary and exposes students to a wide range of disciplines across LUMS. The three-year LL. B phase requires students to undertake fundamental and specialised courses in law. The curriculum at SAHSOL has been carefully designed to ensure key learning objectives about core areas of the law. Students can choose from a diverse set of elective courses organised in five course streams: Government, Law and Citizenship, Criminal Law, Business Law, Legal Theory, and International and Comparative Law. The Socratic Method employed at the school engages students in dynamic discussions that enhance their critical thinking and analytical reasoning skills. In addition to learning in the classroom, real-world training is an important component of this degree. Law majors have multiple opportunities to undertake legal internships, contribute to the LUMS Law Journal, and engage in pro bono work through the Street Law Programme. Students are provided with career guidance through the Advisement Cell at the School and the Alumni Mentorship Programme. The Legal Writing Lab also provides advice on students' analytical, critical, and persuasive writing skills.

The school also hosts the Centre for Chinese Legal Studies, a collaboration with Wuhan University in China. SAHSOL graduates have gained recognition as leaders in the corporate sector, partners in top law firms, as well as advocates for a range of public interest causes.

Syed Ahsan Ali and Syed Maratib Ali School of Education (SOE)

Through its comprehensive programmes, SOE produces strategic leaders, policy researchers, and reflective practitioners who are geared towards directing a vibrant education reform agenda for Pakistan. The school offers three interdisciplinary minors in education, an MPhil in Education Leadership and Management and a weekend based Executive MPhil in Education Leadership and Management. The programmes feature extensive field engagement and operate at the nexus of research, policy, and practice.

MPhil candidates participate in the Practicum Programme, a mandatory, intensive semester long 'residency' rooted in field-based research during which students are placed in one of the 46 educational organisations that have partnered with SOE. The school also helps students reach their full potential through the numerous individual interviews, advising sessions and networking events conducted by the SOE Career Placement Programme. The school provides Professional Education solutions to educators in various stages of their careers. The solutions are offered at the individual level through courses, trainings, workshops, and certifications, as well as at the organisational level through custom programmes. Faculty at SOE actively engages at the national level. They are part of the government's education task forces, boards of public private partnerships, and autonomous bodies in the government. They also lead policy roundtables with multiple stakeholders on issues of national importance.

CENTRES AT LUMS

Rausing Executive Development Centre (REDC)

The Rausing Executive Development Centre imparts executive education with the aim to enable managers to progress into leaders, following both case-based teaching and hybrid pedagogies. The Centre is recognised for its transformative learning experiences impacting individual and organisational performances.

Centre for Business and Society (CBS)

The Centre for Business and Society is a platform for debates, policy discussions, student engagement and events to engender positive societal impact. This impact is created by providing a critical forum for discussion on focus areas vital to Pakistan's social and economic sustainability.

National Centre in Big Data and Cloud Computing (NCBC)

The National Centre in Big Data and Cloud Computing partners with 11 universities working on big data across areas of agriculture, industry, energy, health, multimedia, and local languages. The Centre also hosts Pakistan's open data portal and focuses on human resource development in the specialised field of big data and cloud computing and its practical applications.

Centre for Water Informatics and Technology (WIT)

The Centre for Water Informatics and Technology conducts research and works closely with industry and the government on developing technologies to improve irrigation efficiency and introduce sustainable agricultural practices.

LUMS Energy Institute (LEI)

The LUMS Energy Institute works with the energy and power sector of Pakistan. It provides interdisciplinary research and shares capacity building practices, which support power and energy planning, renewable energy technologies, and grid modernisation.

Technology for People Initiative (TPI)

The Technology for People Initiative was established to explore and enhance sustainable, innovative, and low-cost technology. It aims to make government institutions in Pakistan as informed, inclusive, and responsive as possible to achieve good governance.

Mahbub Ul Haq Research Centre (MHRC)

The Mahbub ul Haq Research Centre supports interdisciplinary research, scholarship, and teaching on issues of human development, social exclusion, and inequality across South Asia.

Saida Waheed Gender Initiative (SWGI)

The Saida Waheed Gender Initiative leverages research, teaching, and praxis related to gender at LUMS. It encourages research and resource development supporting pedagogy in gender studies. The initiative hosts events that bring together scholars, students, and members of the broader community.

National Incubation Centre Lahore (NICL)

The National Incubation Centre Lahore has a focus on contributing to Pakistan's economic development by promoting innovation and entrepreneurship in high impact areas. It inspires and facilitates problem-solvers in agriculture, education, environment, financial inclusion, healthcare, and applications utilizing artificial intelligence and machine learning.

LUMS Learning Institute (LLI)

The LUMS Learning Institute transforms learning and teaching practices by utilising modern technologies and innovative teaching tools. It also connects students with faculty to establish valuable pedagogical partnerships. The Centre has been instrumental in developing LUMSx - the new digital platform for open courses, encouraging inter-institutional collaboration, and national and regional partnerships.

Gurmani Centre for Languages and Literature (GCLL)

The Gurmani Centre for Languages and Literature was established in 2010 for the advancement of South Asian languages and literature. The Centre achieves this aim through language teaching, research, and publications as well as cultural programming.

Centre for Continuing Education Studies (CES)

The Centre for Continuing Education Studies offers courses that develop the professional expertise of students, professionals, and non-traditional learners. Its courses are designed and delivered by highly acclaimed industry experts and academics.

Centre for Chinese Legal Studies (CCLS)

The Centre for Chinese Legal Studies promotes the teaching of Chinese laws in Pakistan. It aims to become a regional hub for shared legal resources between Pakistan and China. Academics, students, and legal and business professionals in both countries are facilitated to exchange knowledge and build capacity and legal expertise through the Centre.

OFFICE OF RESEARCH

The Office of Research (OR) was established on August 16, 2010, with the aim to promote a research culture at LUMS and since then it is actively pursuing its mandate by making sure that the LUMS research community is facilitated as much as possible. OR acts as a bridge between the faculty and external funding agencies. However, OR does not just limit itself in facilitating the faculty members with their external grants. It also manages the internal grants sponsored by LUMS for its faculty members and students. The Office is responsible for ensuring that all submitted proposals conform to donor guidelines and LUMS policies and once funded, the project complies with donor requirements and applicable University policies and procedures.

Moreover, OR works tirelessly to make sure that all the funding opportunities are identified and availed by faculty members/research, whenever and wherever needed. This pathway is broadly classified into four steps:

01

Pre-Award Administration

OR helps the research community in the review of research proposals to protect the university's interests and ensure compliance of donor guidelines. OR also assists in the due diligence of the organisation as part of proposal submission to international donors. All efforts from identifying funding opportunities to proposal submission, fall under the Pre-Award phase.

02

Contract Review & Signing

After the submission, proposals are reviewed by the donor and contracts are drafted. The in-house legal counsel at OR assists PIs in drafting of contracts that are then shared with the respective donors. Once the terms have been negotiated between the PI and donor, the contract goes through a final budget review by the OR and signing off through the Vice Chancellor or his/her designated authority.

03

Post-Award Project Management

OR provides Post-Award Project Management services once the grant is approved from the donor and formal contract is signed. Support in the Project Management is provided through GAMES including change request management, resource hiring, bridge finance and ethics approvals etc. The financial controls are facilitated through SAP GM-GTE module for reporting to stakeholders.

04

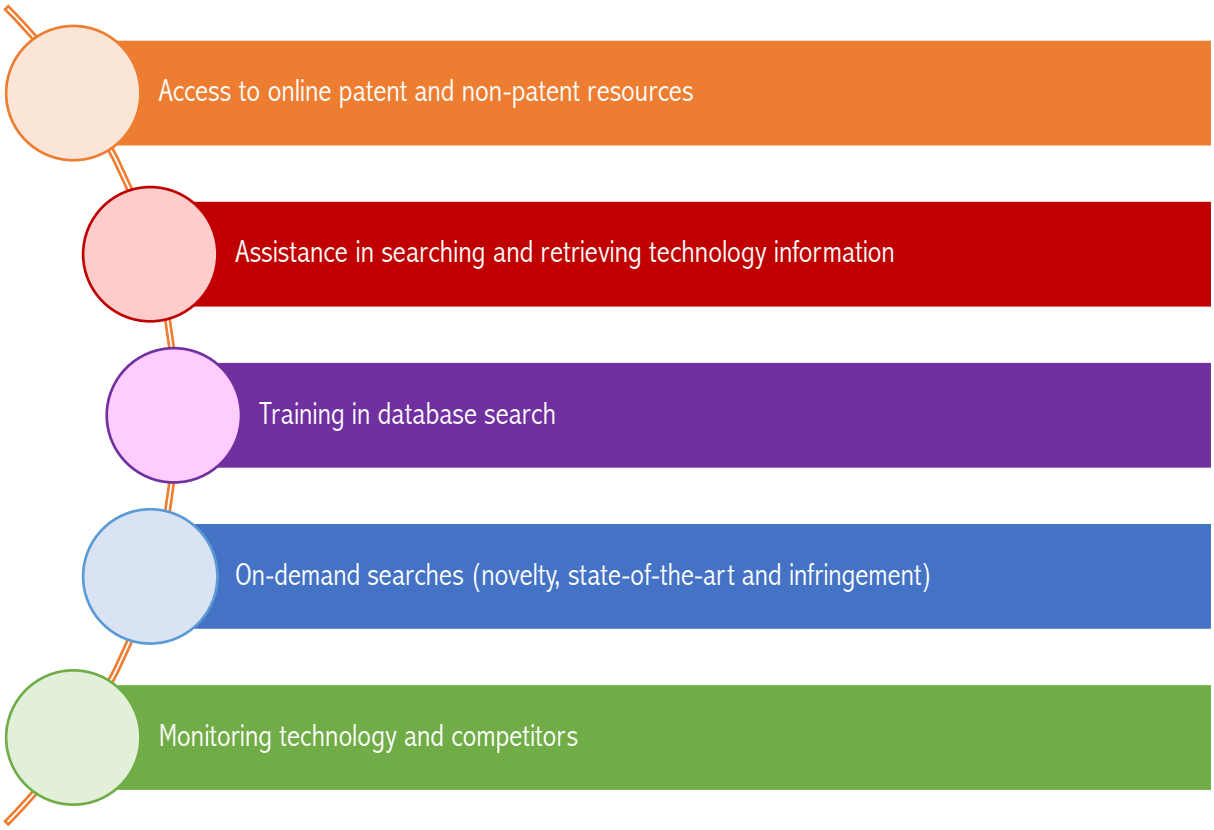
Closure & Commercialisation

In the closure phase, assistance is provided with audits for official closure. Project completion certificate is acquired from the donor. In case a commercialisable product is produced, OR provides legal advice for Patent Filing, Drafting, IP Licensing, Trademark and Copyright Registrations along with the commercialisation support including industrial partner identification and negotiations.

Technology and Innovation Support Centre

In April 2009, the World Intellectual Property Organization (WIPO) initiated a pilot project designed specially to help innovators in developing areas access local based, high-quality technology information services. This project was titled as Technology & Innovation Service Centres (TISCs). The commencement of these centres was a success and therefore, currently there are 500 TISCs operating globally.

Out of these, 23 TISCs are operating in Pakistan. LUMS being a proponent of such science and technology related initiatives is one of these 23 institutional bodies. LUMS signed an MoU with WIPO, HEC, and IPO on December 12, 2017, thereby, laying a foundation of TISC at LUMS.



Eminent Research Awards

LUMS has always been a step ahead when it comes to research and innovation. To accomplish the mission of the institute, it actively pursues every single opportunity to create an impact on various research domains.

Following are the top funded projects by **national and international donors** during the last two years.

National Donors

Dynamic Financial Data Analytics for Policy and Governance	Creating Technological Foundations of Data-Driven Policy Making for Sustainable Urban Development	Big Data based Platform to Promote EV Penetration in Pakistan	On-chip Epilepsy Predictor using AI for Chronic Neurological Disorders
• Donor: Sub-National Governance (SNG) Pakistan • Award Amount: PKR 20,780,958	• Donor: Higher Education Commission (HEC) • Award Amount: PKR 210,221,860	• Donor: National Center in Big Data and Cloud Computing (NCBC) • Award Amount: PKR 19,214,545	• Donor: National Center of Artificial Intelligence (NCAI) • Award Amount: PKR 14,421,000

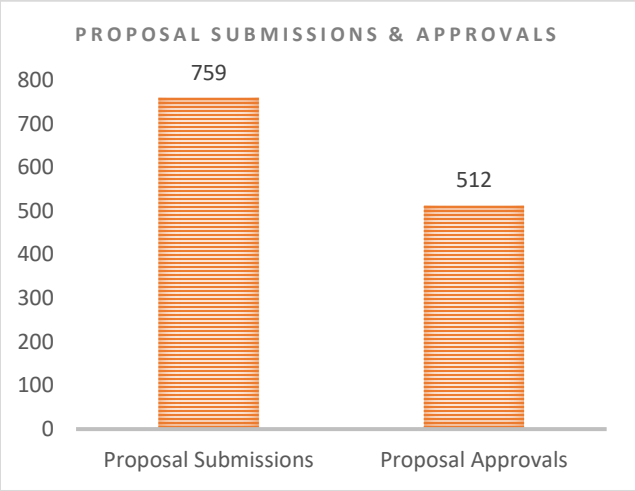
International Donors

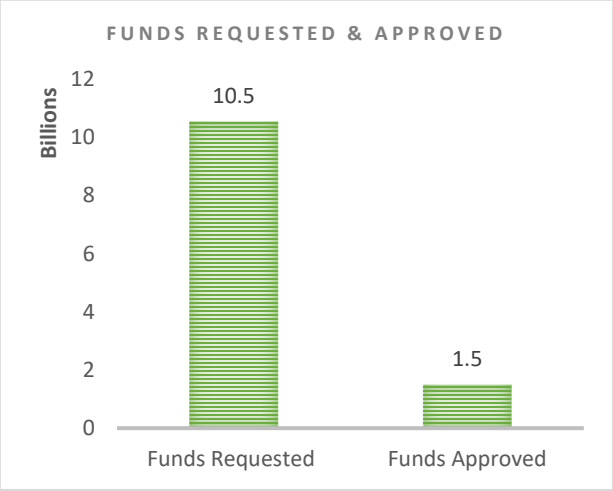
Rethinking Cybersecurity in Pakistan - Human Factors' Essential Role (ReCyP:HER)	Protecting and Promoting Children's Rights in Pakistan	Establishing Decentralized Global Genomic Surveillance for the Pneumococcus	Electric Vehicles and Batteries Market Assessment
• Donor: University of Saarland • Award Amount: PKR 26,437,662	• Donor: American Bar Association (ABA) • Award Amount: PKR 24,550,620	• Donor: Genome Research Limited • Award Amount: PKR 18,003,000	• Donor: USAID • Award Amount: PKR 11,500,380

Research Statistics

Submissions and Approvals

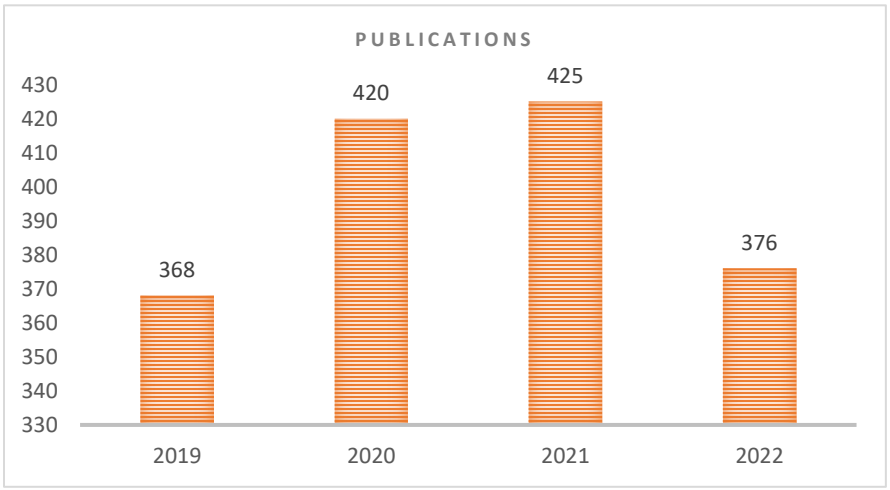
This section encompasses the latest submissions and approvals of the grants that OR has managed for the last two years i.e., July 2020 - June 2022. Starting off with the facts and figures, the following illustration depicts all grants that got submitted by OR and approved by the Sponsors.

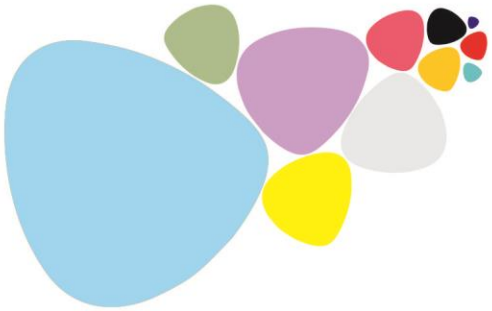




Scopus Publications

The range of research activities and publications by the LUMS faculty is broad and profound. The graph below reflects the increase in the total unique publications authored by LUMS faculty in the last four calendar years (2019 to 2022). The research publications experienced a growth demonstrating a healthy trend during the period, which reflects the extensive research endeavours by the faculty over the years.





LUMS Funding Sources

LUMS aims to facilitate its faculty and students financially for their research endeavours. This section encompasses the internal funding sources managed by LUMS for the benefits of the LUMS' community.

Faculty Initiative Fund (FIF)

LUMS provides internal funding opportunities to support research and development. The FIF offers competitive grants ranging from PKR 500,000 to PKR 1,000,000 to LUMS faculty. These grants aim to facilitate innovative projects, benefiting the university and potentially leading to larger initiatives, new research endeavours, external funding opportunities, or creative works.

Faculty Travel Grant (FTG)

LUMS offers the Faculty Travel Grant (FTG) to support the research activities of its full-time regular faculty. The grant aims to encourage international travel and collaborations for faculty members to enhance their research endeavours.

Start-Up Grant (STG)

Start-up grants are the first grants given to full-time regular faculty; newly recruited on tenure track or as tenured faculty. These grants are awarded by the Deans of the respective schools.

Students as Co-Researchers (SCR)

The ScR programme supports undergraduate students as co-researchers. It promotes scholarly activities among students who have completed their junior year and are beginning their senior year. The programme encourages students to pursue their own research projects in collaboration with a LUMS faculty member. The funding provided can be utilised for summer research projects or SPROJs.

Sponsors


SAARLAND
UNIVERSITY

Adam Smith
International

ABA
AMERICAN BAR ASSOCIATION

GCRF
Global Challenges
Research Fund

HEC

IBA

WORLD BANK

BRITISH
COUNCIL

Association for
Asian Studies


WWF

DUKE UNIVERSITY
1838

EMBASSY OF THE ISLAMIC REPUBLIC OF PAKISTAN
FRANCE

HAWKEYE

CMYK
Research & Development

engro powergen



institute of
development
studies

ARANDAAZ

IGC

International
Trade
Centre

IsDB

J-PAL

Coca-Cola

ABACUS
YOUR TRANSFORMATION PARTNER

MicroTech
Industries (Pvt) Ltd.

LSE
THE LONDON SCHOOL
OF ECONOMICS AND
POLITICAL SCIENCE

ncbc
National Center in Big Data and Cloud Computing

NCAI

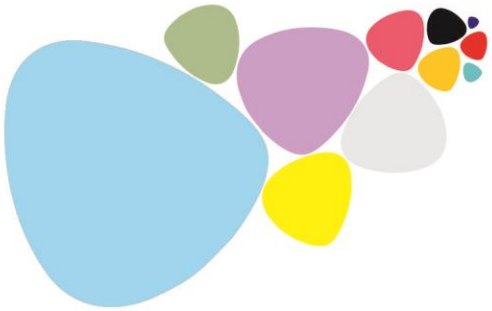
University of
Reading

wateen

xavor

Penn
UNIVERSITY of PENNSYLVANIA

UNIVERSITY OF
CAMBRIDGE




CERP
Centre for Economic Research in Pakistan


RAND
CORPORATION


CLERENS


SEWANEE
THE UNIVERSITY OF THE SOUTH


SHF


SSHRC
CRSH
Canada


sng
Sub-National Governance Programme


COLGATE UNIVERSITY
DEO AC VERITATI
FOUNDED 1819


DAAD
Deutscher Akademischer Austauschdienst
German Academic Exchange Service


FPS


TECHNISCHE UNIVERSITÄT
KAISERSLAUTERN


UNITED STATES AGENCY
USAID
INTERNATIONAL DEVELOPMENT


CureMD


Indus Consortium
Humanitarian Environment and Development Initiatives


CDC


DRF


CPPA


giz


The Institute of Chartered Accountants of Pakistan
CA
PAKISTAN


IDRC · CRDI
Canada


NCCS


SSRC


NCRA
NATIONAL CENTRE OF
ROBOTICS & AUTOMATION


UNIVERSITAS
BERGENSIS


NCGSA
NATIONAL CENTER OF GIS & SPACE APPLICATIONS


Ed. JaM


HBL
HABIB BANK
حبیب بینک


QADRI Group


Arctic
Pharma

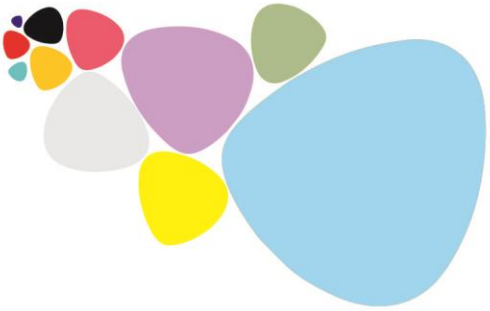

UNIVERSITY OF
MARYLAND


MITSUBISHI


University of
BRISTOL


THE UNIVERSITY OF MICHIGAN
1817


UNIVERSITÄT
DES
SAARLANDES



HEALTH

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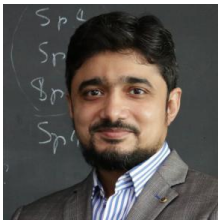

Impact Evaluation of Super Abbu: A Speech based MNCH Platform in Pakistan

Sponsor: University of California, Davis
Funding Amount: PKR 22,240,872
Project Initiated in: 2020

Pakistan has the highest neonatal mortality rate in the world (44.2 per 1000 live births), accounting for 7% of the world's neonatal deaths, and among the worst maternal mortality rate in the region (178 per 100,000 live births). These indicators remain high despite the best efforts of the government and NGOs to leverage modern practices and technology to improve maternal, new-born, and child health (MNCH). To this end, the province of Punjab, Pakistan has hired 48,000 Lady Health Workers (LHWs), has introduced multiple information communication technology (ICT)-based health monitoring systems, and has launched the Punjab Health Line staffed by 150 doctors 24/7. LHW effectiveness has been limited, however, given the size of Punjab (100+ million people). LHWs are expected to visit nine homes per day and in 40 minutes cover a long syllabus and perform several tasks. Similarly, high deployment costs, low smartphone penetration, and low literacy rates in rural areas have limited the effectiveness of ICT-based interventions. The Punjab Health Line has been ineffective for more mundane reasons—its adoption has been very slow despite extensive publicity. This project developed, piloted, and proposed to expand and to experimentally evaluate a speech-based service that connects expectant fathers to doctors and helps them to interact with each other over a simple phone call. This service, dubbed Super Abbu (Super Dad in English), addresses the challenges faced by existing efforts in several new and important ways. Currently, the entire public health infrastructure in Punjab is geared towards providing information to women hence this service targets fathers and aims at generating useful information on frequently asked questions for public health professionals to better understand their population. It supplements LHWs by providing information between LHW visits in an appropriate manner for those who are illiterate and do not have smartphones. Expectant fathers can leave questions without synchronous calls and access past questions and answers asked by themselves and other users.

Leveraging Polio Helpline for Creating RI+MNCH awareness

Sponsor: University of Michigan
Funding Amount: PKR 34,000,081
Project Initiated in: 2021

The project seeks to achieve Sehat Tahaffuz 1166 helpline (managed by Islamabad EOC) to add ANC, PNC to its existing options of immunization and Polio in Pashto and Urdu –making a Health Protection helpline. It also aims to enhance Super Abbu (Super Dad) capability to answer MNCH and immunization questions comprehensively. Lastly, 1166 is set to be advertised to answer MNCH and immunization related questions in addition to Polio on all the existing and new channels including Billboards, TV / Radio ads and through a speech-based online community like Baang.

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Graph2Speech: Making Graphs accessible to Persons with Vision Impairment Using Computer Vision and Natural Language Processing

Sponsor: LUMS
Funding Amount: PKR 900,000
Project Initiated in: 2021

Persons with vision impairment (PVIs) face numerous hurdles in education and employment. This is especially true for science, technology, engineering, and math (STEM) fields that involve scientific graphs and charts for information summarization and communication. Traditionally, two methods are employed to produce accessible graphs. Both methods require specialized hardware (braille embosser with cardboard, thermal embosser with swell sheets) that are difficult to procure. More recent methods based on sonification systems and refreshable tactile graphics are either experimental or extremely expensive. This project aims to develop a software tool, called Graph2Speech (G2S), that leverages artificial intelligence (AI) for understanding and communicating the information contained in graphs to PVIs. This project is a continuation of previous works on accessible math and technical document authoring and presentation from the same research group. It is a step towards making STEM fields more accessible to all.

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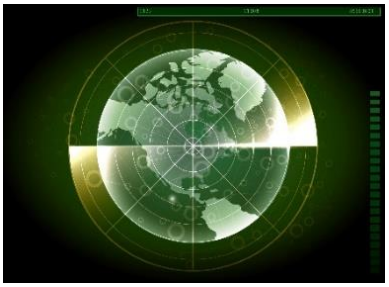

HealthSecure Radar: Software Defined Radio based Micro Doppler Radar for Health Care and Security Applications

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

Commercialization of drones has granted the public an easy access to unmanned aviation such as hobbyist drones. There are undoubtedly many advantages of these drone platforms such as delivery drones, media coverage of events, however, the uncontrolled proliferation of drones also has numerous disadvantages. These drones can cause accidents if they collide with other UAVs (unmanned aerial vehicles) or aircrafts. They can also be used in activities that are anti-social and are in violation of privacy rights. Therefore, radars can be used for security applications such as detection and classification of drones. Additionally, Pakistan is susceptible to a range of natural disasters especially the earthquakes. Hence, there is a need for technological developments that can help in rescuing human victims buried under piles of rubble due to disasters. This project proposes to develop a software defined radio (SDR) based HealthSecure radar that can detect and classify human gait, human activity, type, and movement of drones and through the wall detection and activity classification.

ASSISTIVE TECHNOLOGY

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Digital Street Theatre for Global Maternal and Child Health Education

Sponsor: University of Michigan
Funding Amount: PKR 16,541,461
Project Initiated in: 2019

The research goal is to conduct cross-cultural, interdisciplinary research to identify low-income mothers' health knowledge, attitudes and behaviours that may lead to a reduction in maternal or infant mortality in those settings and design and test technology enabled solutions that can help spread health education to low-income mothers in a format that is easily embraced by such communities. The study is aimed at arriving at developing technology or tech-use scenarios to transfer information about pregnancy and childcare to low-income women and reach generalizable lessons that apply broadly in contexts outside of Cape Town, Detroit, and Lahore.

Embodied Virtual Agents for the Developing Context

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

Embodied conversational agents (ECAs) are advanced computational interactive interfaces designed to engage users in the continuous and long-term use of a background application. When the agent is embodied in a human-like appearance, it can be used as an advanced tool for human-computer interaction that implements a combination of dialogue interaction and a set of body movements and facial expressions to simulate face-to-face conversations. The advantages and benefits of these agents have been exploited in several e-health systems but within a western context with digitally literate users. The understanding of how virtual embodied agents are perceived in our context is of vital importance for the design of virtual companions in the healthcare industry. As mobile phones become cheaper and more accessible among low-literate and low-income users, the possibilities for providing health support using an ECA directly on a mobile device becomes a viable method for reaching these populations and engaging with them over longer periods of time. However, to be able to create such an application, there is a need to understand the perception of differently rendered avatars (male, female, highly realistic, more cartoon-like etc.) among these populations. This project aims to deploy a working prototype of the ECA with a selected group of users to monitor engagement and usage over a period. This long-term engagement also allows monitoring the use of such a health application in low-income populations and provides access to statistics related to their health.

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Towards Ubiquitous Cardio-Respiratory Health Monitoring using Passive Wireless Sensing

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

Arguably, the most important vitals that need ubiquitous remote monitoring are those related to a patient's cardio-respiratory health. Existing solutions towards monitoring these vitals (such as breathing and heart rates) require individual monitors for each patient. In addition, these monitors are tethered, and therefore inconvenient. This project aims to capitalize on recent advances in wireless radio frequency (RF) sensing to design and develop a system capable of simultaneously monitoring multiple patients' cardio-respiratory vitals without being tethered to their bodies. More specifically, the proposed patient monitoring system attempts to use ambient radio signals in the environment coupled with cheap and passive RF tags/wireless stickers (placed on the patients' body/clothes) to not only track the patient mobility and position (contrary to the use of cameras to overcome privacy concern), but also to continuously measure their vitals such as the breathing rate.

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A Fully Integrated Wearable/Portable EEG System on Chip for Accurate Monitoring of Depth of Anesthesia

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

This project aims to develop a wearable, "non-invasive, patient-specific" device for accurate monitoring of DoA in collaboration with local and international Anesthesiologists that can be used during the surgery as well in the post-operative stage to ensure patient proper recovery without burdening the medical staff. This is expected to be the world's first "patient-specific" DoA estimator System-on-Chip (SoC) combined, all in a small form-factor sensor. The proposed device is to be composed of an EEG acquisition system, followed by EEG signal filtering, and then signal processing for extraction of useful information.

A Patient-Specific Fully Integrated Transparent Electroencephalogram (EEG) Sensor for Seizure Prediction

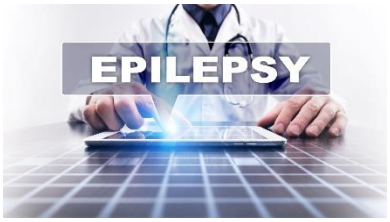
Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 14,764,057
Project Initiated in: 2019

This project aims to create a special device that can help people with epilepsy. Epilepsy is a condition where a person has seizures, and it affects around 60 million people globally, with over 2 million in Pakistan alone. People with epilepsy often face challenges in society due to a lack of awareness and limited medical resources, particularly in rural areas. This project aims to develop a small, wearable device like a hearing aid that can continuously monitor brain signals called electroencephalogram (EEG) data. It will detect any abnormalities and send an alert to the caregiver's smartphone before a seizure occurs, potentially preventing accidents or harm.

Lab-on-Chip: Affordable and Accurate Lab Tests for all

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

This project proposes to develop a PoC device for blood tests using an innovative lab-on-chip (LoC) technology. The device presents a test kit for Complete Blood Counting (CBC) which is an essential test for initial screening of most of the infectious diseases (including Dengue, malaria), chronic illnesses such as heart diseases, anemia, leukemia, and pregnancy-related complaints. The proposed LoC develops a miniaturized device that integrates into a single chip capable of doing a single or several analyses, which are usually done in a laboratory. Miniaturization of biochemical operations normally managed in a laboratory has numerous advantages, such as cost efficiency, parallelization, diagnostic speed, and sensitivity. The proposed LoC project mainly relies on two core technologies: microfluidics and integrated circuit design.



On-chip Epilepsy Predictor using AI for Chronic Neurological Disorders

Sponsor: National Centre of Artificial Intelligence (NCAI)
Funding Amount: PKR 14,421,000
Project Initiated in: 2021

Antiepileptic drugs are the standard treatment for controlling and reducing epileptic seizures, but around 30% of patients cannot be effectively treated with medication. Deep Brain Stimulation (DBS) and Vagus Nerve Stimulation (VNS) therapy is a high-risk surgical treatment for people whose seizures are not by medication. Moreover, the implantable devices need to be replaced often to avoid infection. In this project, full integration of components for continuous operation, ultra-low power, low noise front-end readout circuits with a seizure prediction AI-processor will be assembled. This can minimize the number of off-chip components therefore enabling the reduction of space used while maintaining processing power and performance. Ultimately, a small form factor, patch-type long-term seizure prediction and recording device can be realized.

Patient-adaptive Wearable Device for Chronic Disorders

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

Public health sector is an important Sustainable Development Goal of United Nations and is one of the neglected sectors in Pakistan. This project relates to the (early and extended) investigation for diagnosis, track disease progression and patientcare for commonly occurring diseases/neurological disorders in our country using ambulatory and wearable devices for outdoor patients by researching at next generation capability body sensor network. This project aims at development of a prototype smart mobile personal health system for chronic heart disease, epilepsy, and migraine with specific focus of adding features of smart processing of data and patient-adaptation (personalization) with EEG/ECG sensing of patients.

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Computational Modelling of Active Tuberculosis Using Clinical, Immunological and Radiological Data

Sponsor: HEC-USAID
Funding Amount: PKR 1,664,000
Project Initiated in: 2018

The major obstacle in treatment and eradication of TB is the limited understanding of the disease at the molecular or cellular level, delayed diagnosis, poor health care facilities, and lack of infrastructure. TB is generally curable, but the major problem is the current diagnostic methods such as Acid-Fast Bacilli (AFB) microscopy and chest X-ray (CXR), and state-of-the-art molecular tests have been inadequate in providing the capacity to efficiently detect active TB patients in high disease burden countries. The resulting poor detection rates lead to mismanagement of infectious cases, further spread of infection and possible development of drug resistance. In high burden countries like Pakistan, healthcare systems can substantially benefit from rapid, accurate, and cost-effective TB detection. Blood tests in combination with clinical data, aided by computational analytical tools, can enable rapid and cost-effective measures. This project plans to use combined data from independent markers of disease, analysed by computational methods to develop predictive modelling for TB detection.

ASSISTIVE TECHNOLOGY

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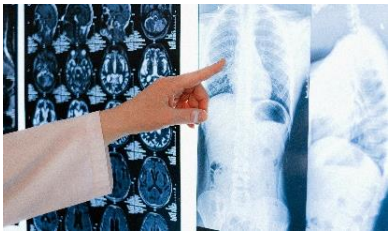
Towards Developing Portable Optical Sensor for Rapid and Non-Invasive Diagnosis of Pneumonia

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

In Pakistan, pneumonia is responsible for deaths of 92,000 children every year. The reason for such a high death toll is due to the time consuming and inaccurate diagnosis of the disease. Currently, state of the art tests for detecting pneumonia include X-ray, blood test, sputum culture, and pleural membrane culture. However, these methods are not specific and can give false positive results. The project focuses on the development of a novel optical sensor that uses laser Raman spectroscopy to analyse the breath of a patient for rapid pneumonia diagnosis.



Towards Developing Rapid, Portable Tuberculosis Detector using Optical Fibre Cavities

Sponsor: CureMD Research & Development
Funding Amount: PKR 1,650,000
Project Initiated in: 2021

This project intends to develop a portable TB sensor by innovating the sensor's chemistry and engineering aspects to prepare the sensor for human sampling after the project. This research will eventually lead to a device like a commercial glucometer that not only provides rapid TB diagnosis but can also be easily operated by non-specialists.

Towards Optical Fibre Sensing Platform for Rapid Detection of Pulmonary Tuberculosis

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

Pakistan is among the top five countries in terms of TB incidences. Currently, state-of-the-art tests for detecting TB involve examining patients' sputum using smear microscopy and test culture. However, these tests take days to weeks for producing results, during which time the TB-positive person is in the general population, infecting more people. Optical sensors leveraging spectroscopy have a tremendous potential to provide an accurate, sensitive, and real time TB test via the detection of TB biomarkers. However, optical techniques for detecting TB are still in infancy. This project aims to develop a novel optical sensor that uses laser ring down spectroscopy in an optical fibre cavity to detect LAM as a TB biomarker in solutions rapidly.

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Data-driven Soft Sensors for Indirect Measurements in Biomedical: A Multi-Vital Soft Sensor for Non-Invasive Cardiopulmonary Monitoring System

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

Hardware-based sensors can be difficult or costly in scientific and engineering applications. This issue is even more significant in certain industries, like control and process, or the biomedical field, due to high risks to human life or economic risks. Soft sensors offer a valuable alternative, using mathematical models to produce targeted monitoring quantities from indirect measurements. This project develops the foundations of soft sensors, paving the way for sensor virtualization in different applications, especially in the mobile health sector.

PPGBeat: Remote and Ambulatory Monitoring of Cardiovascular Diseases Using Wearable Photoplethysmography with Deep Learning

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

The proposed project aims to make it easier for common public to ambulatory monitor and assess their cardiac conditions without the need of any specialized personnel. As a first step to this goal, here, the research proposes to develop a basic wearable prototype to record PPG signals and make efficient decisions for classification of any observed troubling cardiac event.

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Microfluidic Lab on a Chip Cytometer for Point of Care HIV/AIDS Diagnostics

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 11,083,000
Project Initiated in: 2018

This project is aimed at developing a product level demonstration of a biochip for the point of care diagnosis of HIV/AIDS. The current medical equipment used for HIV/AIDS diagnostic is bulky and expensive (cost

around PKR 7 -15 million) and requires operating/maintenance cost of about PKR 1 million. It is only available in big hospitals and sophisticated research laboratories in Pakistan and is neither accessible nor economical for a vast majority of the infected population. Lab on a Chip is an emerging technology that has made it possible to develop portable biochips for the diagnosis of a broad spectrum of diseases. The device can not only enumerate the biomarkers but can also provide useful information about the disease signatures associated with its developmental stages in a human body. The chip intakes a tiny blood sample that flows through microfluidic channels fabricated using integrated circuit technology. A set of microelectrodes integrated on the microfluidic channels' outputs electrical pulses sensitive to the count and shape of the target cells as the blood sample is pushed to flow through the inlet of the channel. By coating biological antibodies that are specific for a given biomarker, the biomarkers in the blood sample are captured in a chamber inside the chip while rest of the sample flows through another set of microelectrodes. A differential impedance signal between the inlet and outlet of the capture chamber provides information that correlates to the number, size, morphology, and the membrane properties of the target cells.

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Remote Healthcare System for Diabetes Management

Sponsor: Global Challenges Research Fund
Funding Amount: PKR 4,601,508
Project Initiated in: 2021

Type 2 diabetes management is a prime example in which the continuous glucose monitoring system has led to a marked improvement in the quality of life for patients. However, the greatest prevalence is in middle- and low-income countries, where these systems are unaffordable. Therefore, there is an urgent need to develop low-cost glucose monitoring systems that allow continuous tracking of glucose levels non-invasively. This project produced such a monitoring system in close collaboration with world leading diabetologist Prof. Naveed Sattar. The sensor design has undergone major improvements and the system performance is being clinically evaluated at The Diabetes Centre in Pakistan. The data generated from this project has the potential to serve as the first of its kind glucose management platform in which artificial intelligence will be used to make informed decisions that adapt to local settings such as climate, dietary patterns, and physical activity.

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Deployment of Health Level Seven International's (HL7) Fast Healthcare Interoperability Resources Standard for the Hospital Information Management System (HIMS) at Shalamar Hospital

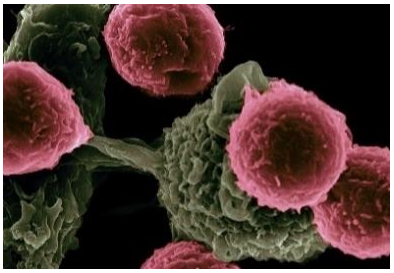
Sponsor: Shahid Hussain Foundation
Funding Amount: PKR 999,600
Project Initiated in: 2020

The goal of this project is to implement HL7 international standards for Shalamar Hospital by developing an adapter application for acquiring and processing health data. Health data interoperability is the missing link across all health care centers in Pakistan. This project gives an opportunity to implement the international health data interoperability standard i.e., HL7 to Shalamar and reap its benefits in terms of saving lives and resources. This project is intended to function as a pilot project to evaluate the compatibility of the Health Information Management System (HIMS) at Shalamar Hospital with Fast Healthcare Interoperability Resources.

Design and Development of a Wearable Continuous Glucose Monitoring System for Diabetes Patients

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 13,946,000
Project Initiated in: 2019

This project focuses on the development of an in-house Continuous Glucose Monitoring (CGM) system to provide for constant monitoring of glucose levels for diabetic individuals, around the clock. The designed CGM device displays current levels of blood glucose in near real-time and alerts the diabetic before a high-risk situation arises due to extreme variations in their blood glucose. This device also allows the diabetic to keep a complete log of blood glucose data which can be used to identify the causes and timings of glycaemic excursions. The CGM helps diabetics in managing blood glucose in acceptable rang, thereby preventing organ damages, saving lives and billions of rupees in health care cost.

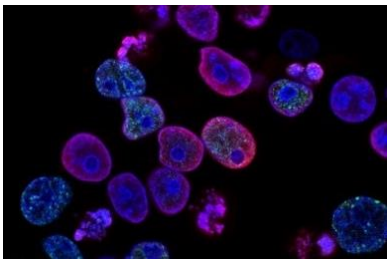


Development and Delivery of Personalized Cancer Therapies through a Cloud-based Omics Pipeline and Model Repository

Sponsor: National Centre in Big Data and Cloud Computing (NCBC)
Funding Amount: PKR 14,978,980
Project Initiated in: 2021

Cancer is a complex multifactorial disease with poor prognosis and limitations in drug response. Despite the development and availability of several treatment regimens, cancer patients continue to suffer from high mortality rates due to drug resistance and drug cytotoxicity. However, scientific, and technological developments in the last decade have yielded precise molecular insights from high throughput genomics and

proteomics experiments which have shed new light on mechanisms underpinning tumour growth and development. Clinical utilization of this omics-based data now represents the state-of-the-art practice in cancer treatment. The project aims to develop a cloud-based multi-scale cancer modelling pipeline and an associated digital modelling repository using omics-based big data towards developing and translating personalized targeted cancer therapeutics. To this end, six clinical case study models of Oral Cancer, Colorectal Cancer, Pancreatic Cancer, Neuroblastoma, Autophagy, and Warburg Effect are in the process of development by using the new cancer modelling platform "Theatre for in silico systems oncology (TISON)".



Development of a Pharmacogenomics Pipeline and Model Repository for Personalized Cancer Therapies

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

Cellular life is tightly regulated by a multifactorial interplay of biomolecular entities at both inter and intra-cellular scales together with extracellular environments. These biomolecular entities including genes, proteins, and metabolites, interact and function over a wide range of spatiotemporal scales in the form of regulatory pathways. The interlinking of these pathways results in formation of biomolecular interaction networks such as gene-regulatory networks, protein-protein interaction networks, and metabolic networks. This hierarchical and heterogeneous nature of biological systems, along with their spatial and temporal diversity at each scale, obscures the understanding of system-level manifestations of complex diseases such as cancer. Introduction of whole-genome sequencing and quantitative proteomics in clinical settings has resulted in patient-specific gene and protein profiles for a large variety of cancer types. Clinical utilization of this molecular data now represents the state-of-the-art practice in cancer treatment. This data-centric technological innovation now beckons us with a valuable opportunity to tailor and optimize cancer therapies for individual patients in Pakistan while making it affordable for the masses. For that, however, there is a need to establish an integrative multi-scale pipeline and model repository for simulating and decoding patient-centric cancer development, and the treatment response for specific targeted therapeutic regimens. This project aims to develop an indigenous multi-scale pharmacogenomics pipeline and model repository to decode mechanisms underpinning tumorigenesis, tailor efficacious individualized therapies and dispense therapeutic cocktails for cancer patients in Pakistan.

Enhancing Preparedness of Pakistan's Healthcare Ecosystem through Development of a National Health Information Management System

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

Health data digitalization and integration is one of the biggest national challenges in Pakistan and obstructs the effective provision of high-quality healthcare to the public. This project proposes to develop a unified national Health Information Management System (HIMS) that can be made available for ubiquitous deployment across Pakistan's healthcare ecosystem. The proposed platform is expected to be freely available as an open-source enterprise software solution with components for managing hospital workflows, patient care, clinical practice, laboratory testing, emergency response, reporting dashboards, etc. The need of this project is underscored by its salient outcome i.e., digitalization and interoperation of the health system in Pakistan, which remains one of the country's biggest national challenges. This project can replace paper-based healthcare practice across the country by developing an HIMS, where incomplete and incorrect medical records frequently lead to inaccurate or unreliable diagnosis and poor management operations. The project can help usher in a knowledge-based healthcare ecosystem by leveraging data

interoperability which can strengthen the collaboration among stakeholders such as public and private hospitals, governments, paramedic and forensic services, diagnostic centers, and insurance companies, among others.

Smartphone-based Sensor-integrated Assistive-diagnosis for Diabetes using GIN Clinical Guidelines

Sponsor: LUMS
Funding Amount: PKR 996,000
Project Initiated in: 2019

The project aimed to design and develop a low-cost but highly accurate smartphone-based diagnosis system for diabetes. This was achieved by obtaining and tailoring the GIN clinical decision-making process for diabetes diagnosis and treatment, into an Android-based application, in the form of a Bayesian network containing diseases, risk factors and symptoms. The app is integrated with an in-house continuous glucose-monitoring sensor. A multilingual interface ensures that the application can be conveniently used by laymen as well as illiterate segments of the population. It is expected that the application will provide significant assistance to it users in the private and public sector hospitals, laboratories, and physicians for the monitoring of diabetes.

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Developing Digital Aids for Early Diagnosis and Intervention of Children with Learning and Developmental Disabilities

Sponsor: Babar Ali Foundation
Funding Amount: PKR 3,720,000
Project Initiated in: 2018

There is a rough estimate that around 2 million children in Pakistan are affected by learning disabilities and majority of them are diagnosed at a very late age. This project aims to understand and address the needs of children with learning (Dyslexia) and developmental (Autism) disabilities in Pakistan thus helping them to perform well academically and socially. For both groups, the emphasis is on helping parents, caregivers, and teachers in early diagnosis and supporting them with digital tools for improving URDU language skills (reading, speaking and eventually writing) of children with disabilities. Another key objective is to run a national prevalence study, starting from Lahore and then broadening it to Punjab, to understand the overall pervasiveness of these disabilities.

Digitally Gamified Tools for Screening and Remediation of Developmental Dyslexia in Urdu

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

Dyslexia is a widely underdiagnosed condition in Pakistan, resulting in a lack of facilities and professionals for remediation. This has significant consequences, as low academic achievement associated with dyslexia can lead to depression, anxiety, and even suicide. To address this urgent need, a comprehensive mechanism is required to screen, assess, and remediate individuals with dyslexia in the region. Leveraging technological advancements and the widespread availability of affordable smartphones, a technology-based solution becomes highly accessible. This project aims to develop a gamified dyslexia test battery that can be used for screening purposes and to identify the specific strengths and weaknesses of atypical readers. Additionally, a working prototype of a contextualized remediation tool will be created in the form of a serious game, tailored to children with dyslexia in the Urdu language. Considering the complexities of Urdu's orthography and word formation mechanisms, this tool will undergo thorough testing before implementation in schools and homes, providing crucial support for children with specific learning difficulties, particularly developmental dyslexia.

Kahaniaan: Designing an Interactive Storytelling Application using Localized Narratives to Target Depression and Anxiety in University Students

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

Mental health disorders like depression and anxiety are rising globally, particularly among college students. Barriers like high costs, lack of resources, and social stigma hinder students from seeking help. Mobile health applications offer a convenient and anonymous solution, but there is a lack of research on mental health apps in Pakistan. This project develops a mobile app that combines interactive storytelling with localized narratives to address mental health issues. It investigates the effectiveness and acceptance of this approach compared to established psychotherapy models.

Persuasive Prompting as a Coping Mechanism for Depression: Towards Designing Digital Aids to Support People with Depression

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

Depression, being the most prevalent mental illness, urges the need to test different methodologies to try and tackle the issue. One such method is the adoption of persuasive behavioural change models in prompts for mHealth applications to assist in 'prompting' the user to adopt healthier behaviours. However, the acceptability of such persuasive prompts along with the selection of behavioural change models most suitable for people suffering through depression is unknown. The main objective of this study is to create a mHealth application which not only allows depression monitoring (first time in Pakistan) but also acts as a rehabilitation tool through behaviour change.

Supporting Children with Disabilities with Smart Digital Aids to Become Self-reliant Members of the Society

Sponsor: Mitsubishi
Funding Amount: PKR 5,150,000
Project Initiated in: 2019

Pakistan has one of the highest reported rates of childhood intellectual disabilities in the world (19-65/1000). However, due to stigma and misconceptions surrounding these disabilities, most of the parents in Pakistan do not recognize these issues as 'remediable,' diagnosis process is of poor quality and rehabilitation is unstructured and costly. Therefore, often these children are marginalized by society, and they don't enter in mainstream schools. Moreover, with most developing countries' health budgets being spent largely on communicable diseases, there are inadequate resources left to invest in rehabilitation of children and adults with special needs. Therefore, technology can play a vital role in filling the gap and helping the masses by assisting diverse stakeholders (parents, teachers, caretakers). In this project, the aim is to take a holistic approach to address this issue by using online (social media and design of a web portal) and offline (community workshops with localized material) platforms to address (social) stigma and raise awareness and developing open-source digital aids to assist parents, teachers and caretakers in the diagnosis and rehabilitation process.

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A Fully Integrated Wearable Patient-Specific ECG sensor for Ventricular Arrhythmia Detection System

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

This project aims to develop a wearable, non-invasive device that can be used during daily life routine and provide the user an early alarm for further clinical follow-up. This is proposed to be the world's first "patient-specific" VA detection system in a small-form factor sensor. The proposed device is composed of an ECG acquisition system, followed by ECG signal filtering, and then signal processing for extraction of useful information. The overall system is realized on a single silicon chip (IC) to allow small form factor and minimum battery requirements for long time operation. It is attached to the patient's chest and analyses ECG for 15-20 days, applies pre-processing techniques, extract the discriminating features, and based on those features; an adaptive decision model will detect the occurrence of VA.

ASSISTIVE TECHNOLOGY

A Vital Monitoring Device for monitoring COVID-19 patients remotely

Sponsor: Islamic Development Bank (IsDB) | LUMS
Funding Amount: PKR 7,831,425 | PKR 1,000,000
Project Initiated in: 2020

This project aims to develop the first complete wireless vitals monitoring system on chip (SoC) for COVID-19 patients. It can monitor the patient's body temperature, heart rate, and its variability, blood oxygen saturation (SpO2), respiratory rate, and blood pressure from the PPG signal. This allows the patients to be monitored wirelessly with comprehensive information about their vitals and it informs the healthcare through alarms if any patient requires hospitalization. The care providers can access information about a patient's vital signs while the patient is at home, reducing the need for hospital visits and minimizing the risk of exposure to coronavirus. To extend the battery life of this wearable device, a low power capacity can be achieved through various technologies including Wi-Fi, custom Bluetooth, magnetic fields, and wake-up radios. This device can be utilized for various respiratory infections like asthma and seasonal winter diseases that affect millions of people each year.

EEG Based General Anesthesia Machine: A leap into indigenous development

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

This project develops EEG-controlled anaesthesia machines with integrated DoA monitoring. The DoA monitor utilizes EEG-based features and machine learning to adjust the anaesthetic agent quantity based on its effect on the central nervous system. This ensures accurate management of muscle relaxation and pain inhibition without side effects, promoting early recovery. It is the world's first "patient-specific" anaesthesia machine incorporating EEG-based DoA monitoring, implemented using System-on-Chip (SoC).

Fully automated closed-loop Anaesthesia Machine with EEG based Depth of Anaesthesia Monitoring

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 12,877,829
Project Initiated in: 2021

One of the current challenges in medicine is monitoring the patients' depth of general anaesthesia (DoA) and automatically controlling the dosage based on the patient's need. Currently available basic anaesthesia machines allow estimated dosing of aesthetic agent-based patients parameters; however, it cannot fine-tune the dosage according to the specific needs of the patient. This project envisages local development and production of EEG controlled anaesthesia machines. This project integrates an EEG-based DoA monitoring module that controls the aesthetic agent quantity in response to its effect on the central nervous system. This allows accurate management of muscle relaxation and pain inhibition without overdoing it, thus having a positive impact on the overall condition of the patient. It also significantly helps in early recovery without leaving any side effects. This is the world's first "patient-specific" anaesthesia machine that incorporates EEG-based DoA monitor to control the drug dosage implemented using System-On-Chip.

Non-invasive Continuous Glucose Monitoring Using a Multisensor IoT Based Glucometer Powered by Energy Harvesting

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 2,094,576
Project Initiated in: 2019

According to a recent national survey, 26% of Pakistan's total population is diabetic. The survey conducted during 2016-2017 states that almost 35 to 40 million children under the age of 20 are victims of diabetes. Those patients are required to continuously monitor their blood sugar levels to avoid any complications. The conventional method of "finger-stick" that measures the sugar level by taking blood samples is very painful for frequent usage. This project aims to develop the first wearable continuous glucometer for diabetic patients powered by a clean energy source on a small chip. It measures the sugar level without the need to draw blood samples from the patient. Therefore, it can be used more frequently with no pain while providing a high level of accuracy. The device is also connected to the doctors through the internet which allows the doctors or caregivers to monitor sugar levels of the patients remotely in real-time.

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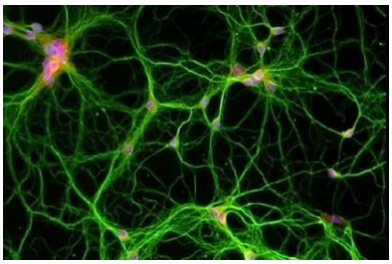

Cellular Assays to Aid Lead Optimization Studies for LDHA Inhibitors

Sponsor: Arctic Pharma
Funding Amount: PKR 3,461,974
Project Initiated in: 2021

In continuation of the ongoing collaboration between the Cancer Therapeutics Lab (CTL) at LUMS and Arctic Pharma, LUMS through this project performs cellular assays of potential LDHA PROTAC compounds shipped to LUMS from another CRO providing services for Arctic Pharma. This project aims to produce LDHA protein in bacteria and purify it through affinity chromatography. The cell-based assays for the LDHA PROTACs that are performed include determination of the half-life of LDHA protein. The half-life of LDHA is determined by western blotting after inhibiting protein synthesis using cycloheximide. It also includes determination of reduction of LDHA activity by the PROTACs or inhibition of their precursors. The CyQUANT LDH assay is used to determine whether PROTACs or their precursors reduce LDH activity in this in vitro assay from BT549 cells. This assay is already optimized and has been previously used in previous lead optimization studies. Moreover, it deals with determination of LDHA levels in cells treated with PROTACs. The proposed LDHA PROTACs is evaluated in BT549 cells (or other cell lines) for their ability to downregulate LDHA protein levels. It also studies antiproliferative activity of the LDHA PROTACs. The antiproliferative activity of the LDHA PROTACs is determined in BT549 and MiaPaCa2 cell lines using the SRB proliferation assay. The assay has previously been used during lead optimization studies. Lastly, it deals with the production of LDHA protein. The LDHA protein is expressed in bacteria using the expression vectors provided by Artic Pharma and purified through Nickel Affinity chromatography. The purified protein may be used in the binding studies with the LDHA PROTACS using an NMR facility at LUMS.

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Surface Enhanced Raman Spectroscopy of Pneumococcus Bacterial Capsules and Biofilms

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

Pakistan is host to a burgeoning population with rapid urbanization into ever expanding cities. Dense populations with poor hygiene practices, limited access to clean drinking water, sanitation and overcrowding in hospitals makes Pakistan a prime canter of communicable diseases. Alarming rates of antimicrobial resistance among bacteria

cause common infections. Resistant bacteria in community and hospital settings continue to claim thousands of lives, and the challenge is expected to grow in coming years. Despite availability of vaccine, pneumococcal infections continue to plague the elderly and children in Pakistan. Such persistent colonies are referred to as biofilms. Understanding biofilm architectures, chemical composition, formation factors, and difference in biofilms between different pneumococcal serotypes can lend insight into their resistant nature and allow for the development of probes/methods that will help prevent formation of these biofilms and aid treatment. This project aims to carry out foundational work on pneumococcus bacterial biofilms and capsules as part of a collaboration between research groups at the Physics and Biology Departments at LUMS.

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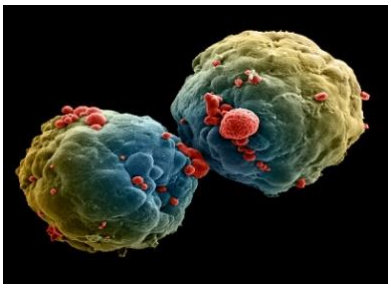

Discovering Etiology-based Strategies for the Prevention and Treatment of Estrogen-induced Breast Cancer

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 2,498,062
Project Initiated in: 2017

This project is focused on the identification, isolation and characterization of proteins and designing the strategies for prevention and treatment of breast cancer by using the newly discovered proteins as therapeutic targets.

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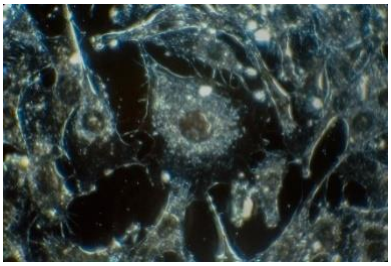

Characterizing a New Class of Cancer Driver Mutations

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

This research employs cell-based models to study genome protection function of the histones and the impact of histone H4 mutations on the integrity of the genome. These assays can help to determine if any given histone H4 mutation has a critical role in cancer development. This study has the potential to pave way for future mechanistic studies to investigate the role of histone mutation-mediated molecular changes in cancer cells which will have potential implications in the development of targeted therapies.

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A Gene Activator or a Gene Silencer: Analysis of Anti-Silencing Effect of HATX on Polycomb Group Genes and Link to Cancer

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

Each cell type in our body has characteristic gene expression patterns which are maintained throughout the life of an individual; referred to as cell memory. Early events during onset of cancer are attributed to loss of cell memory of a single cell in which a particular cell will undergo changes in patterns of gene being maintained in “on '' or “off” states in a normal cell and consequently it starts uncontrolled proliferation. Polycomb group (PcG) proteins are involved in maintaining the silent state of cell type specific genes whereas Trithorax group (TrxG) proteins act as anti-silencers to maintain active state of cell type specific genes. Several key Polycomb group members also act as tumour suppressors which function to ensure cancer does not develop. The study proposes to understand the molecular function of this HAT in relation to the TrxG gene and its effect on PcGs which also act as tumour suppressor genes.

Chaperoning Epigenetics: Molecular and Genetic Analysis of Polycomb-Chaperonin Nexus Linked to Cell Fate Maintenance

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

This project proposes a detailed molecular and genetic analysis of Gene-7/PcG nexus to understand how Gene-7 may alter PcG mediated gene silencing. Since PcG genes are known tumor suppressors and impaired PcG function leads to onset of cancer, molecular characterization of this novel chaperone Gene-7/PcG link leads to understand how cell fates can be altered resulting in onset of disease like cancer.

Investigation of Hyperglycemia Specific Circulating Non-coding RNAs in Type 2 Diabetes

Sponsor: Shahid Hussain Foundation
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

This study suggests that specific lifestyle and dietary habits of the Pakistani population lead to changes in gene expression, which involve epigenetic factors like specific non-coding RNAs in diabetes. These non-coding RNAs regulate specific genes, for development of disease and comorbid conditions such as cardiovascular conditions. Discovery of circulating non-coding RNAs will not only provide an excellent tool to understand development of diabetes in such a high number in Pakistan but will also lead to the development of a robust method for early diagnosis of cardiovascular disease in those with diabetes. The aim of this study is to identify circulating non-coding RNA from

blood samples in type 2-diabetes and correlate these non-coding RNA molecules with hyperglycemia mediated epigenetic changes in patient genome.

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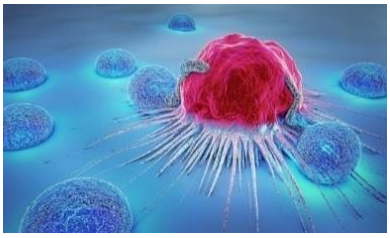
Declustering the Supernumerary Centrosomes in Cancer Cells using Small Organic Molecules: An Approach to Selectively Kill Cancer Cells

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

The project includes the synthesis and evaluation of the small organic molecules that can inhibit formation of two poles during division of these cancer cells. A library of organic molecules is prepared based on literature insights and assesses those molecules in the cells with normal number of centrosomes and with supernumerary centrosomes. During this process, a robust in-house assay for the screening of compounds is developed and the activity of these compounds is quantified. This project is expected to lead to identification of unique compounds that could selectively kill the cancer cells with extra centrosomes and function as lead for further studies into potential drug development along with the training of graduate and undergraduate researchers in this interdisciplinary research area.



Development of Next-generation Chemotherapeutics Targeting Microtubules and Addressing a Key Concern of Multidrug Resistance in Cancer Cells

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

This research synthesizes concise natural product inspired, computational docking guided library molecules and evaluates the compounds for their ability to kill cancer cells, ability to stop cell division, binding with microtubules, ability to evade PGP mediated efflux, and ability to kill the cancer cells that are resistant to current medications.

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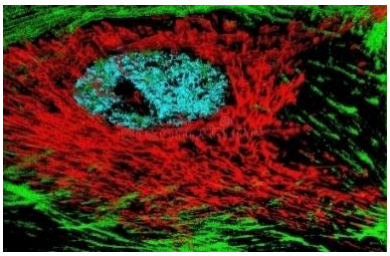

Understanding the Molecular Mechanism of Disease Related Endothelial Activity of Oxidized Phospholipids

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

It is well established that oxidized lipids activate endothelial cells (cells at the interior surface of blood vessels) leading to the development of atherosclerosis that can result in several diseases including cardiovascular and kidney diseases, and even brain stroke. In this regard, a specific type of molecule, called PEIPC produced as the result of the oxidation of phospholipids has been identified to regulate over 1000 genes in endothelial cells of human arteries. Many of those genes activate cellular processes leading to the development of inflammation and atherosclerosis. For such gene regulations, PEIPC binds to its target proteins at the surface of endothelial cells. It initiates certain biochemical signals in the cell, while activating several enzymes in a series. The process is called signal pathway that ultimately results in the activation or deactivation of certain genes. Here, the project aimed to understand the binding of these PEIPC isomers to HRas protein, which is one of the twenty target proteins of these PEIPC isomers. This study is highly significant to understand the mechanism of molecular recognition related to several chronic disorders.

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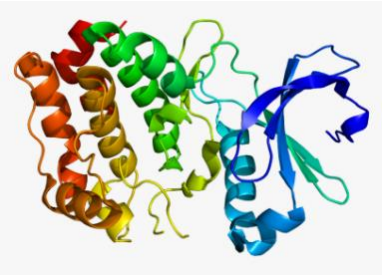

Characterization of Aminochalcones as Novel Aurora A Specific Inhibitors with an ability to Overcome Multidrug Resistance

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

The human body is composed of trillions of cells that all derive from a single cell through a tightly controlled process of cell division. In an adult individual, most cells never divide; others, however, keep on dividing to form new cells according to the needs of the body. An elaborate "cell division machinery" ensures that cells only divide when required; any perturbation of the tight controls enforced by this machinery can result in diseases like cancer, where cells divide uncontrollably and spread to various parts of the body. Many components of this cell division machinery have served as targets for therapeutic interventions for cancer treatment. One of these components is the Aurora A protein that is excessively produced by many cancer types. Through in-house cell-based screening approaches, a chemical compound has been recently identified that blocks the function of Aurora A protein and as a result, kills cancer cells. This chemical compound is part of a library of compounds synthesized at LUMS and represents a new class of inhibitors specific to Aurora A protein. More interestingly, the compound appears to overcome multidrug resistance – a phenomenon where cancers become refractory to unrelated drugs. Multidrug resistance is the major reason behind the failure of chemotherapeutic drugs. Based on the above data, this project proposes to characterize this chemical compound to show whether it is specific for Aurora A protein relative to other related Aurora proteins, determine how it binds to Aurora A protein through different approaches, determine whether it can inhibit the cell division and kill different types of cancer cells, determine the mechanism through which it kills cancer cells, and identify how it overcomes multidrug resistance.

High-throughput Compound Library Screening and Validation of Potential Targets for Regulators of Polycomb/Trithorax Group Members

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

Humans are made up of trillions of cells (building blocks) that can be grouped into hundreds of cell types such as kidney, liver, fat, muscle, and neuron cells. All the different cell types are derived from a single cell. The specific properties of each cell type, however, require that precise sets of proteins are present in each cell type. There are two major groups of proteins, Polycomb group (PcG) and Trithorax group (TrxG), play an essential role in the process of defining cell memory. The current project deals with identification of novel regulators of Polycomb and Trithorax proteins through screening of large numbers of drugs (1127) through a process called "high-throughput library screening". Drugs with known targets are used in a cell-based reporter assay to identify the ones that can increase or decrease the gene expression.

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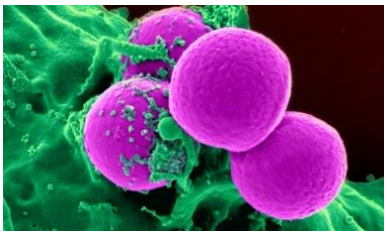

Design and Synthesis of Electron-Deficient Fluorinated Sulphonamides and Evaluation of their Antibacterial Efficacy

Sponsor: Shahid Hussain Foundation
Funding Amount: PKR 1,200,000
Project Initiated in: 2021

Urinary tract infections (UTIs) are amongst the common infections caused chiefly by uropathogenic Escherichia coli (UPEC), which account nearly 80% of such infections. UTIs are becoming increasingly difficulty to treat owing to the rapid spread of drug resistance among Gram-negative bacilli, unambiguously UPEC. The increasing frequencies of infections caused by such pathogens, particularly in developing countries has headed towards misuse of broad-spectrum antibiotics aiding the development of multi drug resistant (MDR)bacteria and limiting the options for anti-biotic therapy. Thus, there is a need to develop new antimicrobials to combat infections caused by these pathogens. This project aims to develop a novel sulfonamide compound with antibiotic efficacy against multi-drug resistant bacteria and determine if the antibacterial capacity of novel fluorinated sulphonamides is greater than currently available antibiotics for the treatment of urinary tract infections, primarily caused by E. coli and other infections caused by S. aureus.

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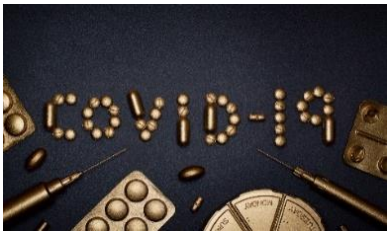

Computational Designing, Synthesis, and Evaluation of Benzothiophenes as Antiviral Drugs for the Treatment of COVID-19

Sponsor: LUMS
Funding Amount: 1,000,000
Project Initiated in: 2021

A surge of coronavirus Covid-19 cases in the world, especially in Pakistan has put pressure on several infrastructural facilities, hindered the functionality of the workforce in all sectors, and burdened the economic as well as social stability of the country. Hence the development of an effective therapeutic against this virus would undoubtedly be a breakthrough in medicinal sciences, both nationally and internationally. Once a potential drug-like molecule has been identified, and further developed into a potential drug with the help of local pharmaceutical company, this pioneering research would hugely impact the capacity building of the local pharmaceutical infrastructure. The goal of this project is to synthesize the computationally designed parent molecules, prepare libraries of their analogues, and then evaluate their antiviral properties in the conventional biochemical (antiviral) assays. This rational drug discovery approach is based on targeting (and inhibiting) the biological role of essential factors (so-called viral targets) of the virus and thereby hitting the viral reproductive system directly, without eliciting any side effects.

Synthesis and Evaluation of Computationally Designed Antiviral Compounds for the Treatment of COVID-19

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

The causative agent of COVID-19 is a bat coronavirus, named as SARS-COV-2 that has acquired a previously unknown tendency (mutation) to infect humans and transmission from human to human. This project team has conducted extensive literature search and computational modelling to design a molecule with a potential to curb the reproduction of SARS-COV-2 in human cells. Ultimately, the project aims to synthesize the designed molecule and prepare a library of its analogy and then test its potential to inhibit the function of the essential viral protein at the enzymatic level.

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Investigation of Effect of Diabetes Associated Hyperglycaemia on Bactericidal Activity of Neutrophil

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 1,661,991
Project Initiated in: 2020

The association of type 2-diabetes with lower respiratory tract infections caused by the bacteria, some of which are fatal, is well recognized. The proposed study is designed to elucidate the cellular and molecular mechanism involved in alteration of phagocytosis/NETosis axis. Results of this study can provide a complete understanding of the global mechanism of regulation of bactericidal activity of neutrophils in diabetes. As neutrophils are central to killing of numerous pathogens, understanding of these pathways can help develop interventions to enhance neutrophil antibacterial activity against pathogens.

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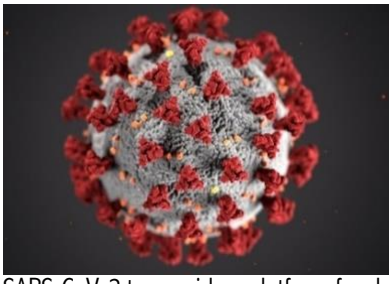
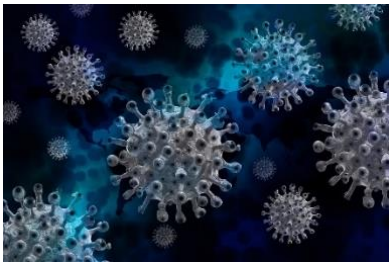


Development of Pseudovirus-based Coronavirus Cellular Infectivity Assay for Drug Discovery and Vaccine Research

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

The current project envisages to develop pseudovirus based cellular infection assay of SARS-CoV-2 to provide a platform for drug discovery and vaccine research along with initiating the screening for the identification of SARS-CoV-2 cellular entry inhibitors. The project consists of development of SARS-CoV-2 pseudovirus, optimisation of human cell lines with stable expression of the SARS-CoV-2 receptor ACE-2, optimisation of pseudovirus based SARS-CoV-2 infection assay and testing of potential SARS-CoV-2 entry inhibitors as potential drugs.



Discovery of New Potential Therapeutics Against Coronavirus by Targeting Viral Cellular Entry and Replication

Sponsor: Shahid Hussain Foundation
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

The current global pandemic of coronavirus disease-19 (COVID-19) caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) has drastically affected healthcare, economies, and social life all over the world. To date, no specific treatment is available to lessen the infection. The current study aims at antiviral drug discovery. The research intends to inhibit the cellular entry of SARS-CoV-2 by targeting its surface glycans and receptor binding sites on the spike protein by testing already known lectins and by discovering new inhibitors from natural sources such as algae and from traditional herbal medicines. Another aim is to identify new potential anti-SARS-CoV-2 drugs by targeting its RdRp enzyme. Work is being done to identify inhibitors of RdRp of other viruses, and the researchers have established relevant biochemical and biophysical assays in lab at LUMS. By utilizing the established system, the respective research is expected to produce this viral protein and screen different libraries of compounds including commercially available drug like molecules, natural products derived from our traditional herbal medicines and organic compounds libraries. Finally, any identified molecule in the studies will be tested in viral infection assays in Dr Marc Windisch's lab at Institut Pasteur, South Korea in future.

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A Game Theoretic Approach to Evaluate Vaccine Efficacy for COVID 19

Sponsor: LUMS
Funding Amount: PKR 960,000
Project Initiated in: 2022

The proposed study aims to develop a game theoretic framework to evaluate vaccination and social distancing as control measures that can be adopted by individuals. Starting with a mechanistic model for the transmission dynamics of COVID19, important pathways are to be incorporated for transmission including an asymptomatic compartment and high and insignificant risk susceptible groups. Mathematically, social distancing leads to a reduction in the contact rate between susceptible and infected populations, and vaccination reduces the individuals who can be infected. The study considers that the vaccine is imperfect, and a small fraction of the vaccinated individuals may fall ill. Individuals have a choice to vaccinate, the payoff depends upon the prevalence of the disease (and hence the mortality) and the negative effects of vaccination (these may include vaccine induced mortality and perceptions of harmful effects of vaccination). The virus itself is assumed to mutate over time, reducing the efficacy of the vaccine, a host reservoir is needed for the virus to mutate. In response to a new strain of the virus, a 'newer' version of the vaccine is introduced with a higher efficacy. The study intends to determine the conditions at 'equilibrium' in terms of parameters of the model, which include vaccine efficacy, rate of mutation of the virus and vaccine reluctance.

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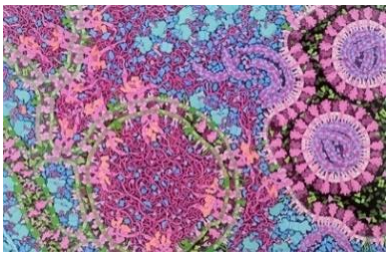
Establishing Decentralized Global Genomic Surveillance for the Pneumococcus

Sponsor: Genome Research Limited
Funding Amount: PKR 18,003,000
Project Initiated in: 2021

PCV targets the capsule around pneumococcal cells and has been very effective in reducing pneumococcal disease. However, the vaccine is only able to target some strains and the population overall can evolve to evade the vaccine. This creates an arms race between the vaccine and the pathogen, in which surveillance plays an important role to maintain the diseases at low level or further reduce them. The study is aimed at achieving this goal by building a federalized system for local generation and analysis of genomic data that is sustainable in the future.



Mapping Immune Response to SARS-Cov2 using a Multidisciplinary Approach

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 12,633,414
Project Initiated in: 2020

The goal of the project is to investigate patterns of immune responses to infection by SARS-nCov2 virus and use immunological data to develop mathematical models of transmission. Immune responses play a critical role in resolution of infection and in response to vaccines. Variability in immune responses is dictated by either difference in host immune systems or differences in invading pathogens. Outcomes associated with infections by Coronavirus SARS Cov-2 are vastly different and include, asymptomatic carrier state, mild disease state not requiring hospitalization or oxygenation and sever fatal disease, which requires oxygenation and hospitalization.

Mechanisms of Immune Protection Induced by Pneumococcal Polysaccharide Vaccine

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 5,745,409
Project Initiated in: 2018

Type 2-diabetes is known to impair the immune system, thereby increasing the risk of infections. Understanding how type 2-diabetes mellitus contributes to immune impairment is essential to develop strategies to prevent and combat infections. Since the link between metabolic impairment and immunity is multifaceted, its understanding requires an integrated approach. The project therefore focuses on understanding the mechanism of immunogenicity of the pneumococcal polysaccharide vaccine. Results of this study are expected to be widely applicable as they provide common pathway(s) that are essential in both B cell (pneumococcal vaccine) and T cell (influenza) based vaccines.

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Identification of Hepatitis-C Neutralizing Antibodies and Structural Study of their Epitopes to Obtain Essential Information for Rational Vaccine Design

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 11,005,383
Project Initiated in: 2017

Millions of people around the world are affected by HCV infections, which are the leading cause of infection-associated deaths. However, although current drug therapies can treat the HCV infections, yet they have not contributed significantly to lower the disease burden. Low-income populations have a limited access to available drugs. An effective vaccine is required to combat the disease in a cost-effective manner. This project intends to identify new HCV neutralizing antibodies that are targeted against conserved regions of the HCV envelope and understand the structure of their target sites in the antibody bound conformation.

TECHNOLOGY

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A Robotic Solution for Digital Plant Phenotyping and Intelligent Decision Support System for Smart Farm Management

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 11,988,600
Project Initiated in: 2022

The objective of the proposed research is to evaluate the potential of Sustainable Intensification in Pakistan through digital phenotyping. Plant phenotyping refers to monitoring the structural, physiological, and temporal characteristics of a plant such as the leaf shape and count, stem height, leaf chlorophyll content, NDVI, and canopy size to determine its growth rate and predict yield under various biotic and abiotic stresses. This project constitutes a first of its kind research activity in Pakistan in which the impact of SI in the local environment is analysed through rigorous data-driven approach using modern robotics and sensing technologies.

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Investigating the Security Threats of Deep Learning Technology

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

Recent years have seen a rapid increase in the adoption of Artificial Intelligence technology, particularly by technology giants such as Facebook, Google, and Microsoft. This recent success of deep learning also attracts the attention of miscreants, who wish to misuse its purposes. To this end, this research is motivated by two broad questions, the first is that of trust: can we trust the AI technology to perform correctly under all circumstances? The second broad question is: how AI technology can, particularly in the context of automated video and text generation, be used to influence public opinion, in potentially malicious ways. This study aims to understand to what extent this is already happening on the Internet, by leveraging detection technology as well as by conducting systematic Internet measurement studies.

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Creating Technological Foundations of Data-Driven Policy Making for Sustainable Urban Development

Sponsor: HEC
Funding Amount: PKR 210,221,860
Project Initiated in: 2021

The project aims to utilize technological innovations for data gathering, analytics, and decision-making in addressing complex urban issues in Pakistan. Over the three-year duration, activities focus on six interrelated verticals spanning urban sprawl, environment, health, and mobility. Each vertical is supported by linked horizontal themes, ensuring transdisciplinary collaboration and long-term impact. Key horizontals include technology development, equity, transparency, and social acceptability. The project also emphasizes advancing data-driven decision-making, evidence-based policy design, and capacity building for stakeholders, fostering sustainable change in Pakistan's urban landscape.

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Automated Authorship Obfuscation

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

Authorship attribution aims at identifying an anonymous or disputed document's author by stylometric analysis (i.e., examining writing style). Stylometry exploits features such as word frequency and sentence length that reflect distinguishing characteristics of text written by an individual. Such stylometric features enable authorship attribution because they tend to remain sufficiently consistent across different documents by an author but vary across different authors. Stylometric authorship attribution aims to identify an anonymous or disputed document's author by examining its writing style. The development of powerful machine learning based stylometric authorship attribution methods create a serious privacy threat for individuals such as journalists and activists who wish to publish anonymously. Unfortunately, existing authorship obfuscation approaches are lacking because they either require some manual effort, require significant training data, or do not work for long documents. To address these limitations, this study proposes a genetic algorithm based random search framework which can automatically obfuscate text to successfully evade attribution while keeping the semantics of the obfuscated text like the original text.

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Artificial Intelligence: Images, Gestures, Ancient Materials. Machine Learning for the Multidimensional Perception of Objects in Archaeology

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 1,500,000
Project Initiated in: 2021

This project aims to develop algorithms dedicated to archaeological research for the formal study of artefacts (recognition of the object and its shape) and their reconstitution from fragments. It allows the comparison of research results with hypothesis tests (contextual viability of the reconstructions proposed by archaeologists by implementing knowledge of the mechanics of materials), and the experimental approach in archaeology with field scenarios. The objective is to develop links between digital humanities and archaeology (non-existent in Pakistan), to support the protection of archaeological sites and to help prevent the trafficking of antiquities.

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Catalysing Industry 4.0: Development of Framework and IIoT and Machine Vision Testbeds for Providing Automation Roadmap to the Industries

Sponsor: National Centre for Robotics and Automation (NCRA)
Funding Amount: PKR 10,321,000
Project Initiated in: 2021

The industrial sector is facing its latest revolution, Industry 4.0, due to "digitalization" a concept that involves using smart data gathering and information processing technologies to improve efficiency, sustainability, and productivity of the industrial sector. This project focuses on the development of a framework for devising the digital transformation strategy to be adopted by the local industries to optimize their productivity and efficiency. The proposed framework enables carrying out assessment of the standing of the manufacturing relative to the available potential when it comes to the digitalization of the interactions between man, machines, and methods. Furthermore, the proposed framework supports analysis of innovation in both the technology (such as use of data analytics, deep learning) and service or process.

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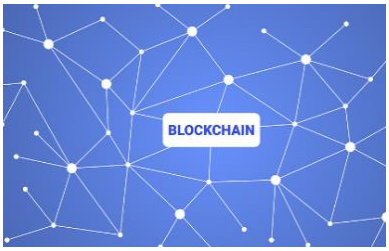

Towards the Development of Blockchain-enabled Prosumer-Oriented Electricity Markets in Pakistan

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

This project includes identification of appropriate blockchain-based setup and associated trade-offs according to the specific requirements (latency, throughput, privacy) of various market models such as peer-to-peer and community based. This project is expected to enable the early introduction and adoption of blockchain technology for a useful energy-sector application in Pakistan. The project can help in improving the understanding of smart grid research community on the integration of blockchain in smart grid applications.

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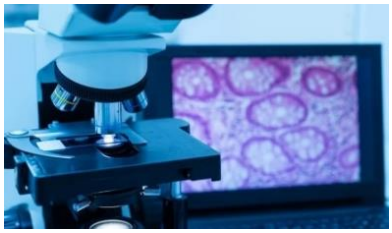

Developing a Modular 3D Printed Platform for High Resolution Microscopes with Advanced Imaging Applications

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

This project proposes the development of a versatile, modular optical imaging system capable of performing conventional as well as digital microscopy. The project intends to establish a multi-purpose platform that uses a mixture of 3D printed and machined parts that can be developed, repaired, and scaled locally.

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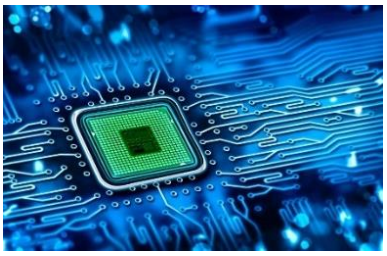
FFConv: Resource-Efficient FPGA-based Design and Acceleration of Convolutional Neural Networks (CNNs) for Embedded Vision Applications

Sponsor: LUMS
Funding Amount: PKR 995,000
Project Initiated in: 2020

This research caters huge computational requirements of modern neural network architectures by exploring their FPGA-based implementations that exploit the parallelization capabilities of the algorithms. Existing neural network architectures are studied, and their resource efficient and high throughput implementations are proposed. Some of the possible research directions include design-space exploration of soft as well as hard quantization schemes aiming at reducing the on-chip memory footprint, external memory bandwidth and resource utilization for FPGA-based neural network implementation, probing the possibility of using alternate architecture designs for convolutional layers to reduce the computational costs of these layers and design of parallel and pipelined architectures aiming at high-throughput/speed processing of ConvNets to accelerate modern AI-based machine vision applications such as self-driving cars, autonomous drones, industrial robots, etc.



Real-time Display of High Dynamic Range (HDR) Images and Videos Using Embedded Tone-Mapping Operators

Sponsor: LUMS
Funding Amount: PKR 980,000
Project Initiated in: 2022

The proposed research tackles the need for huge computational requirements of modern TMOs by exploring hardware-efficient FPGA-based implementations as a short-term goal. The FPGA-based solutions can then in future be translated into ASIC-based custom hardware circuits that can be deployed into end consumer-electronics devices such as Set-Top Boxes (STBs) for LDR displays.

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Analysing and Forecasting Socio-Economic Development Using Satellite Imagery of Districts of Punjab

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 4,267,776
Project Initiated in: 2019

The increase in human population has resulted in multiple changes in our ecosystem. Major changes could be seen in construction and farming which are two of the oldest professions, since the dawn of civilization. The analysis of construction and cultivation using spatial data of past and present, is regarded as one of the basic requirements for future planning and geographical studies. Satellite imagery is one such spatio-temporal data that provides an opportunity to estimate the changes in land use over time. This research work focuses on the development of specialized techniques of machine learning to understand satellite image for the extraction of socio-economic indicators. Overall, the project is divided into four modules: satellite imagery data collection, designing and training of networks such as for object detection and segmentation, temporal analysis of satellite Imagery, and identifying socio-economic indicators.

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Development of System for the Detection of Edge Cracks in Bulleh Shah Packaging Board Production Process

Sponsor: Bulleh Shah Packaging
Funding Amount: Confidential
Project Initiated in: 2021

In Bulleh Shah Packaging, the paper (board) of different web-width is produced and is supplied to different customers to produce end-products. During the board production process, cracks of varying sizes may develop on the edges of the paper on either side of the process line due to the variations in the production process. These cracks are undesirable as the cracks may cause web breaks at the winding machine resulting in production loss and a decrease in the throughput at the winder and/or customer end. There is a need to devise a system to detect the cracks on the edges during the production or slitting process. This project is aimed at enhancing the process efficiency, reducing the production loss and waste, and limiting the customer claims. Such detections can facilitate the process engineers or operators to appropriately review the production process and raw material. Later, the data collected by the system may also be reviewed offline to assess the production/material quality.

Development of System for the Detection of Spots in Bulleh Shah Packaging Board Production Process using Machine Vision

Sponsor: Bulleh Shah Packaging
Funding Amount: Confidential
Project Initiated in: 2020

This study includes development of a system that exploits machine vision algorithms to identify the spots from video stream of the web running at high rates in real time. To ensure the simplicity in design commercial of the shelf components are used. In addition, to address computational overhead state-of-the-art machine vision algorithm is utilized. The developed system is robust enough to capture the spots at speeds up to 200 meters per minute.

Motorway to Safety: Design and Development of an Intelligent System for Active Traffic Management and Efficient Law Enforcement on National Highways and Motorways

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 12,745,000
Project Initiated in: 2019

This project is aimed to design, develop, and deploy an active highway safety system consisting of a set of sensing and decision-making road-side modules capable to communicate the sensed and inferred information over a wireless channel, on national motorways and highways to assist law and enforcement agencies so that they

can implement and enforce traffic rules and regulations more efficiently and effectively for enhanced highways safety. The overarching goal of this research is to enhance safety of travellers and commuters on national highways or motorways by developing systems for automated speed enforcement (ASE) and detection of mobile phone usage while driving. Scientific, administrative, and operational challenges in the development of these systems are addressed by utilising the technology advancements in smart and ubiquitous sensing, computer vision and the industrial internet of things paradigm along with the expertise in information theory, reinforcement learning, machine-to-machine communication, signal processing, and predictive modelling to develop cutting-edge automation solutions for the industrial sector. These developments are sustainable as end-user is on-board and the plans are in place for commercialization.

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Enhancing Power Sector Data Security, Risk Assessment and Cyber Resilience

Sponsor: Hagler Bailly Pakistan
Funding Amount: Confidential
Project Initiated in: 2022

This project focuses on conducting an in-depth cybersecurity vulnerability study for PITC-supported systems. The study comprises of an in-depth security diagnosis of the existing PITC-supported ICT infrastructure and systems, power management systems and external networks connected to the PITC systems. PSIA is conducting a review of any existing cybersecurity tools, systems, protocols, processes, and procedures deployed in the current environment.

Rethinking Cyber Security in Pakistan—Human Factor's Essential Role

Sponsor: University of Saarland
Funding Amount: PKR 26,437,662
Project Initiated in: 2021

With the increased digitization of industry and government in Pakistan, threats to cyber security for Pakistan's citizens, government, and industry might be more severe as they are for other countries. Added to this, the critical infrastructure in Pakistan is poorly protected, which makes even less sophisticated cyberattacks a severe problem. These threats are increasing in their severity as more Pakistanis are using the internet in their daily lives. IT graduates are not trained in analytical training and complex problem-solving skills, which is a core demand of the industry especially in the domain of cybersecurity where attack mechanisms constantly change. To strengthen the links of Higher Education Institutions to the industry in the domain of cybersecurity and increase the employability of IT students, it is necessary to have a holistic approach to cybersecurity as a domain. This project addresses the cybersecurity training issues in university degree programs and makes them more immersive and experience based.

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Protection at the Physical Layer: Towards Building Resiliency against Cyber-attacks for Smart and Sustainable Cyberphysical System

Sponsor: National Centre for Cyber Security (NCCS)
Funding Amount: PKR 8,590,500
Project Initiated in: 2021

Modern Cyberphysical Systems (CPS) such as smart grids and industrial systems, consist of a variety of sensors, control systems, and communication networks which make it highly complex, connected, and automated. This in a way makes CPS vulnerable for adversaries to perform coordinated cyber-attacks on its different attack surfaces. These attacks could be really sophisticated and stealthy and have knowledge of physical process, measurement model and noise information which can inflict significant damage to the system while avoiding detection. Several mechanisms are already available to tackle such attacks but with the increasing complexity and scalability of CPS, the nature and dimension of these attacks is becoming increasingly sophisticated. Therefore, existing solutions fall short in modelling effectively many different aspects of these attacks. This project aims to close this gap by developing a cyber-security framework consisting of algorithms and analytical methods to provide protection against most common cyber threats present at the physical layer of any CPS such as smart grids and industrial control systems. The successful execution of the proposed project can help prevent system-wide failures or blackouts which critically affect the overall system performance. The special focus is to make the overall framework suitable for real-time application which can help in its scalability for a wider adoption in local industry.

INTERNET OF THINGS (IOT)

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Greencomm: Toward Developing an Energy-Efficient Next Generation Communication Platform for Enabling Internet of Things (Iot)

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 3,758,512
Project Initiated in: 2020

This project aims to contribute towards designing next-generation energy-efficient (green) communication platforms that would steer the future technologically more-connected society towards a more energy efficient (green) society. The evolution on the internet, short-distance communication, and embedded sensor design has enabled us to convert our daily-life objects (things) (such as home appliances, electrical sockets, power meters, vehicles, etc.) into smart objects that can "think", analyse, and react to their environment. Such "things" form the basic fabric of the Internet of Things (IoT) and enable novel computing and communication applications. This phenomenon is expected to lead to a new global industrial and economic revolution in coming future.

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Developing Security-aware Distributed Applications in the Cloud and Edge Computing Environments

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

The objective of the proposed work is to develop a framework for secure distributed workflow applications in the cloud and edge computing environment. This ubiquitous environment has enabled development of next generation distributed applications that are autonomous, co-operative, adaptive, evolvable, emergent, and trustworthy. These apps are architected and mechanized using resources and services belonging to different organizational domains. These domains are usually autonomous with their own security and access control policies. Development of such dynamic application workflows require considering the security requirements and access control policies of all collaborating organizations throughout the application lifecycle. To address these challenges, the project team built on prior research work that led to development of a framework for composition and management of distributed business processes and workflows in the services cloud and edge-computing environment. The project plans to extend this framework to support development of security-aware distributed applications.

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Reducing Tail Latency in the Cloud using Proactive Job Duplication

Sponsor: LUMS
Funding Amount: PKR 985,000
Project Initiated in: 2020

Cloud datacentres form a critical infrastructure for hosting large-scale Internet services, such as cloud-based file storage and video on-demand. Yet, meeting the performance expectations of cloud applications is challenging; typical cloud applications have workflows that involve contacting multiple servers at the same time and may face different potential bottlenecks. Thus, even a single slow component ends up delaying the entire application. This project proposes a new strategy for dealing with stragglers that proactively duplicates jobs named as DASE. The aim of the project includes conducting a large-scale performance evaluation study of state-of-the-art duplication schemes over real cloud workloads, to design and analyse DASE, a duplication scheduling framework for data centres, and to implement and evaluate DASE using real testbed experiments across diverse network and traffic scenarios.

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Greenifying Older Building in Emerging Countries

Sponsor: German Pakistani Research Cooperation Program - DAAD
Funding Amount: PKR 18,435,256
Project Initiated in: 2019

Pakistan has a rapidly growing population, with a burgeoning fraction residing or working in urban buildings or industrial complexes. This population growth, along with aging building infrastructure, puts tremendous pressure on the supply of three basic resources: electricity, gas, and water. The study focuses on development of Internet of Things (IoT) based approach that seeks to retrofit the current lot of buildings with an Integrated Resource Management (IRM) system. IRM can remove inefficiencies in the resource consumption and improve the safety and living standards of Pakistani citizens. The local conservation of resources directly results in a country wide better supply-demand balance that provides economic respite (no need to buy additional resource to meet demand) and keeps the citizens satisfied (demand being met at lower cost). The IRM's ability to enforce safe living standards and prevent fatal accidents indirectly provides socioeconomic benefit by maintaining a healthy and able workforce that contributes to the development of Pakistan. This project targets two important aspects of the Vision 2025 of the Government of Pakistan: integrated resource management, and modernising infrastructure. This project requires an initial survey to quantify inefficiencies in resource consumption at building level, followed by a prototype development and evaluation of the IRM solution that can curb these inefficiencies through preventive resource management.

No-fills Water Comfort for Developing Regions

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

In developing countries, most households use overhead water tanks to have running water in their taps. These water tanks are exposed to the elements, which usually render the tap water uncomfortable to use, given the extreme subtropical weather conditions. Externally weatherproofing these tanks to maintain the groundwater temperature is short-lived, and only results in a marginal (0.5 −1 ◦C) improvement in tap water temperature. The proposed project i.e., ASHRAY is an IoT-inspired, intelligent system that can minimize the exposure of water to the elements thereby maintaining its temperature close to that of the groundwater. A machine learning based approach is proposed for ASHRAY that can identify the water demand patterns of a household and pump water into the overhead tank only when necessary. ASHRAY can provide thermal comfort in summers and save water heating costs in winters through reduction in natural gas consumption, by leveraging ground water temperature. The proposed system, ASHRAY, can positively impact the lives of millions of people in developing countries.

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Bonded labours of Brick Kilns: Employing Machine Learning on Remote Sensing Data to Perform Comprehensive Survey of Afghanistan-Nepal Brick-Belt

Sponsor: Facebook
Funding Amount: PKR 853,516
Project Initiated in: 2019

This project aims to eliminate bonded labour in South Asia by providing an up-to-date and automatically generated count of brick kilns within the Afghanistan-Nepal belt, along with the geographic coordinates of individual kilns, and an estimate of the number of children and adults working and residing at each site. The proposed solution is expected to eradicate modern-day slavery from South Asia by enabling data-driven policy-making, and regional monitoring and evaluation mechanisms for the Sustainable Development Goals.

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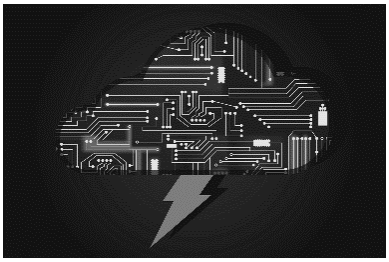

Short Term Load Forecasting Tool

Sponsor: Central Power Purchasing Agency (CPPA)
Funding Amount: PKR 4,962,586
Project Initiated in: 2020

At the LUMS Energy Informatics Group (EIG), research is being conducted towards developing a customized tool for accurately forecasting electricity load in Pakistan. The tool can be catered for any granularity, especially forecasts that are needed at the DISCO scale. The tool works at the level of DISCOs but can also work at the level of circles, divisions, and sub-divisions for providing better accuracy and area-specific load forecasts to forecast the electricity demand on day-to-day intervals. Using the techniques, this tool can forecast the electricity demand for up to 7 days. Unlicensed spectrum bands, particularly TV White Space (TVWS), hold tremendous potential to fulfil the ever-growing spectrum demands of intelligent Internet-of-Things (IoT) applications, e.g., smart cities.

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Unlocking TV White Space Potential for Intelligent IoT

Sponsor: National Natural Science Foundation of China (NSFC)
Funding Amount: PKR 7,000,000
Project Initiated in: 2019

Unlicensed spectrum bands, particularly TV White Space (TVWS), hold tremendous potential to fulfil the ever-growing spectrum demands of intelligent Internet-of-Things (IoT) applications, e.g., smart cities, smart grid, intelligent transportation, etc. Communication networks could be conveniently and opportunistically deployed to provide connectivity over free TVWS in urban and remote locations. Amid stiff competition for free resources, the availability of TVWS spectrum however is random in nature. This randomness in spectrum availability is not suitable for IoT applications with different Quality of Service (QoS) requirements. This project proposes leveraging the novel concept of high priority channels (HPCs) in the TVWS bands that could be temporarily leased by interested operators for short term usage, which would counter these issues and keep the cost low.

INTERNET OF THINGS (IOT)

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Development of Application and Website for Shirkat Gah

Sponsor: Shirkat Gah
Funding Amount: Confidential
Project Initiated in: 2019

Initiated as a small voluntary women's collective in Pakistan in 1975, Shirkat Gah was the country's first self-avowed feminist organisation. SG has played a pivotal role in the women's movement in Pakistan. As one of the leading women's rights organisations of Pakistan, Shirkat Gah has established itself as a resource centre for advocacy, capacity building, knowledge production and dissemination. Shirkat Gah houses historical archives pertaining to women's and minorities' rights and laws from Pakistan's early existence. This project includes development of an App and Web Site for Shirkat Gah under SAFE Project along with a project report that outlines the design of the app, website, and limitations of the project.

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Internet of Things (IoT) Based Conversion Kit for Motor Loads

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 13,958,000
Project Initiated in: 2018

The project focuses on the development of a conversion kit solution that not only retrofits legacy air conditioner with an adjustable-power operation (like dc inverter type air conditioners) to allow up to 60% power saving but also eliminates power surge drawn by motor loads at the onset and during load transitions. Pakistan being a developing country is plagued with a weak and intermittent grid. One-half of the population solves this issue by arranging alternate to grid solutions like UPS, captive generation, or renewable energy systems. Effective uptake of renewable energy systems is constrained by its high upfront cost, battery life, below-par utilization of available energy, and excessive sizing to run critical and convenient motor loads. The conversion kit aims to address all these issues. This allows user to operate their ACs even using constrained sources e.g., UPS. The solution is an Internet of Things (IoT) enabled over Wi-Fi which allows dynamic control and monitoring of operational parameters and complies with the growing trend of enhanced user interaction with the devices. It also offers centralized control over a network of appliances being operated. It records consumption data, which can be used for data analytics, future planning, and growth. The work entails the prototype's production readiness and the development of testing procedures and techniques to ensure the product's durability and reliability.

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Establishment of a Carrier Neutral Software-Defined Internet eXchange Point (IXP) and Training Programs for Capacity Building in Managing IXPs

Sponsor: APNIC Foundation
Funding Amount: PKR 3,696,600
Project Initiated in: 2018

IXPs enable ISP networks to exchange traffic with each other, providing cost savings, better performance and user experience for locally hosted content, and improved security and availability. However, developing countries face challenges, either lacking IXP infrastructure or having limited capabilities. Lack of expertise and human resources for operating and managing IXPs is also significant. This research addressed deployment of software-defined IXP, which uses advances in Software-Defined Networking (SDN). SDN allows operators to enable new applications such as application-specific peering, traffic redirection, and inbound traffic engineering. Pakistan IXP was used as a testbed for deployment, testing, and evaluation. Additionally, training programs prepared human resources for managing IXPs and using SDN controllers.

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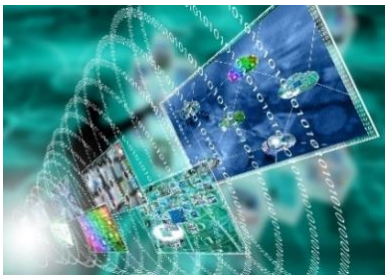

Development of Space-Time Block Coded Wireless Link

Sponsor: National Engineering and Scientific Commission (NESCOM)
Funding Amount: PKR 300,000
Project Initiated in: 2019

Diversity combining is the technique that aims to mitigate the effects of fading by passing signals through independent signal paths. Transmit diversity is desirable in systems where more space, power and processing capabilities are available at the transmitter end such as cellular systems. This project proposed a novel detection scheme that does not require the CSI at the receiver or the transmitter. This detection scheme provides the advantage of relieving the need to estimate the channel during wireless transmission by employing a novel mechanism for decoding at the receiver end and encoding at the transmitter end.

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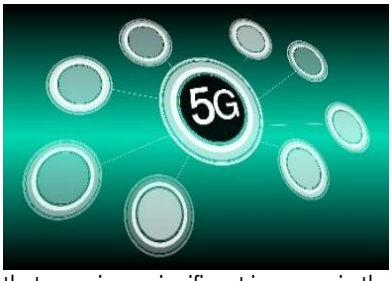
Design of a Generalized RF Channel Emulator over SDR, Phase-III

Sponsor: Public Sector Organization
Funding Amount: PKR 250,000
Project Initiated in: 2021

A channel emulator for jet aircraft is proposed in this project. The PI is implementing a channel model and verifying it experimentally over the hardware. In the final phase, the porting over FPGA is expected to be completed along with the verification of the conformance to the originally conceived design.



Non-Orthogonal Multiple-Access for 5G Networks: Theory, Design, Prototyping, and Experimental Evaluation

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 4,065,374
Project Initiated in: 2018

Cooperative communications and cognitive radios are two exciting new research areas that promise a significant increase in throughput, power efficiency, and coverage area for wireless networks. Most existing studies

in the two areas are of theoretical nature that are often based on idealistic assumptions which may never come to pass in a real-world network. This research is aimed at devising novel, effective, and practically feasible system-level cognitive cooperation protocols with the help of a hardware/software experimental platform. The ultimate, long-term objective of the project is to explore how cognitive cooperation could efficiently be incorporated into the next-generation wireless industrial standards, as well as for emerging applications such as wireless sensor networks and smart-grids.

Towards Inexpensive and Portable Food Quality Testing using Wireless Stickers

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

This research focuses on identifying adulterated milk and utilizing the domain expertise in signal processing and machine learning to extract relevant analogue features of the radio signals, characterizing their dependency on the quality of milk as well as the concentration of different adulterants (such as detergent, formaldehyde, starch, and water), and subsequently using this learned characterization to classify whether the milk sample being tested is fit for human consumption. This work on milk quality testing can lay the groundwork for subsequently developing a portable solution towards testing of a whole variety of other food items.

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Prototyping Reconfigurable Intelligent Surfaces (RIS) for 6G Communication Systems

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

This project explores the theory and design of RIS-assisted wireless communication. The objective of the project includes developing and fabricating a meta-surface in the RF band that can reflect the incoming wave to the desired direction. A full wave electromagnetic solver is used for the initial validation of the design followed by the fabrication, testing and validation of the proposed RIS prototype.

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A Low Latency Cellular Control Plane for 5G

Sponsor: LUMS
Funding Amount: PKR 960,000
Project Initiated in: 2020

5G networks promise to provide ultra-low latency to support applications such as virtual reality, remote surgery, multi-player online gaming, self-driving cars, and to improve the responsiveness of web browsing and other applications. However, the existing 4G/LTE network deployments suffer from path inflation as all user traffic must be routed to one of the few data centres hosting network functions part of the cellular core. This can result in web traffic experiencing delays of hundreds of milliseconds. As cellular networks move towards 5G, the cellular core functionality will also need to move to the edge to meet these latency demands. As a result, to support these new and emerging applications, there is a need to revisit the cellular core network design and deployment which this project planned to implement and evaluate as a new edge-based cellular control plane with the goal of reducing control plane latency, while providing fast failure recovery.

ENERGY

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Covalent Conjugates of Organic Semiconducting Polymers and Non-Fullerene Acceptors: Towards Improved Photovoltaic Devices and Accelerated Artificial Photosynthesis

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

The current project aims at developing unprecedentedly all organic covalent hybrids of organic semiconducting polymers (OSPs) and non-fullerene small molecules as electron acceptors (NFAs). The project is expected to contribute a library of novel P3HT-NFAs donor-acceptor covalent hybrids exhibiting higher efficiency of solar energy harvesting. These materials can be applied as photoactive materials in photovoltaic devices for improved photocurrent generations and to enhance the photoinduced CO_2 fixation via artificial photosynthesis in microbes.

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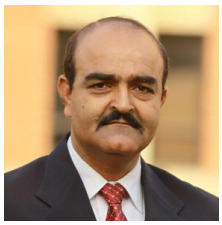

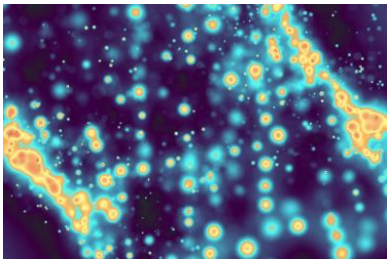

Chemical-assisted Hydrogen Evolution Reaction (CAHER) using Nanoporous Electrocatalysts

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

The goals of the proposed study are to prepare nanoporous metallic, metal oxides and metal sulphides based electrocatalysts of various transition metals and identify biomass-based chemicals like alcohols, carbohydrates, amines etc., which can be electrooxidized easily and converted into useful products. It also deals with optimizing the conditions for hydrogen evolution reaction in the chemical-assisted process and training students, including females and research manpower.

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Ageing and Degradation Analysis of Lithium-ion Batteries

Sponsor: SkyElectric
Funding Amount: PKR 1,326,000
Project Initiated in: 2021

Lithium-ion batteries are increasingly being used in diverse applications because of their ability to provide higher energy and power density. Performance of a lithium-ion battery degrades over its lifetime and its degradation is typically studied as a function of number of charge-discharge cycles. There is huge variability in the life cycles of different Li-ion batteries depending on their chemistries and manufacturing process. For the manufacturers, such information can help in increasing their production by quick characterization of their production lots and for the users, it can help in finding out the remaining life of the product so that they can optimize their use. This study is conducting fundamental research on ageing and degradation analysis of lithium-ion batteries by making use of the dataset provided by Centre of Advanced Lifecycle Engineering (CALCE), University of Maryland, USA. This is an ongoing collaboration with Prof. Michael Pecht of UMD College park.

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Development of Novel Electrode Materials for Sodium/Lithium-ion Batteries for Improved Energy Storage Applications

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

The exponential increase in the world population has led to an excessive use of fossil fuels resulting in their depletion and evolution of hazardous gasses causing many health and environmental issues. Therefore, there is a dire need to explore the energy resources to maximize their effective utilization, which can be realized by storing energy in the form of electricity/potential in energy storage devices (like batteries) and assembling them in parallel with the energy production systems. This project aims to develop novel nanoscale materials based on metal nanoclusters on porous supports as electrode materials to enhance the life of lithium/sodium ion batteries and overall efficiency.

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Development of Sodium-ion Batteries using Earth Abundant Materials for Stationary Energy Storage

Sponsor: LUMS
Funding Amount: PKR 960,000
Project Initiated in: 2021

This project proposes to develop and validate sodium-ion batteries using mostly locally available resources to make it cost effective and reduce the burden on nation's import bill in the long term. Success of this project is not only expected to positively impact the domestic and grid energy storage market of Pakistan, but it can also provide a major boost to transportation sector.

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Development of a Retrofit Li-ion Battery System for Lead-acid Batteries

Sponsor: Sozo Group of Companies
Funding Amount: PKR 2,710,000
Project Initiated in: 2017

The existing electrical energy storage solutions are dominated by Lead-Acid battery banks that range from a variety of products in the flooded and sealed battery product categories. There is a huge problem in this existing space due to variability in the quality of batteries compounded by an inefficient utilization of available technology based on ill-designed solutions. The marketing of the battery products is based on total storage capacity which far exceeds the usable energy capacity for optimal utilization of this expensive resource. This has created room for intelligent introduction of new battery solutions based on the evolving technologies in this space. The Sozo Group, in collaboration with LUMS is exploring the possibility of introducing Li-ion based battery-pack and battery-bank electrical energy storage solutions in Pakistan. Exploration includes new/existing markets, new Li-ion solutions or retrofitting with replacement battery packs, and local/imported sales or joint venture assembly with tech transfer.

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Composite Carbon Nanofiber Based Nanostructured Electrodes for Enhanced Energy Storage in Lithium-Ion Batteries

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 6,071,998
Project Initiated in: 2018

Owing to the fast expansion of portable electronic devices and hybrid electrical vehicles, the demand for high performance energy storage devices such as batteries, fuel cells and capacitors, is rising sharply. Hence, supercapacitors (SC) are emerging as the most exciting area of research. Carbonaceous materials act as traditional electrodes as they offer very high-power densities, but they have a drawback of poor energy density in comparison to common rechargeable Li-ion batteries. Therefore, designing a SC that has both high energy density and high-power density with long cycle life is the major challenge for researchers. This project aimed at growing evenly distributed CNTs through chemical vapor deposition (CVD), over electrospun carbon CNFs by using iron (Fe) as a catalyst for the growth of CNTs. This resulted in much improved capacitance, power density, energy density and cyclic stability after multiple charge discharge cycles.

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Electrification - A Step Towards Sustainable Mobility in Pakistan

Sponsor: HEC
Funding Amount: PKR 34,437,727
Project Initiated in: 2021

The focus of this project is on uplifting our industry's value chain with exploration and dissemination of understanding of new business models and supply chain management related issues to guide the development of the needed policies and regulatory frameworks. This is expected to be accomplished by understanding the underlying factors that can trigger the build-up of the ecosystem for the development of manufacturing supply chain and adoption of EVs in developing countries, particularly in Pakistan. Furthermore, LUMS as the prime partner intends to create a Centre for Electric Mobility (CEM) for stakeholders to collectively have the impact needed for this mobility transformation.

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Big Data based Platform to Promote EV Penetration in Pakistan

Sponsor: National Centre in Big Data and Cloud Computing (NCBC)
Funding Amount: PKR 19,214,545
Project Initiated in: 2021

This project rests upon the fundamentals of Big Data and Cloud Computing. The project involves a large-scale and extensive data collection exercise where a large amount of real-time raw data at a high granularity is being collected from batteries, motors, and Motor Control Units (MCUs) amongst various other components and systems in a vehicle. The collected data can be stored in the cloud storage. From cloud storage, the data can be cleaned and processed to make it ready for further processing at the central server. Exhaustive data processing exercises can be carried out during this project so that various useful results and insights can be derived from the data. Various analytic techniques in the domain of big data such as machine learning, deep learning and other predictive analytics can be used to obtain useful results and outcomes from the collected data. The processed data can be used by android/iOS applications to directly benefit the end users.

Electric TTrike Replacement of Donkey Carts

Sponsor: Xavor Corporation
Funding Amount: Confidential
Project Initiated in: 2020

The objective of this engagement is to jointly build a functional prototype that demonstrates the product vision. This project resulted in a tangible product to validate the functional, technical, and financial parameters and to show officials, investors, and policy makers the possibility and potentials of a Smart Tricycle for Pakistan and the Export Market.

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Electric Vehicles and Batteries Market Assessment

Sponsor: USAID
Funding Amount: PKR 11,500,380
Project Initiated in: 2021

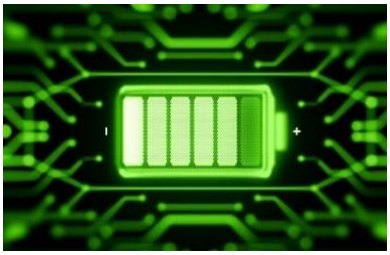
This study carries out an Electric Vehicle (EV) and storage industry market assessment describing the current and future potential of the market for international companies. The study focuses on aspects such as market size, market sub-segments, and competitors. The assessment also covers incentives offered by the government for foreign investors as well as marking potential local investors interested in partnerships.

Feasibility Study for Actualization & Implementation of Electric Vehicle Policy in Punjab

Sponsor: Punjab Energy Efficiency and Conservation Agency
Funding Amount: Confidential
Project Initiated in: 2020

This project provides an assessment of the industry readiness for manufacturing of BEVs in Pakistan and India. The findings suggest that BEV industry in Pakistan is at a nascent stage and understandably below par compared with developed countries. The study concludes by making several recommendations on how to generate domestic demand for BEVs in Pakistan.

ELECTRIC VEHICLES



Machine Learning Based Battery Degradation Models for Electric Vehicles

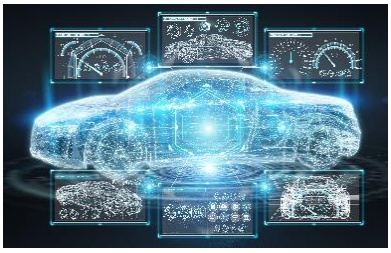
Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

Pakistan is actively promoting electric vehicles (EVs) as part of its efforts to combat climate change. However, the performance of EVs heavily relies on the reliability and efficiency of lithium-ion (Li-ion) batteries, which tend to degrade over time. To address this issue, this study focuses on utilizing data-driven machine learning algorithms to model battery degradation and accurately predict the state of health (SOH) and remaining useful life (RUL) of Li-ion batteries used in EVs. By estimating the SOH and RUL, this research aims to enhance battery management strategies and optimize the performance and lifespan of EV batteries. Implementing these methods will contribute to efficient EV operation, reduced emissions, and improved energy sustainability in Pakistan's transportation sector.

Real-time Spatiotemporal Emissions Mapping (Phase-II)

Sponsor: Trans-Eurasia Information Network (TEIN)
Funding Amount: PKR 22,666,658
Project Initiated in: 2021

This project is planned to develop a localized passenger transport service on selected routes using the proposed electric 3-wheelers. The procured vehicles are decided to traverse a predefined route and briefly stop at each predefined location to collect the data. The vehicles' routes, fares, and timings are to be communicated to the potential commuters using the mobile application and web broadcast. The revenue generated from the service can be used to maintain the vehicles, sensors, website, database, and a stipend of personnel handling the project. This project is expected to serve as a long-term solution to ensure the project's financial sustainability and develop a low-cost alternate means of measuring air quality in countries having limited resources to deploy expensive stationary environment monitoring solutions.



Reducing Weighted Average Cost of Generation in Pakistan Through Time of Use (ToU) Pricing Models for Electric Vehicles Charging

Sponsor: Pakistan Institute of Development Economics (PIDE)
Funding Amount: PKR 3,945,008
Project Initiated in: 2021

For the past many decades, the electricity supply and demand scenarios in Pakistan have been hovering between over-supply and under-supply. In the last few years, Pakistan has had surplus generation capacity. This surplus generation capacity has resulted in an accumulation of a large circular debt and a huge sum of capacity payments is paid to compensate for the surplus generation capacity. In addition to this, Pakistan has significant daily and seasonal variations in the demand which further accounts for vast surplus generation capacity. The Weighted Average Cost of Generation (WACG) has increased drastically over the last few years due to this reason. Electric Vehicles (EVs) are a non-seasonal load that can be charged during off-peak hours to bridge the gap between demand and available generation capacity. To this end, development

of a dynamic artificial intelligence (AI) based Time-of-Use (ToU) pricing tool for EV charging is proposed. Real-time electricity demand data is used in the tool to develop short-term demand forecasts.

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Technical and Economic Framework Development for EV Battery Swapping Stations in Pakistan

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

Electric vehicles (EVs) are becoming popular worldwide due to climate change and rising fuel costs, thanks to supportive regulations and decreasing battery prices. E-bikes and e-rickshaws have large battery capacities (1-2 kWh and 5-7 kWh, respectively) that have solved range anxiety. However, battery charging remains a significant challenge due to lack of infrastructure and charger downtime risks, even with super-fast DC chargers. Battery swapping is a promising solution for commercial EVs, allowing depleted batteries to be replaced with pre-charged ones in minutes. This project aims to create a technical and economic framework for EV battery swapping, from entering a battery swapping station (BSWS) to leaving.

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Photo-chemical and Photo Electrochemical Production of Dimethyl Ether, A New Sustainable Energy Storage Medium

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

In a bid to replace fossil energy with sustainable alternatives and put Pakistan at the forefront of the low-carbon economy, the proposed concept of simultaneous reduction of CO_2 and water splitting addresses key bottlenecks (underperformance, high-cost, and scalability) in the conversion of sunlight energy into stable storable chemicals. This research intends to develop cost-efficient and scalable production pathways from sunlight to energy storage compounds, which provide flexibility, convenience of use and the potential for unlimited storage, and to bring developed integrated solutions to validation in a relevant environment.

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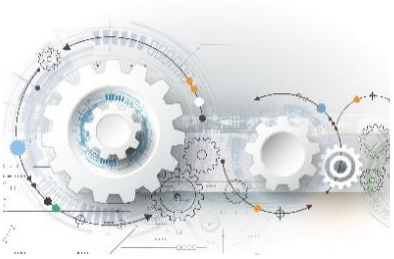

Power Systems in the Developing World: Understanding the Role of Metering, Infrastructure Improvements, and Institutions in Power System Resilience

Sponsor: Duke University
Funding Amount: PKR 1,512,850
Project Initiated in: 2020

Electricity enables many services provided by home appliances as well as numerous processes critical to businesses. Yet, low quality electricity services are common in many developing countries and attenuate the economic benefits from grid connections. When the quality of services delivered is poor, consumers may resist paying for those services. Many utility revenue collection models may also be negatively affected by the pandemic. However, different metering technologies and systems bring a variety of functionalities and benefits. Some utilities employ Automated Meter Reading, whereas others installed Advanced Metering Infrastructure (AMI), yet little evidence exists on the relative importance of and benefits from different metering systems. This study aims to address these existing knowledge gaps through research in three specific countries – the Kyrgyz Republic, Nepal, and Pakistan. All three of these countries suffer from high losses, low-cost recovery, and sub-standard electricity service quality. This project is expected to result in causal evidence on the benefits from different smart meter technologies, infrastructure upgrades, and institutional innovations in the power sector and how they impact electricity utility functioning.

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Project Analysis Study for the CDC Group

Sponsor: CDC Group
Funding Amount: Confidential
Project Initiated in: 2020

In collaboration with the CDC group, a comprehensive study has been conducted to evaluate the investment suitability of potential projects. The study covers an in-depth analysis of the dispatch and financial prospects of the projects, considering various sensitivities. In addition to this, the study also includes the development of bases for production and simulation. The simulation models will be used to evaluate the project performance and conduct prudent economic dispatch practices to ensure that the supply is efficiently matched with the demand. Through this study, the aim is to provide valuable insights to potential investors to make informed decisions and maximize their return on investment.

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Evaluation of Battery Discharge Profile for In-Service Mobile Phones

Sponsor: University of Maryland
Funding Amount: PKR 788,430
Project Initiated in: 2019

The performance of Lithium-based batteries in mobile phones is highly dependent on its usage profile among other factors such as aging, operating temperature, defects etc. Therefore, to estimate the life of batteries it is important to carefully observe the battery discharge profile under active phone operation. As various apps/processes draw power from these batteries in a varied manner, it can have a significant impact on the life and performance of phones. The main task in this research was to evaluate discharge profile of android based mobile phones to estimate aging process. The implementation of this task was achieved through application programme interface (API) given in the software and a relevant APK (Android Package) was designed to decipher the discharge current.

Next Generation DC/AC Hybrid Building Level Distribution Architectures for Intermittent Grids

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 2,508,978
Project Initiated in: 2019

This research is focused on establishing more efficient power architectures in these urban buildings and houses to reduce redundant power conversions. Moreover, with increased emphasis on in-house solar generation, net-metering and increasing percentage of DC loads in modern settings, there is a need to alter the building level power architecture to allow grid-feeding and cater for DC loads. To achieve the rationale stated, the study further investigates to create an efficient hybrid building level power architecture which can reduce local power losses in the buildings by up to 50%. This allows efficient utilisation of power and in turn reduce consumer's electricity bill and the increasing burden on national grid due to urbanisation. The surplus grid power (as a result of direct savings) can then be provided to industry as well as rural electrification which would contribute to the country's GDP.

Reliability Modelling and Assessment of Smartphone Batteries for Lifetime Enhancement

Sponsor: LUMS
Funding Amount: PKR 995,000
Project Initiated in: 2022

This project aims to develop an interface system using an external sensor network to find out the real-time (in-service) performance of smartphones under the active operation of major apps such as WhatsApp, Facebook, Facebook Messenger, Skype, Zoom, PUBG, Instagram, Snapchat, and TikTok and others. These apps will be tested on multiple smartphones to evaluate consumption profile and modelling parameters.

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Smart Energy Metering Solution with Monitoring and Control Capabilities for Efficient Demand Side Management

Sponsor: German Pakistani Research Cooperation Program - DAAD
Funding Amount: PKR 13,421,990
Project Initiated in: 2020

The project aims to improve energy optimization in the electricity distribution network of Pakistan. By integrating smart energy solutions with IT and Communication Networks, the project focuses on enhancing the efficiency and stability of the network during the re-activation phase after load shedding. The project proposes alternate Demand Side Management strategies to effectively manage and control energy demand, leading to optimized resource utilization and reduced wastage. Through the implementation of intelligent control

mechanisms and real-time monitoring, the project aims to ensure a smooth transition and improved performance in the energy network.

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Layout of Amplifier in High Voltage 180nm CMOS

Sponsor: National Electronics Complex of Pakistan (NECOP)
Funding Amount: Confidential
Project Initiated in: 2021

The project focuses on providing a 5-day training program offered by LUMS specifically designed for operational amplifier design in a high voltage 180nm CMOS process. The project aims to train a group of ten participants in the layout design aspects of amplifiers using the specified technology.

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Storage Systems and EV Expert for USAID Power Sector Improvement Activity (PSIA)

Sponsor: Hagler Bailly Pakistan
Funding Amount: Confidential
Project Initiated in: 2022

This project is focused on supporting USAID and GoP efforts towards increasing power-sector competition through support to develop Pakistan's wholesale electricity market, improving the management and operation of transmission and distribution system, and optimizing grid electricity load.

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Enabling Municipalities to Harness Digital Energy Data

Sponsor: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
Funding Amount: PKR 12,095,011
Project Initiated in: 2021

This project proposes to demonstrate the impact of digital energy data for utilization in Energy Management System (EnMS) for large buildings. The activity involves extensive real-time data collection from various high-power consuming appliances and main distribution box in the selected buildings. The data is processed to yield various short and long-term measures that can be implemented to enhance the energy efficiency of the building. Furthermore, based upon the collected data, input parameters and other conditions such as temperature and humidity etc, the EnMS suggests high, low, and zero-investment measures along with their payback periods that can be used to conserve energy. The system can model the potential efficiency that can be achieved under a range of Energy Conservation Measures (ECMs). The proposed system is a web-application to enable its utilization by the wider community. A key vertical of the proposed activity is to disseminate the results and obtained insights as well as conduct training of personals to allow wider applicability of ECMs in other buildings.

Improving Electricity Distribution System through Dynamic GIS Based Asset Management

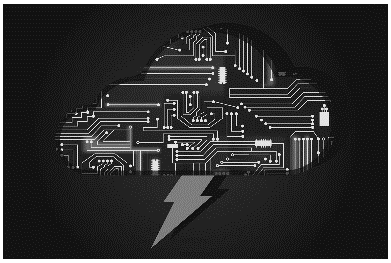
Sponsor: National Centre of GIS and Space Applications (NCGSA)
Funding Amount: PKR 10,592,000
Project Initiated in: 2022

The power sector of Pakistan has been facing problems for the past many years. While the country has adequate power generation to fulfil our needs, the transmission and distribution are not resilient enough to provide reliable electricity supply to consumers. In particular, the distribution companies (DISCOs) face tremendous challenges in upkeep of their assets. Frequent outages and power failures are a common place that impacts the financial lifeline of the country. In this project, the goal is to develop a GIS enabled system for preventive maintenance of the distribution system assets. This system provides a dynamic view of the distribution grid with which DISCOs can perform system updates and reconfigurations before any asset is overloaded and may compromise the whole grid.

Keeping Our Cooking Stoves Burning Beyond 2030: How Can Pakistan Mitigate the Impact of Depleting Natural Gas Reserves?

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

This project aims at developing a roadmap for building electrification for the country. It shall drive its policy recommendations with a data-driven approach, evaluating the impact of residential electrification on the grid, consumer behavior, market trends in developed and developing world, and the broader implications of such an undertaking for the socio-economic uplift of the country.



Using Batteries as a Large Virtual Energy Store for the Grid

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 1,940,255
Project Initiated in: 2019

This study is focused on decreasing the dependency of the country's energy source from fossil fuels to wind and solar power. It is a research effort to study the possibilities of inclusion of UPSs as energy storage for utility-scale electricity systems. It is aimed at making existing UPSs more efficient through better charging and discharging models, linking charging, and discharging of a myriad number of UPSs with available renewable generation and to develop an initial cost-benefit analysis of such massive small-scale storage for utilities. Additionally, the study investigates the integration of rooftop solar with traditional batteries for power supplement for the grid during evening hours. Finally, newer highly efficient battery technologies such as Tesla Power Wall and glass batteries for usage as rental energy space for the grid are also studied.

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Self-Assembled Liquid Crystalline Hole Transport Layers and Physical-Gels for Hybrid Dye Sensitized and Perovskite Solar Cells

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 14,363,818
Project Initiated in: 2019

This project is aimed at conducting experimental as well as simulation studies on the application of self-assembling discotic liquid crystalline (DLC) materials to dye sensitized solar cells (DSSCs) and perovskite solar cells (PSCs). DSSCs and PSCs both suffer from stability challenges, due to evaporation of the electrolyte and degradation of the semiconducting materials, respectively. Solving these challenges (combined with their low fabrication costs) is expected to make these technologies competitive with both silicon photovoltaics as well as fossil fuel-based electricity generation. This research attempts to address both challenges using mesophasic materials in novel device architectures.

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Identification of Cenospheres in Biomass Fly Ash

Sponsor: Bulleh Shah Packaging
Funding Amount: Confidential
Project Initiated in: 2022

The objective for this project includes utilizing at least three samples of fly ash (not more than 500 grams each) for identification of Cenospheres by Bulleh Shah Packaging. The identification of Cenospheres can predictably be accomplished in a short period of time because of consultant's extensive experience of working with the ash residues being produced at BSP.

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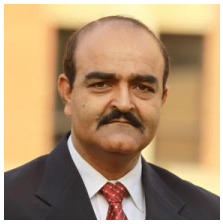

Investigation of Hexagonal Perovskite Derivatives as Oxide Ion Conductors for Solid Oxide Fuel Cells

Sponsor: LUMS
Funding Amount: PKR 980,000
Project Initiated in: 2020

The current energy generation technologies rely primarily on fossil fuels and therefore are unsustainable. As members of the global society, there is a need to discover novel materials that are cost-effective, stable, environment friendly, and that can be used in sustainable and renewable energy technologies. Solid oxide fuel cells can efficiently convert chemical fuel into electricity without producing any harmful gases. However, with the available materials, these fuel cells can only operate at higher temperatures of around 900–1000 °C. This issue can be resolved or at least minimized if alternative electrolyte materials are found. In this study, research is conducted in collaboration with the University of Aberdeen, UK which includes performing experiments, collecting, and analysing experimental data and writing manuscripts for publication. The completion of the study is expected to produce new knowledge, improve understanding of these materials, and train a diverse range of future innovators.

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Dispatch Analysis Study for EPQL

Sponsor: Engro Powergen Thar Limited
Funding Amount: Confidential
Project Initiated in: 2020

Engro Energy Limited collaborated with LUMS Energy Institute (LEI) to conduct a Dispatch Forecast and Analysis of the Client's 217 MW dual-fuel permeate gas and diesel-based power plant at district Ghotki, Sindh, owned and operated by its subsidiary EPQL. The project is Engro's first endeavour in the power sector of Pakistan; developed in the independent power producer (IPP) mode and achieved commercial operations in March 2010. It utilizes high sulphur permeate gas flared through the Qadirpur gas field for reduced carbon emissions and high-speed diesel as secondary, backup fuel.

Review and Analysis of Indicative Generation Capacity Expansion Plan (IGCEP) of National Transmission and Despatch Company (NTDC)

Sponsor: European Climate Foundation
Funding Amount: 8,770,209
Project Initiated in: 2021

This project critically reviews and analyses the Indicative Generation Capacity Expansion Plan (IGCEP) of National Transmission & Despatch Company (NTDC), conduct sensitivities, and proposes measures that support maximum penetration of renewable energy-based electricity which reduces the usage costs for consumers, and a policy framework for project development in the power system planning process.

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Organic and Inorganic Hybrid Materials for Energy Conversion and Storage

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 5,010,600
Project Initiated in: 2021

Developing countries like Pakistan are struggling to realize and plan the energy-environment-economic nexus. Pakistan's heavy reliance on fossil fuels results in hefty import bills and a significant financial burden at the local, regional, and national levels. In comparison, the production and use of renewable energy is a reliable way of import substitution, self-sufficiency, and a sustainable energy system. Further, renewable energy promises socio-economic prosperity, human well-being, and environmental safety. The proposed project includes the design and production of electrocatalysts, photocatalysts and hybrid porous materials for hydrogen production, and storage. The project rationalizes the adoption of innovative renewable technologies in Pakistan to meet its sustainable development goals. In the future, green hydrogen production through this technology is used in the industries like fertilizers, steel, oil refining and transportation.

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Low Cost, Circular, Modular Distributed Off-grid Energy System for Remote Locations including Hydrogen

Sponsor: CLERENS
Funding Amount: Confidential
Project Initiated in: 2022

This project includes coordination in the EU proposal writing process and providing support for writing of the proposal titled 'Low cost, circular, modular distributed off-grid energy system for remote locations including hydrogen' with oversight from CLERENS. The project proposal involves the objectives of the project and its strategic positioning within the participating organisations, the structure of the project and its management model, the work plan (activities, lots, tasks, milestones, deliverables), the strategy for exploiting the results and the envisaged intellectual property rights. It also deals with assistance of the consortium in the development of a work plan (activities, lots, tasks, milestones, deliverables) in line with the objectives of the project.

Microgrid Interface Kit for Standalone Solar PV and UPS Backup Systems

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 12,473,000
Project Initiated in: 2019

In this project, a plug-and-play microgrid interface kit is designed and developed (a compact power electronic kit, is termed as MIK). It can integrate multiple standalone photovoltaic (PV) systems or multiple backup systems to formulate a microgrid. The developed prototypes consist of bidirectional converter, its control regime, and an energy accounting mechanism. The system allows sharing of energy resources at a neighbourhood level allowing the maximization of resources without the need of extra solar generation, a key aspect in reducing the system cost and enhancing its utility. To enhance the user friendliness and consumer involvement in a free energy trade market, graphical user interface (GUI) based web and mobile applications are being developed and integrated with the developed solution so that individual users may have a log of their energy transactions and set their transaction preferences for enhanced profitability.

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Visible light-mediated Conversion of Biomass into Selected Chemicals

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

In recent years, Lahore has experienced severe smog episodes from mid-October to February, impacting health and mobility. Limited data availability on smog constituents hinders effective measures for reduction and eradication of air pollutants. Five recently installed Ambient Air Quality Monitoring Stations (AAQMSs) provided intermittent data from November 15, 2017, to September 02, 2018, showing excessively high levels of PM, NOx, and CO. Unfortunately, these AAQMSs are no longer functional. This project aims to chemically analyse particulate matter composition and identify major contributors (e.g., vehicle emissions, biomass burning, brick kilns) using statistical methods. Unlike conventional methods, this approach provides accurate PM measurement and composition data.

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Dual Mode Hybrid Inverter

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

Key challenge in realizing the true potential of Solar PV lies in efficient harnessing of a variable source, in real-time, and is done through grid-tied systems. These systems are incapable of working in the absence of the grid. The alternative is to use battery storage systems which are both expensive and require periodic replacement. The requirement of a stable grid for grid-tied systems is a key challenge in developing countries. Therefore, a more optimized solution needs to be designed for the local requirements which can create a local supply-chain and after-sales support and service. This project aims to establish an industry-academia linkage with design and development at LUMS and simultaneous productization at the industry partner, Microtech Industries Pvt. Ltd. (MTI). The goal is to design a 3kW single-phase grid-tied hybrid inverter that can also work as a solar UPS with minimal storage in islanded mode.

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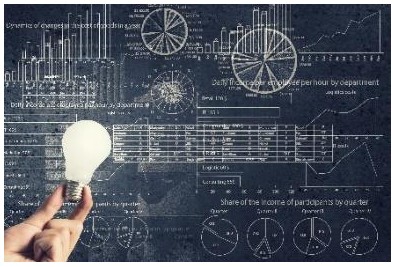

Design and Development of a Software Framework to Facilitate Electricity Markets in Pakistan

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

The power sector in Pakistan is facing macroeconomic challenges due to unreliable supply of power, deteriorated quality of service, inadequate recoveries, sovereign guarantees and escalating circular debt. This crisis stems majorly from the current electricity market arrangement in Pakistan, which favours the dominion of one entity or a single buyer. Additionally, long-term contracts are signed between generation companies and public utility, to minimize the governance risks associated with new investments in the power sector. As a result, the sovereign guarantees provided by the state under the obligation to purchase power from Independent Power Producers (IPPs) even when demand level falls below the forecast levels subjects the state to serious financial risk. Introducing competition in electricity generation and retail markets can alleviate the prevalent problems in Pakistan's power sector. However, to ensure reliability of supply, the generators and retailers must be able to ensure the provision of generation availability and reserve resources. For both participants, it is essential to have adequate and efficient means of forecasting tools. To aid the transition of power market and to facilitate the participants, this project develops a decision support system for participants of electricity markets, that will enable them to participate in the competitive electricity market in a way that favours their individual interests. For instance, the proposed software framework will allow the retailers to use this tool for forecasting demand, and make decisions regarding the management of financial resources, negotiation of short-term contracts, selection of wholesale electricity provider, and power dispatch levels.

Power Sector Improvement Activity

Sponsor: Hagler Bailly Pakistan
Funding Amount: Confidential
Project Initiated in: 2022

This project is focused on supporting the efforts of USAID and GoP to meeting the objectives that include increasing power-sector competition through support to develop Pakistan's wholesale electricity market, improving the management and operation of transmission and distribution system and optimizing grid electricity load.

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Near Real-Time Co-Optimization Engine for Integrating Utility-Scale Photovoltaics and Battery Storage in Smart Distribution Grids

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

This research proposes a near real-time convex optimization-based control framework for co-optimization of feeder reconfiguration with optimal dispatch of PV inverters and BESS. The feeder reconfiguration problem is a nonconvex problem mainly due to the presence of discrete variables and nonconvex load flow equations. The proposed co-optimization engine can result in economic gains and sustainable future by minimizing the distribution losses to improve economic gains, mitigating the voltage limit violations to increase the hosting capacity of current distribution grids, which can contribute towards the attainment of Pakistan's 2030 renewable goal and maximizing the load balance among feeders to relieve the anticipated overload, which can defer the feeder reinforcement investments.

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Changing Wind Energy Industry Dynamics in the Gharo-Jhimpir Region: Can the Current Tariff-determined Risk-return Equilibrium Adequately Assist the Industry in Transitioning into the Next Phase of Possible Market Expansion?

Sponsor: LUMS
Funding Amount: PKR 795,000
Project Initiated in: 2020

As the global renewable wind energy market moves from being an exclusively technology driven one to a mainstream industry, the wind power industry in Pakistan has also seen a rapid evolution since its inception. Favourable site conditions and ease of setting up wind/ renewable power projects are key to industry expansion, allowing economies of scale is another. The primary purpose of the research is to determine the factors that underpin the commercial business model of current industry players. The purpose is to develop an understanding of underpinning technological, regulatory, operational, and financial risks that industry must factor in within these business models to make good returns given the evolving tariff structures.

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Transient Heat and Stress Analysis of Exhaust and Inlet Valves in a Diesel Engine

Sponsor: Pakistan Science Foundation
Funding Amount: PKR 499,800
Project Initiated in: 2018

Recent trends exhibit high interests in increased efficiency, fuel consumption, exhaust emissions and power of the automotive engines which leads engine manufacturers to further enhance the engine productivity. To comprehend and capture the proper functioning of any engine, it is indispensable to have the knowledge of temperature and stress distribution of different parts of the engine while it is operative. Both inlet and exhaust valves are subjected to high temperatures whereas exhaust valves experience higher temperature as compared to inlet valves. Thus, exhaust valves are generally made of sturdier material than inlet valves to withstand the high temperatures. Consequently, controlling thermal deviations and stresses are critical to achieve to guarantee a long and reliable engine life. The objective of this study is to apprehend the realistic temperature and stress variation on the exhaust and inlet valves while a turbocharged diesel engine is at high speed. A 3-dimensional model of the exhaust and inlet valves based on realistic dimensions is fabricated.

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Indigenous, Sustainable, Peer to Peer based Solar Electrification for 62 million Offgrid People in Pakistan

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

This project proposes field deployment of an indigenously developed system at LUMS allowing peer-to-peer sharing of electricity along with integration/aggregation of solar generation in individual houses to be used for community applications on need-basis or in predefined scenarios. This can potentially enable electricity markets in rural community (a novel concept within off-grid electrification). A communication layer oversees the local generation, local storage, entire bi-directional exchange of energy, and thresholds the power usage, as needed or subscribed. The possibility of electricity theft is negligible as every node is monitored through a central system.

SOLAR ENERGY

Solar Nano Grid in Pakistan

Sponsor: Integration Umwelt & Energie GmbH
Funding Amount: PKR 6,903,305
Project Initiated in: 2021

The proposed idea is to unlock the maximum potential of solar in off-grid homes through Peer to Peer (P2P) power sharing mechanism. This proposed intervention (enabled through efficient DC microgrids) allows resource maximization, reducing costs, allowing higher power utilization (direct impact on socioeconomic status), and creating energy micro-economy at a village scale to bring people out of poverty through sustainable access to (and trade) electricity.

Village Carbon Insetting: Installation of Two Solar PV Micro Grids

Sponsor: Hima^Verte
Funding Amount: PKR 6,538,000
Project Initiated in: 2021

This ambitious project aims to provide sustainable and reliable electricity to remote communities in Punjab, Pakistan by harnessing the power of solar energy through the installation of two solar PV microgrids. The project involves designing, joint-installation, and commissioning of these microgrids, which will be powered by an innovative new DC microgrid technology developed by the PIs.

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Design and Implementation of Light-Trapping Coatings for Thin-Film Solar Cells Using Effective Zero-Index Photonic Crystals

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 7,921,207
Project Initiated in: 2018

This project works on plasmonic waves generated by metamaterials and radiation characteristics of uniaxial metamaterials in addition to the main task of increasing the efficiency of solar cells using the anti-reflection coatings made of zero-index materials. The study is dedicated to studying the zero-index metamaterials and their use in designing anti-reflection coatings which demonstrated the usefulness of zero-index materials for anti-reflection coatings for a solar cell.

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Design and Development of a 3000W Grid-Tied Hybrid Inverter

Sponsor: Microtech Industries Pvt. Ltd
Funding Amount: Confidential
Project Initiated in: 2021

Through this project, MicroTech Industries (MTI) and LUMS are exploring the models of industry-academia linkages that can result in sustainable engagement for both companies. MTI is working in power processing solutions and electronics and intends to develop a solar inverter solution for the Pakistani market. The quality of existing solar solutions and UPS in the market leave a lot of room for intelligent solution designs to overcome local challenges. The idea of solar grid-tied hybrid inverter that can work with and without the grid with zero export option for energy has been discussed. This project aims to develop a solution of Dual Mode Hybrid Solar Inverter that can work in grid-connected and islanded mode, with varying levels of electrical storage connected to the systems.

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Natural dye based High Efficiency Dye-Sensitized Solar Cells

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 6,426,324
Project Initiated in: 2018

The exponential growth of the human population in recent times has led to enormous stress on the global energy resources. Currently fossil fuels serve as the major source of energy. However, there is a finite amount of fossil fuels and increasing global energy demand for the development and adoption of viable alternate and renewable energy resources. The technologies developed to harvest energy from the sun can be deployed to cater to the vast parts of the globe with the human population. So far silicon-based solar cells have yielded highly efficient solid-state solar cells. However, these cells offer challenges to mass production and more significantly, the waste management challenge upon completion of their life. Organic dyes have also been facing challenges like toxicity and complex syntheses. Natural dyes on the other hand present viable low cost, environment friendly alternatives. This project aspires to work on the use of the plant extracts and natural products in identifying the dyes for the dye-sensitized solar cells.

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HUMAN RIGHTS

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Embracing Social Identities

Sponsor: Education Justice and Memory Network (EdJAM)
Funding Amount: PKR 1,522,263
Project Initiated in: 2022

This project investigates a social history of the transgender, khwajasira, community in Pakistan. The study encompasses three potential themes including an introduction to the community and its distinct characteristics, social history of injustice, and legal history of advancement. The aim of the project is to retell stories of this community's culture, social integration, and violent history through active participation of this community in the content creation and delivery.

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Improving Inclusion by Addressing PWDs Inclusion and Sexual Harassment in Educational Institutions in Pakistan

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

Broadly speaking, inclusion implies equal access to opportunities, irrespective of who they are, where they come from and what characteristics they possess. Despite promising freedom from discrimination, Pakistan is marred by a lack of inclusion of many groups across the country. This project focuses on understanding the social and legal context for two main ways in which inclusivity is severely restricted. Firstly, sexual harassment, which affects mostly women, the third gender, and men by making public spaces, such as educational institutions and work environments unwelcome and uncomfortable for them. Second, the project studies the accessibility for persons with disabilities (PWDs), Pakistan's largest minority. In Pakistan, it remains unusual to see PWDs in workplaces and even in public places like parks and markets, simply because there is no provision for them to go from point A to point B. In addition to physical access, the project explores access to learning for PWDs.

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Reform Impacts: Analysing How Merit-based Medical Admissions have Affected Doctor Outcomes in Pakistan

Sponsor: Shahid Hussain Foundation | Colgate University
Funding Amount: PKR 1,500,000 | PKR 160,000
Project Initiated in: 2021

This project evaluates the impact of a medical-admissions reform on doctor outcomes. In 1992 a pre-existing quota on female medical students was removed and admissions were changed to being merit-based. Subsequently, many more women entered medicine and gender ratios in the field were substantially altered. Using a mixed methods approach, the project fields 1000 quantitative and 125 qualitative surveys of doctors across Pakistan, including some doctors who attended medical school before the reform and some who attended it after the reform. In doing so, detailed information is gathered on pay scales, work hours, mentorship access and reproductive burdens, among other outcomes by gender. Using this data and exploiting gender ratio variation across medical specialties, the research explores how the reform affected medical outcomes while highlighting crucial gaps. In the end, the project looks to develop a detailed database on gender differences in and factors affecting doctor outcomes thereby paving the way for structuring policy reform aimed at improving doctor and ultimately patient well-being.

Towards an Intersectional Analysis of Urban Spatial Inequalities in Pakistan

Sponsor: University of Cambridge
Funding Amount: PKR 130,200
Project Initiated in: 2021

The interdisciplinary research project investigates the socio-spatial distribution of energy infrastructure in formal/informal urban settlements in Lahore, Pakistan. It addresses the government's inability to meet growing housing demands that result in the socio-spatial exclusion and marginalisation of the income poor, specifically women, who are further disadvantaged through their inability to access essential resources and infrastructures of energy. The project is aimed to address the gap in current research on the reconstitution of architectural and urban spaces for equitable access to energy infrastructure in the Global South. It intends to take a multidisciplinary approach to the investigation, drawing from concepts in Architecture, Geography, and energy research. It caters analyses of women's everyday practices and engagement with the energy infrastructure through fieldwork.

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Increasing Female Employment in the Transportation Sector in Pakistan

Sponsor: JPAL The Abdul Latif Jameel Poverty Action Lab
Funding Amount: PKR 8,849,401
Project Initiated in: 2021

Pakistan has a particularly low female labour force participation rate. Public transport is often unsafe for women, adding further constraints to female employment opportunities. This project is a collaboration with the largest transportation network company in the region, Careem (a subsidiary of Uber). A pilot study was conducted where female jobseekers were offered a potentially transformative income source, while providing their customers with safe transportation. In this pilot, 50 women were offered a high-quality auto-rickshaw (with enhanced security features) and membership of Careem's driver program. The cost of the vehicle was financed with a flexible interest-free loan provided by a large microfinance institution. To measure impacts on female earnings and other household-level outcomes, another 50 women were selected as control (only receiving information about earnings opportunities available through such work), and utilised high-frequency administrative data, phone surveys and qualitative work to explore the potential engagement of women with the transportation sector.

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Exploring Changing Forms of Gender Issues in Urban Contexts of Pakistan

Sponsor: Oxfam
Funding Amount: PKR 1,830,834
Project Initiated in: 2022

With the imbalance in financial power resulting in reduced financial autonomy for women, and consequently, unequal power relations within the family and outside, women's financial empowerment is instrumental in addressing unequal power relations. This research aims to not only understand the prospects of going digital for women's socio-economic empowerment, but also to help organizations and government bodies chart practical pathways for women's digital inclusion and inclusion in the economy. Women's increasing involvement in the economy and increased financial independence is expected to challenge the power imbalance within the family and social norms that label women primarily as caretakers and not breadwinners.

Impact of Workplace Harassment on Women in Patriarchal Contexts

Sponsor: International Development Research Centre (IDRC)
Funding Amount: PKR 4,370,929
Project Initiated in: 2020

The project delves into the experiences of female factory workers in Punjab, Pakistan, who endure harassment and gender-based violence. The primary objective is to gain a comprehensive understanding of the challenges these women face in their workplaces. The study also investigates the potential role of technology in empowering these workers by facilitating equal access to employment opportunities and providing safe spaces for sharing their personal narratives of workplace violence and harassment. By exploring innovative technological solutions, this project aims to contribute in creating a more inclusive and supportive environment for female workers, fostering a shift towards gender equality and safer working conditions.

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Women in Public Service in Pakistan - Oral History Archive

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

This project aims to collect, transcribe, and archive oral history interviews of women in public service in Pakistan. The project focuses on the gendered experiences of participation and service in government in Pakistan, and its impact on individuals as well as institutions and communities. This research supplies unique and important documentation of the experiences of women in government.

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Testing Gender Sensitivity in Pakistan

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

This project aims to enhance our understanding of gender and how it affects the social makeup of our community and opportunities in Pakistan. This study fills a research gap in Pakistan and investigates gender sensitivity by testing the implicit gender biases of 500 law enforcement officials, lawyers, and civil servants in Pakistan. The study will serve as a foundation for future research on implicit gender bias of different groups in Pakistan and raise questions about the specific ways in which bias may contribute to disparities for women, both at interpersonal and aggregate level, especially in terms of the legal provisions. Laws can be formed considering the statistics collected from this study to ensure equal rights, equal pay scale and the importance of addressing necessary women issues in a workplace.

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Privacy and the Rights of Children and Minors

Sponsor: Digital Rights Foundation
Funding Amount: Confidential
Project Initiated in: 2020

The consultant is engaged in assisting and mentoring in writing of the research report on privacy and the rights of children and minors in the online space, overall climate of harassment, and online intimidation and bullying, misogyny to harassment and from stalking to gender-based violence and explicit threats which affects today's youth, in Pakistan. This research outlines the key risks, challenges, and strategies for combating the overall, as well as gender-specific, threats to minors online and the threat to their online right to privacy via ethnography and data analysis.

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UNICEF Pakistan Development of Child Protection Case Management and Referral System

Sponsor: Oxford Policy Management
Funding Amount: PKR 7, 909,438
Project Initiated in: 2019

The establishment and strengthening of a child protection case management and referral system holds the primary focus for UNICEF's technical engagement on child protection with provincial governments. In this context, the project entails the provision of technical assistance by the consulting firm to support the respective governments of Balochistan, GB, Sindh and KP towards the establishment of their respective provincial public child protection case management and referral systems, inclusive of a child protection information management system.

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Examining the Entry Motives of Child Labourers in the Informal Economy and their Ultimate Exit from it as a Result of Entrepreneurial Spawning: A Case Study of Informal Automobile Workshops in Lahore, Pakistan

Sponsor: LUMS
Funding Amount: PKR 600,000
Project Initiated in: 2020

This study intends to critically evaluate the entry motives of child labourers in the informal economy and aims to assess the impact of the prevalent pandemic COVID-19 on these child labourers, filling the existing gaps in the literature. More specifically, through face-to-face structured interviews of 45 child labourers working in informal automobile workshops across Lahore, Pakistan, this project aims to identify their entry motives, investigate the presence of entrepreneurial spawning intentions amongst them, and highlight the subsequent impact of COVID-19 on both.

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Protecting and Promoting Children's Rights in Pakistan

Sponsor: American Bar Association (ABA)
Funding Amount: PKR 24,550,620
Project Initiated in: 2020

This study aims to expand access of legal services for victims of child abuse and their families. The LUMS team is working with ABA-ROLI to deliver trainings in Lahore, Multan, and Islamabad on Standard Operating Procedures for paralegals to respond to and support survivors of child sexual abuse. They are undertaking a gap analysis of Pakistan's existing domestic legislation in comparison to Pakistan's international commitments with respect to the protection and promotion of child rights. The discrepancies between international and domestic standards are compiled in a policy report. This report will be presented to all key stakeholders in the government, members of the judicial system, and civil society organizations. The project is beneficial to government and civil society representatives who attend the virtual conference as the training workshops will equip them with crucial knowledge on responding to victims and survivors at pre-trial and trial stages. This process will benefit the justice system in this pertinent area of concern.

POLICY MAKING

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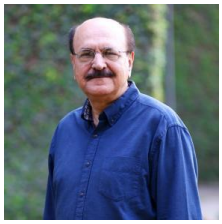

Do Banks in Pakistan Follow Responsible Investment & Financing Policies?

Sponsor: Indus Consortium
Funding Amount: PKR 1,900,000
Project Initiated in: 2020

The aim of this study is to collect, review and analyse all the documents necessary to map and present a macroeconomic picture of the 10 biggest commercial and investment banks operating in Pakistan along with the financial regulations that govern these institutions relevant to social, environmental and gender issues and governance (ESG). This study also identifies which themes are most relevant to the Pakistani context, who are the participating NGOs and provide a list of themes and sectors that should be focused by the future coalition of the Fair Finance Guide Pakistan. Ultimately, the study is expected to analyse whether commercial banks are the best entry point to achieve change in Pakistan and which banks could a future Fair Finance Guide Pakistan coalition engage with and include in the policy assessment.

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Women's Right to Legal Property

Sponsor: Legal Aid Society
Funding Amount: Confidential
Project Initiated in: 2022

The project focuses on Women's Right to Legal Property in 3 districts of Sindh. In Pakistan, women's access to property is hampered by a complex – sometimes contradictory – legal framework that is inaccessible to the average citizen, patriarchal values that lead to inequitable results, and a lack of implementation of laws that benefit women. Access to property is a key factor in opening the space for women's decision-making power in the household and for allowing them the freedom to leave toxic home environments and to build wealth and autonomy. It is therefore necessary to understand the legal regime, support the implementation of state-backed initiatives to implement the law, and to work with women in vulnerable communities to raise their awareness of the ways in which the law can be utilized to their benefit. The project includes preparing and delivering a refresher training to a cohort of 55 women who work in communities in Karachi, Larkana and Hyderabad.

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Performance Management and Discretion in Front Line Police Workers: A Street Level Bureaucracy Analysis

Sponsor: LUMS
Funding Amount: PKR 630,000
Project Initiated in: 2020

Provincial police departments constitute the most crucial civilian security force in Pakistan, tasked with maintaining law and order in the country and to safeguard the citizens from criminal activity. Front line police staff are assigned a wide range of responsibilities, from apprehending unlawful practices and investigating criminal activity; to dealing with emergency situations. Faced with situations of varying importance and urgency daily, these officials, referred to in literature as "Street Level Bureaucrats (SLBs)" often have to improvise policy decisions while remaining within the confines of laws and rules and regulations designed by the senior management. Senior managers adopt various methods to regulate the performance and discretion of SLBs in serving the citizens. These may include strict performance evaluation mechanisms, systems of rewards and punishments, resource allocation techniques and rules and regulations pertaining to day-to-day activities of SLBs. SLBs, on the other hand, do not merely follow these policies; they may try to work their way around them or utilize the gaps in policies to increase their own discretion. This project seeks to understand how SLBs actively perceive policy formulation and where the gaps in policies lie, and how these factors impact the performance and degree of discretion of SLBs.

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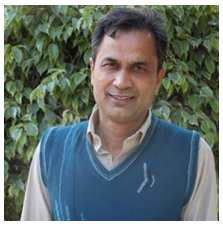

Extending Sexual Harassment and Workplace to Broader World of Work in Society: Developing a Legal Framework for ILO Violence and Harassment Convention 190 (C-190)

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

This project imagines the world of work beyond the traditional 'workplace,' from subcontracting of Global Value Chains (GVCs) to the extent of home-based workers. Its aim is to enlarge and develop labor law framework and institutional mechanism to accommodate legal requirements outlined in the C-190. Instead of courts and police, it wants to rely on available institutional mechanisms of labor representation and organizing for redressal of grievance in harassment and violence cases.

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Whistleblowing in Pakistan

Sponsor: LUMS
Funding Amount: PKR 425,000
Project Initiated in: 2020

One of the most cited definitions of whistleblowing is "the disclosure by organization members of illegal, immoral, or illegitimate practices under the control of their employers, to persons or organizations that may be able to effect action." In a country like Pakistan, where perception of corruption as a major constraint for doing business is the highest in the region, encouraging whistleblowing and protecting people who report wrongdoing is essential. In 2018, The Securities and Exchange Commission of Pakistan directed companies listed on Pakistan Stock Exchange to formulate and disclose several policies including whistleblowing policy. This study evaluates the demographic characteristics and behavioural factors that influence managers in various organizations in Pakistan for their likelihood of whistleblowing upon observing fraud and/or harm in their organizations.

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Legal and Regulatory Strategies for the Coordination and Commercial Oversight of Pakistan's Response to COVID-19

Sponsor: Hanns Seidel Foundation (HSF)
Funding Amount: PKR 1,645,000
Project Initiated in: 2020

In developing countries like Pakistan which have limited resources in the public health sector, tackling COVID-19 was increasingly difficult. This pandemic has already caused acute stress on the health sector of the country and is anticipated to wreak havoc in the economic and social sectors in upcoming times as well. This study is proposed to work on Legal and Regulatory Strategies for the Coordination and Commercial Oversight of Pakistan's Response to COVID-19. This project is designed to identify, research, and provide actionable legal recommendations to aid the Government of Pakistan and all relevant agencies in containing and treating COVID-19.

Poverty Alleviation and Socioeconomic Uplift: Lessons Learned from the Chinese Model

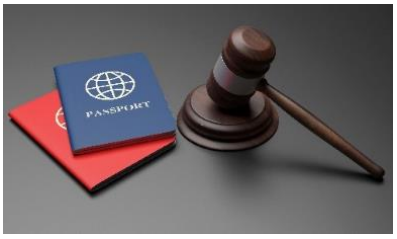
Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

This study intends to examine the policies, techniques, and methods employed by the Chinese Government to alleviate poverty and effect the socioeconomic uplift of economically depressed segments of Chinese society. Analyzing these systems, as applied within historically poorer Chinese counties, can provide insights which can subsequently be adapted to develop a similar policy framework applicable to the Pakistani context, which would help domestic public efforts in alleviating poverty from parts of Pakistan which remain economically underserved.

Project to Develop Business' Respect for Human Rights through US/Pakistan Cooperation

Sponsor: American Bar Association (ABA)
Funding Amount: PKR 15,480,244
Project Initiated in: 2018

The project aims to introduce Business and Human Rights at university level through US and Pakistan cooperation. The objective is to equip Pakistani students with thorough understanding of business and human rights. Moreover, the purpose is to provide Pakistani lawyers with knowledge to effectively advise businesses on how to respect human rights and communities thereby providing an understanding as well as academic and legal exposure to students and the legal fraternity in Pakistan.



The Legal Framework for Refugees in Pakistan

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

This study seeks to conduct research to explore the legal status of refugees in Pakistan and provide policy recommendations for a draft legal framework for the same. The key legal instruments under international law governing the status and treatment of refugees are the Convention Relating to the Status of Refugees, 1951, and its associated Protocol Relating to the Status of Refugees, 1967. Pakistan, despite being the world's second-largest refugee-hosting country, hosting approximately 2.7 million refugees (of which 1.42 million are registered Afghan refugees), is party to neither of the two. This research paper and policy brief include an empirical study of the issues faced by refugees in Pakistan, involving surveys conducted in coordination with key stakeholders from the refugee population in Islamabad. The results from these are to be relied upon in meetings with key stakeholders, including the United Nations High Commissioner for Refugees, Pakistan (UNHCR), the Ministry of Interior (MOI), and Ministry of States and Frontier Regions (SAFRON), to contribute to an informed discourse on the refugee population in Pakistan.

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Re-Imagining Federalism in Pakistan: Issues of Devolution and Reform

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

In the year 2020, the leading constitutional debate in Pakistan relates to the controversy about the 18th Amendment that has the potential to become an explosive issue between the government and the opposition. The current research project addresses this issue in the context of the growing gap between the design and practice of federalism in Pakistan. Given the context of a deficit of provincial autonomy that cost Pakistan heavily in the form of separation of East Pakistan, the on-going contention over re-negotiation of the National Finance Commission Award (NFC) poses a great challenge to the federalist project. Another layer of complexity is the unsettled tertiary transfer of power to the local governments. With the entry of China-Pakistan Economic Corridor (CPEC) into the picture, yet another controversy has emerged over the potential beneficiaries of this massive development scheme. This research project seeks to answer these crucial questions surrounding the evolving nature of federalism in Pakistan.

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Re-Imagining Federalism in Pakistan

Sponsor: Higher Education Commission (HEC) | Embassy of France in Pakistan
Funding Amount: PKR 1,250,000 | PKR 827,814
Project Initiated in: 2019 | 2020

Federalism in Pakistan is directly related to contention between the policies of the state and autonomist aspirations of ethnicities. The current project attempts at mapping out the institutional design, policy framework and politics of federalism in Pakistan. The study aims at pointing out various anomalies in both the design and the operational dynamics of federalism. The idea is to develop certain policy guidelines to making the federation more stable, harmonious, and productive by bringing the constituent parts of the country closer and by removing the sources of mistrust. Apart from discussing various issues that present periodical challenges to the stable functioning of federalism in Pakistan, the research addresses various low-intensity grievances among the smaller provinces. It is expected that the findings of the current project would highlight the gaps in theory and practice of federalism in the country and put together a policy framework for resolution of various intractable problems that stand in the way of making Pakistan a workable, enduring, and exemplary federation in the region.

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Job Quality Study for Karandaaz Pakistan

Sponsor: Karandaaz Pakistan
Funding Amount: Confidential
Project Initiated in: 2022

This project includes job quality study for Karandaaz while reviewing literature and current practices, as well as conducting primary research (both qualitative and a survey) to construct an index of job quality which is to be delivered to Karandaaz.

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Urban Property Tax Reform in Punjab: Using Evidence to Reform the Method of Valuation

Sponsor: International Growth Centre (IGC)
Funding Amount: PKR 4,178,234
Project Initiated in: 2021

In this project, the novel integrated property database for Lahore and Sargodha is utilized to examine the two valuation methods in terms of distributional fairness, revenue potential and buoyancy. The distributional impact of shifting from the ARV system to a CV system is simulated that uses DC rates as proxies for market values. The DC rates are based on property value surveys conducted by revenue officials and the land value declarations made by buyers at the time of purchase in the Government's online estamping system. The study estimates how the property tax burden changes for existing taxpayers that fall in different asset value bands under an area-based quasi-CV system under the assumption that the tax rate is set to generate the same tax collection demand under both systems. The research also simulates the effect this change has on property values if it were to be fully capitalized into market prices and analyse the distributional implication of this change.

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Improving Labour Standards in Pakistan's Textile Industry

Sponsor: Abacus Consulting
Funding Amount: Confidential
Project Initiated in: 2020

The textile and garment sector, concentrated in Punjab Province, is vital to Pakistan's manufacturing industry, employing approximately 15 million people (30% of the workforce). Working conditions suffer from inadequate safety standards, low wages, and a lack of dialogue between management, workers, and state institutions. On behalf of the German Federal Ministry for Economic Development and Cooperation (BMZ), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH supports the Government of Pakistan in capacity building for labour standards in the textile and garment sector in Punjab. The Labour Standards Programme (LSP), in collaboration with the Labour & Human Resource Department (L&HRD) and selected factories, strives to enhance labour standards, educate employers, and improve working conditions.

Outline of the strategic plan of the Qadri group of Industries

Sponsor: Qadri Group
Funding Amount: Confidential
Project Initiated in: 2021

This project includes review of strategic documents including history, organization structure, annual reports, and other relevant documents of the Qadri group. It also involves focus groups with directors/board members and top managers of the group and one on one meetings with directors /top managers of the group. It caters identification /revisiting of strategic mission, vision and values of the group based on the discussions with senior faculty members and top managers and finally provision of initial skeleton /outline of the strategic plan (including broad goals and KPIs and guiding the focal persons in writing the draft plan.

Scaling up of DFS methodology for Multipliers GIZ

Sponsor: Abacus Consulting
Funding Amount: Confidential
Project Initiated in: 2021

This project includes review of existing DfS material provided by GIZ and conducting research on DfS technology for developing case studies. It also deals with development of 5 case studies standard templates along with interviews of 10 industrial partners for collection and tabulation of data. It also includes creation of topic related, training-friendly content for the readers.

Strategic intervention to support the transformation initiative at IBA Karachi

Sponsor: IBA, Karachi
Funding Amount: Confidential
Project Initiated in: 2021

The project is designed to support the transformation initiative at IBA under the new leadership and to enable the institution to be on track to achieve AACSB accreditation including a Broad Situation Analysis and Progress Review. It involves reviewing of IBA's existing strategic situation and new structure, current priorities (university- and school-level), steps taken, key issues and challenges (desk review). It also includes visiting to IBA Karachi in 2020 and 2021 and meetings with key stakeholders for broad situational analysis. It facilitates strategic conversations/introspective sessions with the key stakeholders to review the current priorities and steps, key issues possible interventions, and way forward. It also includes meetings with Deans, HoDs, conveners of committees, centre directors and faculty members (business school) and review of committees TORs and Deans and HOD's JDs. The project identifies the impact, implications and functioning of new organizational structure. Moreover, it aims at the identification of future goals and School-wise KPIs with specific emphasis on short term as well as long term impact.

Strategic Plan of The Samad Group of Industries

Sponsor: Samad Group of Industries
Funding Amount: Confidential
Project Initiated in: 2020

The project is planned to draft the first strategic plan of the Samad Group of Industries. The aim is to institutionalize strategic thinking and systematic management in the family run business.

Strategic Review and Mentoring of the Samad Group of Industries 2021

Sponsor: Samad Group of Industries
Funding Amount: Confidential
Project Initiated in: 2021

The objective of this project is to enable the monthly review of the first strategic plan of the Samad Group of Industries and facilitate Board Meetings and mentoring of young directors. The aim is to institutionalize strategic thinking and systematic management in this family run business.

Strategic Review of Jaffer Brothers Private Limited

Sponsor: Jaffer Brothers Private Limited (JBL)
Funding Amount: Confidential
Project Initiated in: 2021

The consultants are responsible for maintaining the consultancy services for the duration of this agreement or renewal to ensure efficient provision of the same to the client. Consultants shall use their best efforts and experience in fulfilling their obligations under this agreement.

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Consultancy Services for HBL Digital Strategy

Sponsor: Habib Bank Limited (HBL)
Funding Amount: Confidential
Project Initiated in: 2022

The project encompasses a comprehensive assessment of HBL's existing digital strategy. The project aims to provide valuable feedback and strategic recommendations to enhance and optimize HBL's digital initiatives. Through a meticulous evaluation of the current digital landscape, market trends, and customer needs, the project will identify areas for improvement and propose actionable strategies to align HBL's digital strategy with industry best practices. The consultancy services will be delivered by a team of experts with extensive knowledge and experience in digital transformation, enabling HBL to unlock its full potential in the digital realm. The project's goal is to empower HBL with a robust, customer-centric digital strategy that drives innovation, customer engagement, and sustainable growth in the ever-evolving digital landscape.

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Consultancy Services for HBL's Operational Excellence Strategy

Sponsor: Habib Bank Limited (HBL)
Funding Amount: Confidential
Project Initiated in: 2022

This project includes provision of consultancy services to support HBL's Operational Excellence Strategy. This consultancy work requires an assessment of the current internal and external dynamics of the client's organization by meeting senior executives and its strategic ambitions. The current involvement also includes the design and delivery of workshops with senior executives and possible follow-up activities to help the executives develop a strategic roadmap for operational excellence.

Strategic Planning and Growth at Wateen

Sponsor: Wateen Telecom
Funding Amount: Confidential
Project Initiated in: 2021

The Strategic Planning and Growth project at Wateen involves conducting a comprehensive analysis of both the current and potential markets and products associated with the company. This study encompasses an in-depth examination of the organization's existing capabilities and identifies potential collaborations with external partners. The project focuses on the identification and selection of suitable avenues for growth, accompanied by the development of a detailed implementation plan to execute the growth strategy effectively. Additionally, contingency plans will be formulated to ensure organizational agility and flexibility throughout the implementation process, allowing Wateen to navigate challenges and seize opportunities that arise during the pursuit of its strategic growth objectives.

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Technological Innovations and Auditing Practice in Pakistan

Sponsor: Institute of Chartered Accountants of Pakistan (ICAP)
Funding Amount: PKR 540,000
Project Initiated in: 2021

In the rapidly evolving landscape of information technology, auditors in Pakistan face a myriad of challenges and opportunities. This comprehensive study aims to delve into the current experiences of auditing professionals, anticipate forthcoming changes, and develop a roadmap to inform policy decisions, curriculum design, and training strategies. By examining auditing perception, the auditor-client relationship, regulatory impact, changes in firm structures and procedures, and the evolving professional profile, this research project seeks to provide valuable insights and recommendations for auditors, policymakers, educational institutions, and training bodies. The findings will empower auditors to navigate the impact of technological innovations on their practices, while guiding policymakers in fostering transparency, accountability, and trust within the auditing ecosystem. Additionally, the outcomes will shape the design of curricula and training programs, equipping aspiring auditors with the necessary skills and knowledge to thrive in the dynamic auditing landscape of Pakistan. By bridging the gap between technology and auditing practices, this study aims to strengthen the auditing profession, promote adaptability, and foster a resilient ecosystem that meets the demands of the future.

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Organizational Effectiveness and Tax Compliance in Punjab, Pakistan

Sponsor: JPAL The Abdul Latif Jameel Poverty Action Lab | International Growth Centre (IGC)
Funding Amount: PKR 874,873 | PKR 4,596,851
Project Initiated in: 2021

Governments in developing countries are characterized by low tax capacity, driven by limited bureaucratic effectiveness and important constraints on enforcement. In this project, the focus is on three less-studied areas of reform. First, how governments can increase access to information trails to improve enforcement capacity. Second, whether, and how, technology can help the tax authority improve its capacity to process and manage taxpayer appeals cases in the courts. Third, how the tax authority can improve its organizational capacity by leveraging the detailed information captured in a range of newly implemented software systems. To address these issues the project team at LUMS has partnered with the Punjab Revenue Authority (PRA) in Punjab, Pakistan, the Mahbub ul Haq Research Centre (MHRC) based at the Lahore University of Management Science (LUMS), and internationally based researchers at Columbia, Harvard, and LSE.

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Retainership for Providing Guidance and Advice to Qadri Group

Sponsor: Qadri Group
Funding Amount: Confidential
Project Initiated in: 2021

This partnership between LUMS and the Qadri Group is designed to facilitate drafting a strategic plan, for the Qadri Group of Industries, aimed towards strategic thinking and systemic management of the family run business. This consultancy project entails review of strategic level documents such as history, organogram, structure, balance sheet, annual reports, and such, along with focus groups with directors and group members. This project is expected to result in development of shared aspirations for the group along with a clear understanding and articulation of what needs to be done to fulfil these aspirations.

ENVIRONMENT

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Combined Waste Oxidation and CO_2 Reduction for Tackling Climate Change in Pakistan

Sponsor: British Council
Funding Amount: PKR 346,521
Project Initiated in: 2021

This project aims to develop a simple and scalable process for converting waste into marketable resources and fuels to sustainably transform Pakistan's economy towards a greener future. Climate fluctuations constitute a major global challenge and Pakistan is suffering particularly badly. During the winter of 2021, dense smog affected major parts of central Punjab and Lahore was ranked most polluted city in the world. There is an urgent need to tackle pollution and take effective steps towards a climate-neutral Pakistan. The project proposes to develop a low-cost process that can use surplus electricity or sunlight to simultaneously degrade waste, capture CO_2 and generate fuels and organic chemicals. Through a collaboration across materials science, electrochemistry, photochemistry and computation, this research aims to demonstrate the feasibility of this approach to trigger investment into large-scale roll-out.

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Moving Beyond Climate Change Mitigation

Sponsor: British Council
Funding Amount: PKR 1,362,980
Project Initiated in: 2021

This project explores the role of clean energy in enabling climate adaptive strategies with a focus on off-grid communities. Specifically, the study uses a mixed-methods multidisciplinary approach to determine clean energy sources and technologies available in Pakistan to define an optimal range of adaptation strategies within the World Bank's Multi-Tier Framework (MTF) of energy access. Further, the study investigates the socio-economic impacts of proposed climate adaptation strategies in select rural off-grid areas of southern Punjab as a case-study, focusing on women's access to energy and means for empowerment.

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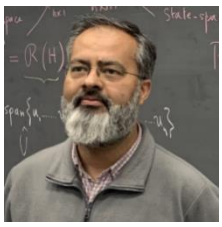

Climate Technology Market Assessment in Pakistan

Sponsor: International Trade Centre (ITC)
Funding Amount: Confidential
Project Initiated in: 2021

The objective of this project is to assess the state of climate technology across Pakistan and provide a menu of options to guide growth for rural advancement and sustainable progress (GRASP), ITC to support innovation of climate technologies and their commercialisation and adaptation in the horticulture and livestock value chain in Sindh and Balochistan. The research carried out by desk research, informal surveys, FGDs, KIIs, and meetings with key stakeholders was documented and digitalised. This ensured the submission of the analytical report to map the value chain for horticulture and livestock. It was followed by a report on the state of climate smart technology and development of menu options for promotion of climate friendly technologies.

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Environmental Noise Pollution: It's Mapping and Reduction in an Acoustical Network Framework Based on Wave-Domain Adaptive Techniques

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 10,649,000
Project Initiated in: 2019

The project goal is to address the increasing noise pollution, its impact on population exposed to it and its mitigation through Wave- Domain Adaptive Techniques. As the advancements in Information and Communication Technologies (ICT) are increasing, their role to improve the quality of life is also expanding with the proposition and development of solutions for modern healthcare, city infrastructure, better security for citizens, smart and secure city asset management and intelligent transportation etc., therefore, this project is one of the most important project of SBASSE because it proposes to leverage the advances in ICT by developing a system which provides a technological and sustainable solution to the problem of environmental noise pollution which has become one of the major environmental issue.

The Waste We Make: Applying Machine Learning for Analysing and Predicting Household-Level Solid Waste Generation and Composition Patterns

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

This project assesses the amount of urban household solid waste by empirical terrestrial data collection and geospatial mapping techniques. The idea is based on the hypothesis that there is a relationship between waste generation patterns and building typology, which represents the socioeconomic conditions of their inhabitants. This, in turn, directly affects their way of life and the corresponding waste generation patterns. By assessing building types and their spatial distribution in Lahore and linking them to information gathered in field surveys, a reliable estimation of the quantity and composition of household solid waste at the city scale is possible. This will lead to a more sustainable management of waste utilization and a more effective disposal infrastructure in future.

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Determination of the Chemical and Biological Composition of Particulate Air Pollution

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

In recent years, during mid-October to February period, Lahore has been observing severe episodes of smog - a mixture of solid particle, fog, and hazardous gases. Resultantly the health and mobility of the inhabitants have been greatly affected. Due to scarcity of the available data about chemical nature, concentration, and principal contributors of smog constituents, taking informed decisions and interventions has been quite challenging. Since the advent of a novel Coronavirus (named SARS-CoV-2) causing severe respiratory illness (termed as COVID-19) in Wuhan, roughly 59 million people around the world have been affected. The second wave of the pandemic was being observed in the country during the time of research i.e., November 2020. The air quality index in Lahore was among the worst in the world at that time. The role of air pollution to enhance the SARS-CoV-2 infection rate has been demonstrated by several studies in various countries. This research hypothesizes that the extremely bad air quality of Lahore in these months of early winter contributes to enhancing the SARS-CoV-2 infection rate. To assess this hypothesis, the project investigates if the concentration of particulate matter (dust, smoke) is correlated to the rate of daily cases of COVID-19 and if the particulate matter acts as a nucleus for the deposition and transport of novel SARS-CoV-2.

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Real-time Spatiotemporal Emissions Mapping under WP5 Asi@Connect

Sponsor: TEIN Cooperation Centre
Funding Amount: PKR 23,839,920
Project Initiated in: 2020

This project proposes development of real-time spatiotemporal emissions mapping mechanism through deployment of cost-effective and portable environment monitoring stations on service or public transportation vehicles. The proposed project is an important step towards addressing the issues of climate change. The project has the potential to be replicated across the globe and can serve as a guideline in climate change mitigation and adaptation efforts. The project can be utilized to reduce air pollution through active monitoring.

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Securing Socio-Economic Stability and Data-Driven Resilience for Ungauged Namal Valley Watershed at Monsoon Margins

Sponsor: German Pakistani Research Cooperation Program - DAAD
Funding Amount: PKR 5,986,511
Project Initiated in: 2022

Pakistan is rich in a variety of natural and human-managed watershed ecosystems. While glacier and snowmelt dominated large watersheds are national priorities owing to their water supplies to agrarian economy, small watersheds that are fed entirely by rainfall and support less resilient local communities are often overlooked. Such small rainfed watershed ecosystems are particularly unstable when situated at the extreme margins of prevailing pluviometric regimes due to their erratic behaviour. Subsequent repetitive flooding and water scarcity put the socio-economic development and human lives in the region on permanent stake. Thus, adopting international practices, deploying state-of-the-art sensing technology for data collection, and employing a comprehensive hierarchical modelling scheme, this project aims to enhance the resilience of the watershed ecosystems to provide better opportunities for the socio-economic development of the locals within the impoverished ungauged watersheds.

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Belief Formation, Signal Quality, and Information Sources: Experimental Evidence on Air Quality from Pakistan

Sponsor: International Growth Centre (IGC)
Funding Amount: PKR 8,120,671
Project Initiated in: 2021

Adaptation to poor air quality in developing countries maybe inadequate by limited access to information. In Lahore, daily air pollution reports by local environmental regulator, The Environment Protection Department (EPD), are unreliable resulting in private initiatives such as Pakistan Air Quality Initiative (PAQI) to provide independent measure. Competition from private sources could improve citizens' access to reliable information and government accountability, but their efficacy may depend on how citizens perceive relative qualities of these sources and whether they modify their beliefs and behaviours in response. This project studies how citizens form their beliefs about air quality and modify their behaviours based on the associated information source.

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Snow Leopard Early Warning System

Sponsor: Worldwide Fund for Nature (WWF-Pakistan)
Funding Amount: PKR 1,170,000
Project Initiated in: 2022

This project proposes the designing and implementation of an early warning system utilizing image and data processing technologies. The system is set up to monitor biodiversity hotspots located in close proximity to rural communities that are prone to wildlife attacks. The goal of the early warning system is to report any sighting of snow leopards within a few minutes to the forest staff so that the potential conflict between the human population and leopards can be avoided. Thus, the main attributes of such a system include active sensing, efficient computation, and rapid communication.

BUSINESS & ECONOMY

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Alternative Dispute Resolution (ADR) in 8 districts of Sindh

Sponsor: Legal Aid Society
Funding Amount: Confidential
Project Initiated in: 2022

This project includes reviewing and finalizing customized training manual on ADR and court annexed ADR frameworks, conflict resolution and consensus building skills with pre and post training assessment forms for paralegals' training. It also covers delivering in person training to a total of 192 paralegals/ attendees in six batches (30-36 participants per training) through 2-days training; imparted at divisional ranges of Sukkur, Hyderabad, and Karachi. Moreover, it caters reviewing and finalizing customized training manual/material for refresher training on ADR and court annexed ADR frameworks, conflict resolution and consensus building skills with pre and post training assessment forms for paralegals' training.

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Improving Contraceptive Uptake by Enhancing Access and Reducing Social Anxiety

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

Pakistan faces a serious public health challenge: the population is growing fast, and the state is unable to keep up with demand for services. Current family planning strategies focus on counselling and providing access to modern contraceptive techniques. But it is apparent that existing strategies have had limited impact on Pakistan's population growth rate. This project plans to address the major development challenge of rapid population growth in Pakistan through administration of an endline survey. The results can help determine whether contraceptive uptake can be increased by simply providing coupons to households. Provided we find strong results—this can be a cost-effective intervention in the sphere of family planning in Pakistan.

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Contextualizing Ethical Leadership in Pakistan: Defining Characteristics and Mapping Patterns

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

This research aims to develop a contextual understanding of ethical leadership and identify traits and behaviours of ethical leaders in Pakistan. It pinpoints patterns of ethical and unethical behaviours across sectors and demographic traits for the development of focused policies. The corporate managers and organizational leaders are to be interviewed and focus group discussions (FGDs) must be conducted with leaders from different industries. The survey study shall help to identify patterns of ethical issues and behaviours across industries, sectors, and demographic characteristics, which will be useful in devising directed policies to address key ethical dilemmas and issues in Pakistan.

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Religion and Politics: Pakistan

Sponsor: SOAS University of London
Funding Amount: PKR 1,643,360
Project Initiated in: 2019

The proposed project aims to explore the intricate relationship between religious attitudes and educational experiences of individuals. It employs a multi-faceted research methodology to examine how different types of schooling, such as religious-based education versus secular-based education, affect the formation and evolution of religious attitudes of individuals. The research focuses on a wide range of religious denominations and educational backgrounds and analyse the various factors that contribute to the shaping of religious beliefs. The findings of this study will have important implications for the design and implementation of educational policies, particularly in areas where religious diversity is prevalent, and provide insights into the complex interplay between education and religion.

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Consultancy Services for HBL Cultural Transformation

Sponsor: Habib Bank Limited (HBL)
Funding Amount: Confidential
Project Initiated in: 2022

This project includes conducting relevant research into people's behaviours (local and International, regional) customized to local environment and HBL. It also covers HBL's Ethical Culture Gap Analysis, Root Causes Analysis (RCA) of unethical conduct (covering all categories as per Ethics and Conduct KPIs) at HBL in terms of the key areas mentioned in the project scope.

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Improving Customer Participation in Service Delivery: The Healthcare Industry of Pakistan

Sponsor: LUMS
Funding Amount: PKR 990,000
Project Initiated in: 2020

Customers in service settings are not merely consumers but also partners that perform a variety of tasks for successful service delivery. Missing, delayed or unqualified participation of such customer partners during service delivery affect the quality of the service and overall service performance. Moreover, the issue becomes critical in the context of complex and relational services such as healthcare, where active, on time and qualified patient participation is essential for smooth and efficient delivery of healthcare services. Thus, it is critical for service organizations, especially healthcare establishments to encourage and shape the participation of patients in service delivery effectively for enhanced service quality. The purpose of this research is to identify and empirically explore the service design level enablers of effective patient participation in service delivery in the healthcare sector of Pakistan.

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What Makes the Family Tick: The Influence of Family Attitude, Family Instrumental and Emotional Support on 'Business Performance' and 'Intention to Quit' amongst Pakistani Women Entrepreneurs

Sponsor: LUMS
Funding Amount: PKR 655,000
Project Initiated in: 2022

The study examines family-related factors by dividing them into a gender-specific component (family attitudes toward the image of women) and an entrepreneur-specific component (family attitudes toward entrepreneurship). Online questionnaires were used to gather data by 300 entrepreneurs from Lahore, Karachi, Islamabad, and Peshawar to target mix culture and ideas regarding the topic. This study is designed to offer tremendous assistance in developing a full-fledged course on women-led entrepreneurship at university level; eventually leading to the launch of a minor in Entrepreneurship at SDSB. Furthermore, this study is offering a practical approach with an evidence-based assessment of how to enhance the scale and scope of women entrepreneurship in Pakistan. The findings of this study highlight the familial challenges/support faced by women entrepreneurs in Pakistan and will assist social institutes and policy makers in developing a more practical and supportive credit policy for female led micro-enterprises and small businesses during the years to come.

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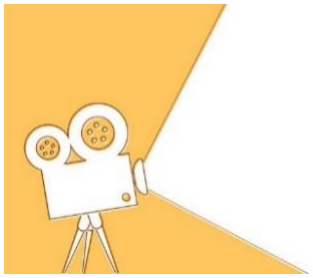

Memories of Conflict: Healing from Lyari's Violent Past

Sponsor: Education Justice and Memory Network (EdJAM)
Funding Amount: PKR 6,653,399
Project Initiated in: 2022

This project utilizes documentary film as a means of learning, healing, and teaching about Lyari's violent past. Through the process of making the film, participants can connect with it to reflect and heal from over a decade of violence. Furthermore, through the screening process, audience members can discuss and mend some of the fissures that were created during this time. The film will also be shared outside of Lyari in other neighbourhoods and cities to reflect on how communities are affected and can heal from violent conflict.

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Integra: Capacity Building in Higher Education

Sponsor: Harokopio University of Athens
Funding Amount: PKR 17,623,809
Project Initiated in: 2020

INTEGRA aims at responding to the limited participation of young refugees from conflict affected countries to the higher education system of India & Pakistan by introducing an innovative methodology that allows them to overcome the obstacles they currently face. This is accomplished by combining a short-term ICT course for youth with migrant background, based on the expectations of the ICT labour market in these countries, along with the establishment of 4 psychosocial support structures which can provide personalised psychosocial support. By bringing young refugees closer to the higher education system in India and Pakistan, the ambition of the project is to facilitate their full integration in these countries by attending higher education courses and/or by entering the labour market and especially the ICT sector, which is one of the main economic activities in this Region.

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Cultivating the Humanities and Social Sciences and Supporting Under-Represented Scholars of Asia

Sponsor: Association for Asian Studies
Funding Amount: PKR 42,937,965
Project Initiated in: 2022

This project aims to develop research capabilities of professionals in the fields of Humanities and Social Sciences in Pakistan. This project targets higher education institutions, away from national and provincial capitals, and which have underfunded humanities and social sciences departments. Various skill and research development workshops will be initiated to develop opportunities for young and upcoming faculty who have not received similar attention in the past. This is a transnational project that aims to develop research and academic linkages between South and Southeast Asian countries such as Thailand, Cambodia, India, and Pakistan, which are entitled to receive a grant for three years. The project encourages scholars from Asia to participate in Association of Asian Studies (AAS) projects and diversify the voices of journalists, artists, non-government organizations and human right activists worldwide. It also aims to contribute to the civil society and shapes policies to help the selected countries achieve their development goals. Moreover, it supports students and emerging scholars in career development. It also plays a significant role to increase the impact of AAS work in neglected regions of Asia by allowing participants to present publications and conducting skill building workshops.

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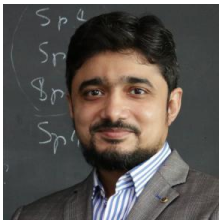

Crime Investigation and Prevention Lab - Speech Forensics

Sponsor: National Centre in Big Data and Cloud Computing (NCBC)
Funding Amount: PKR 2,373,000
Project Initiated in: 2020

Law and order are key characteristics of progressive civilized societies. It is a fundamental responsibility of the government to provide a safe and orderly environment that is implemented through various departments and agencies. Due to its unique geopolitical landscape, law and order has remained a pressing issue for Pakistan. Prevalent procedures for crime investigation and prevention are slow and outdated. The vast amount of structured and unstructured data available today is a gold mine. Unfortunately, sufficient human and technical resources do not exist in government departments and agencies to effectively utilize this data. This project includes The Crime Investigation and Prevention Lab (CIPL) shared between Information Technology University of the Punjab (ITU) and Lahore University of Management Sciences (LUMS) which is striving to provide a platform for research, development, and implementation of data-driven solutions for crime pattern discovery and optimal surveillance, evidence gathering and suspect identification, speech forensics, and vulnerability analysis and crime prediction.

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Information and Behavioural Approaches to Reduce Electricity Theft and Pollution from Electricity Provision: Experimental Interventions in Karachi

Sponsor: Duke University
Funding Amount: PKR 5,910,688
Project Initiated in: 2022

This study proposes a randomized experiment in collaboration with Karachi Electric to test behavioural information, and interventions designed to increase revenue recovery and reduce electricity theft, potentially reducing the wedge between consumption and generation, resulting in avoided carbon emissions.

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Study on Sugar Consumption in Pakistan

Sponsor: Coca Cola
Funding Amount: Confidential
Project Initiated in: 2022

The study includes a cross-product sugar-content research which compares the sugar contents in other products/industries such as bakery and sweets, dairy products, cereals, biscuits, savoury foods, and other processed foods thus making the policymakers aware of the potential of not achieving their stated objective of promoting a sugar-free diet in Pakistan by imposing a discriminatory additional tax on the beverages industry. It also takes a multi-faceted approach by combining Socio-Economic Impact Assessment Framework with primary on-field data. Under the broad categories of input, activity, output, and outcome, the framework's objective was to capture the impact of a potential increase in taxes upon economic variables such as income, tax revenues, and employment. Such an evaluation provides a bigger picture as to how exactly additional taxation impacts socio-economic outcomes in the industry. The research also caters a cross-country comparison in terms of taxes imposed on items with high sugar content. The idea is to make a case for lower taxation by presenting evidence from other countries experiences.

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Dynamic Financial Data Analytics for Policy and Governance

Sponsor: Sub-National Governance (SNG) Pakistan
Funding Amount: PKR 20,780,958
Project Initiated in: 2020

This project provides analytical tools to the selected departments of the Government of Punjab (GoP) for making budgetary decisions. Therefore, the ultimate purpose of this project is to improve budgetary processes, and to enhance the control and predictability of budget execution over time. This project entails the development of dashboards to facilitate analysis of data budget making and the relevant process, initially to a few selected departments. Currently, limited analysis is performed on Punjab's financial data. This gap leads to a lack of transparency with regards to spending and resource utilization, leaving opening for misuse and corruption. This project aims to reduce the uncertainty around budgeting exercises through the provision of timely and contextualized data analysis.

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Cross-Verification of Revenue Data using Third-Party Data

Sponsor: International Growth Centre (IGC)
Funding Amount: PKR 4,576,549
Project Initiated in: 2021

There is presently limited use of geographic information system (GIS) and management information system (MIS) data available from third parties to help the Punjab Government in growing its tax revenue base. This leads to inefficient or arbitrary revenue targets and financial planning, erroneous data leading to inaccurate analysis, and various other inefficiencies. It also leads to a lack of transparency with regards to spending and resource utilization, leaving openings for corruption in revenue collection. This project aims to reduce the unreliability of the current data by using public third-party data providers. The research proposes the integration of Third-Party GIS and MIS data within the Governments' own GIS and MIS data to identify inconsistencies such as missing properties. This can help in generating additional revenue for the government and create transparency regarding budget preparation, spending, and resource utilization.

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Transition of Residential Gas Appliances from Natural Gas to Electricity

Sponsor: Fatima Fertilizer Company Limited
Funding Amount: Confidential
Project Initiated in: 2020

This study explores the present and future supply and demand scenarios for natural gas and electricity in Pakistan. It also investigates the potential, cost-effectiveness, and feasibility of partial shifting of residential natural gas load to electricity at national and consumer level. It includes collection of residential natural gas usage data and its usage to forecast its demand, keeping seasonal variations into consideration.

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Study for CERP SCALE project

Sponsor: Centre for Economic Research in Pakistan (CERP)
Funding Amount: Confidential
Project Initiated in: 2021

This project includes assessment of the impact of smart lockdowns, masking and social distancing on positivity rates and exposure rates in high and low positivity areas, determining the rates of exposure in those tested positive and negative for Covid RNA and those not tested for Covid RNA by measuring IgG antibody titers to Spike and N-proteins. It also uses demographic and clinical data together with antibody titers determine association between seropositivity and post covid syndrome and finally predicts the risk for re-infection, post covid syndrome (long Covid) and break through infections among those with positive IgG titer to Spike or N protein.

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Discrimination in Online Marketplaces

Sponsor: Sewanee: The University of the South
Funding Amount: PKR 280,865
Project Initiated in: 2021

This study conducted an audit of an online marketplace in a typical patriarchal context of Pakistan and performed an experimental evaluation to measure gender bias. Based on a repeated weekly census of listings on the marketplace, selected sellers who regularly sell on the marketplace and were contacted through buyer profiles that unambiguously signalled gender without revealing caste, ethnicity, or other economic markers. Economic variables such as offered prices, delivery discounts, and product characteristics for each gender were recorded and analysed. In addition, any unsolicited attempts from sellers at communicating with each gender, such as messages, phone calls, friend requests, etc were recorded. This paper presents unique evidence on not just gender discrimination in prices and product characteristics but also on other facets of online interactions that may be a hurdle in the inclusion of women in the online marketplaces of patriarchal societies such as Pakistan.

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Evaluation of Textile Companies in Innovation Contest

Sponsor: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
Funding Amount: Confidential
Project Initiated in: 2021

The project is driven by the objective of conducting a comprehensive assessment of participating textile companies. With an academically researched approach, the project aims to evaluate the innovative ideas put forth by these companies. By scrutinizing their proposals, the project team will provide valuable insights and recommendations to GIZ, aiding them in selecting suitable partner companies for collaboration. Through this evaluation process, the project seeks to identify the most promising and impactful ideas, fostering a culture of innovation and driving progress in the textile industry.

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Providing Affordable Housing for Low-income Households Using Shared Ownership Contracts

Sponsor: LUMS | International Growth Centre (IGC) | Higher Education Commission (HEC)
Funding Amount: PKR 1,000,000 | PKR 4,034,940 | PKR 5,193,500
Project Initiated in: 2019 | 2021| 2022

Providing innovative solutions to the shortage of affordable housing for the poorest members of society is a critical policy challenge in many countries, especially in Pakistan. This project ultimately aims to develop an innovative housing finance product, based on the principles of ownership and risk sharing in Islamic finance, and in collaboration with one of the largest and fastest growing microfinance institutions in Pakistan, Akhuwat. The project intends to provide low-income households with financing amounts in the region of PKR 500,000–800,000 which they will be permitted to use for one of the two purposes: construction of a new house and renovation or extension of an existing house. This study served as an initial exploratory pilot.

Equity-Based Microfinance Contracts for Microenterprises

Sponsor: University of Oxford | LUMS
Funding Amount: PKR 6,883,962 | PKR 960,000
Project Initiated in: 2016 | 2021

The proposed project intends to focus specifically on micro-entrepreneurs in services and help them set-up a business. The goal is to offer equity-based financing to ten different types of services-where people have certain skill set but they need capital to set up or expand business. An exploratory field experiment is implemented using a randomised controlled trial (RCT) to conduct detailed baseline and follow-up surveys and investigate the success of this intervention and the impact on a range of different business and household outcomes for the entrepreneurs.

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Collaborating on the Pakistan Country Economic Memorandum

Sponsor: World Bank
Funding Amount: PKR 12,988,000
Project Initiated in: 2021

The aim of this project is to measure the trends in TFP across districts and to pinpoint factors that allow some district to be more productive than others. It can help to measure productivity in Pakistan, its provinces, and agro-climatic zones by using district level aggregate data for the period between 1992 and the latest available year. This can allow us to visualize evolution of productivity levels, and dispersion across space. Moreover, the data can be used to investigate the drivers of productivity change for policy interventions.

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Can Low-cost Demand Augmenting and Informational Inputs Help Street Vendors Improve Enterprise Outcomes?

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

Spoilage losses are a key concern for street vendors selling fruits and vegetables in Pakistan. These losses can also contribute to food insecurity as well as threaten environmental sustainability by increased

emissions from food decomposition process. The main aim of this project is to evaluate the impact of two interventions on spoilage, profits, and market behavior of street vendors in Pakistan. The first intervention enhances the demand faced by vendors by giving them access to a free vendor-to-home delivery service. The second intervention helps vendors price more competitively by giving them access to regular prices from other markets in their own towns as well as from other towns.

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Value Addition for Local Artificial Jewellery Industry through Electroplating Process Optimisation

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 12,464,000
Project Initiated in: 2019

The jewellery industry in Pakistan has a great potential to enhance the exports and contribute to the national economy through indigenous skill and technology development in the field. The quality of the finished product relies on the various manufacturing steps including casting, surface preparation, and the final coating through electroplating of copper, nickel, gold, etc. The aim of this project is to enable the local jewellery industry to compete internationally by adding value to their products through electroplating process improvement optimisation. A demo and training lab is established at LUMS for electroplating which benefits the local industry. This facility intends to have a wider impact on other related industries wherever electroplating is employed such as automotive, kitchen utensils, etc.

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Belt and Road Initiative and Supply Chain Development: A Case Study of the Havelian-Thakot Motorway in Pakistan and Tourism Supply Chain Development

Sponsor: RAND Corporation
Funding Amount: PKR 400,213
Project Initiated in: 2021

In explaining the factors that drive tourism supply chain changes after the completion of Havelian-Thakot Motorway, the paper assesses the quality of financial performance and operational performance of the actors involved in upstream, midstream, and downstream. Firstly, to assess the quality of financial performance, the paper evaluates the quality of financial attributes of those actors which include return on investment, manufacturing costs, total revenue, and distribution cost. Secondly, the quality of performance attributes encompasses quality of operational performance of service

delivery which comprises of product availability and quality among others. As a result, the effect is expected to translate into achieving objective attributes of the level of customer satisfaction and robustness and flexibility of the tourism supply chain in the area.

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FCDO Covid-19 Social Science Research Evidence Platform

Sponsor: Institute of Development Studies (IDS)
Funding Amount: PKR 4,772,916
Project Initiated in: 2020

This project aims to deepen the understanding of how states have engaged with informal economies and workers during the Covid-19 pandemic, how informality has affected workers' access to crisis support, and how these outcomes have affected state-society relationships and the underlying accountability processes. In particular, the project seeks to examine the role of trust between informal workers and state institutions.

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Internationalization of Pakistani Exporting Firms

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

The aim of this project is to guide current international business thinking towards understanding the issue of SME intermittent exporting from the emerging market economy (EME) perspective. Intermittent exporting is a behaviour where companies enter the export market but then soon exit it only to re-enter after sometime. This phenomenon has not been adequately studied. EME perspective contends that emerging markets have a different set of socio-economic and political conditions as compared to the developed economies and, therefore, these economies should be dealt with a different approach when being studied.

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Transforming Academic Knowledge to develop Entrepreneurial Universities in Pakistan

Sponsor: University of Saarland
Funding Amount: PKR 21,770,351
Project Initiated in: 2020

This project focuses on the capacity building of (associated) staff members of BICs, as these play a crucial role in the motivation, development, and sustainability of business ideas at the HEIs and equip universities with necessary tools to facilitate the work of incubation centres. Activities in the project are designed in a way that a holistic approach is taken to create a broad understanding of being an entrepreneurial university, so that the capacity building effort has a sustainable effect on the institutions themselves.

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An Exploratory Analysis of the Role of Prior Experience, Start-up Motives and Growth Intentions on the use of Financial Bootstrapping Techniques amongst Women Entrepreneurs in Punjab, Pakistan.

Sponsor: LUMS
Funding Amount: PKR 605,000
Project Initiated in: 2019

As in other parts of the world, the concept of women entrepreneurship in Asian emerging economies has recently gained tremendous attention, and it is commonly understood by policy makers that empowering women will be the key to transforming these economies at large. However, in many countries with a low level of economic development and a low degree of industrialization, this potential remains yet to be explored. Due to deep-rooted discriminatory socio-cultural norms and traditions, women entrepreneurs do not relish the same opportunities as men in Pakistan. As such, once established, the biggest challenge women-led enterprises face is to raise capital to finance their ongoing operations; making it difficult for women entrepreneurs to capitalize on their full potential in Pakistan. The aim of this study is therefore, to firstly understand and empirically assess the characteristics of women entrepreneurs and women-led enterprises in Pakistan's urban-spatial context, along with providing qualitative evidence of the experiences of women entrepreneurs in navigating Pakistan's women-centric social, cultural, and economic challenges. Secondly, the difficulties faced by women led micro-enterprises and small businesses in raising financial capital through bootstrapping methods are evaluated specifically.

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Microequity for Micro-enterprises: Encouraging Female Entrepreneurship with a Transportation Asset

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

This project intends to focus specifically on female entrepreneurs and help them enter a non-traditional sector: Rickshaw driving. The focus is to train females on how to become rickshaw drivers, and then provide them with equity-based financing to purchase the asset. An exploratory field experiment using a randomized controlled trial (RCT) was carried out to conduct detailed baseline and follow-up surveys, as well as using high-frequency sales data generated by an app and administrative data from microfinance institutional partner, to investigate the success of our intervention and the impact on a range of different business and household outcomes for the female entrepreneurs.

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Inclusive Sourcing Initiative Survey Analysis Project

Sponsor: Syeda Henna Babar Ali
Funding Amount: PKR 1,010,000
Project Initiated in: 2020

This project was an initiative undertaken in collaboration with WEConnect and the Pakistan branch of Chartered Institute of Procurement & Supply (CIPS) International. The aim of the project was to successfully increase local, regional, and global business opportunities for women-owned businesses by connecting them with buyers, heads of supply chains of large corporations, and government agencies. The collaborating partners have drafted surveys, the results of which helped the partners understand the existing supply chain situation in Pakistan. This understanding leads to the development of virtual workshops on Women Empowerment in Supply Chains in Pakistan. These findings are expected to prove pivotal in establishing a local professional network, sharing knowledge, and promoting representation, visibility, and engagement in the local environment.

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Evaluating Development of Cold Supply Chain Infrastructure in Pakistan

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

One of the bottlenecks hindering the country from achieving food self-sufficiency remains the absence of an appropriate cold supply chain infrastructure in the country. Due to the absence of proper cold chain facilities, Pakistan faces a severe challenge of post-harvest losses of fresh agriculture produce. This loss of precious merchandise of small-scale farmers (which make up 64% of total private farms of the country) also remains one among the prime reasons for the widespread poverty in our village areas. This has also become crucial in the context of COVID-19, which has inflicted enormous damage to our national economy. Building a state-of-the-art food cold chain (FCC) can help us realize our national dream of economic prosperity and financial independence. However, unfortunately, not to speak about building the cold chain itself, there even does not exist a policy document, setting the direction and laying the foundation for crystallizing the vision of building a world-class FCC facility in Pakistan. In such a context, this research aims to conduct a pan-Pakistan study dealing with the various dimensions of developing a sustainable FCC infrastructure in the country. The study is comprehensive enough to deal with such diverse subjects as supply chain design, inclusive business opportunities, social, ecological, and economic impacts, technical specifications, and compliance with global standards.

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COVID and Agricultural Supply Chains

Sponsor: International Growth Centre (IGC)
Funding Amount: PKR 4,400,352
Project Initiated in: 2021

This study focuses on the complete supply chain of fresh produce, from the farmer to the wholesale markets to identify the role played by middlemen and how it impacted farmers and consumers during the pandemic. Specifically, the aim is to identify if they acted as facilitators or created encumbrances during the COVID lockdown. To understand the impact of the study, the importance of the farmers and agricultural produce for the largest province of Pakistan is highlighted. Very little research has been done to investigate this influential position occupied by the different tiers of middlemen in the agriculture supply chain in Pakistan and no steps have been taken to find alternatives. This study is aimed at generating evidence on the facilitative or exploitive role played by middlemen during

natural calamities and seeking to uncover avenues through which the agents' role can be improved or minimised with alternatives to the current archaic market mechanism through a partnership with the Government and the private sector.

Understanding Agri Supply Chain Dynamics and Price Wedges

Sponsor: International Growth Centre (IGC)
Funding Amount: PKR 4,692,515
Project Initiated in: 2022

The agriculture sector in Pakistan plays a central role in the economy of the country as it employs 43% of the country's labour force and makes 19% contribution to the overall GDP. The agriculture landscape in Pakistan is characterized by inefficient markets leading to high price volatility, lack of innovation, and food insecurity for the masses. Research was previously conducted which focused on understanding the gap between the farmgate prices and retail prices for Potato and Onions. This gap was split into two of its components; gap between farmgate and wholesale prices and gap between wholesale and retail prices. After studying the first gap for Potatoes, the Department of Agriculture expressed keen desire to understand the second gap as well for three commodities (Potato, Tomato, and Onion). This second gap was also of policy relevance as most of it was determined within the regulated markets set-up by the government and the government also directly intervenes through retail price control mechanisms. Following up on the demands of the policymaker, the current research investigates the wedge between wholesale and retail prices for the three commodities using the existing administrative data. The wide gap and the large fluctuations between these two prices warrant detailed investigation forming the basis for this research.

MEDIA

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Price Information and Competitive Spillovers in an Online Platform in Pakistan

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

This project, in partnership with PakWheels.com, the leading Pakistani online platform for used vehicles, is aimed at studying how sellers in the used vehicle market make strategic decisions in the face of access to information, and their subsequent impact on market efficiency and the competitive structure. The study tests two dimensions: pricing and advertising. The analysis aims to understand if and how information about the market price of their vehicles affects usage of these strategies and their transaction outcomes. The extent of individual sellers' pricing and advertising choices spill over to other sellers in the same market is examined. This project highlights the potential for online platforms in emerging markets to both help address economically important questions and help lift potential frictions and constraints, in cost-effective ways.

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Women Home-based and Domestic Worker Vulnerabilities and the Role of Digital Technology in Pakistan

Sponsor: Oxfam
Funding Amount: PKR 1,708,860
Project Initiated in: 2021

This research is conducted in collaboration with women's rights organizations - CIRCLE, which works to provide digital training to women, and HomeNet, which works exclusively with home-based workers - to understand and support the existing work of the organizations to mitigate economic vulnerabilities. In collaboration with these organizations, the insights from this study can be used for formulating policy briefs for the state and WROs on the potential ways and means to support women with digital skills to alleviate their socio-economic vulnerabilities during the pandemic.

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Vaccine Marketing and Compliance: The Fake News Threat for the COVID-19 Response

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

The study tests message features that increase the attractiveness, readability, believability, source credibility, to curb misinformation and fake news and increase compliance with real health promotion and marketing messages regarding COVID-19 vaccination. These message features range from source presentation, use of tropes, sensationalism (in both images and text), and targeting. The use of sensationalism and social context is found to be a leading cause of information uptake for fake news and misinformation. The study therefore tests sensationalist message features and social context in a full experiment setting to see if real health promotion and marketing messages for COVID-19 can outperform fake or misinformation-based variants, and if exposed individuals can be persuaded using the SARF and HSM framework into creating an information sharing cascade for the real health promotion information and against the fake news narrative. The study is expected to create actionable health marketing guidelines for online and social media-based health promotion; the use of which is likely to allow the official health messages to overtake fake and misinformation-based narratives.

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Gender and Online Markets

Sponsor: LUMS
Funding Amount: PKR 900,000
Project Initiated in: 2021

The study seeks to determine if gender bias exists in online marketplaces and if so, seeks to measure it as captured by differences in the final price of a product. This study aims to implement an audit study where consumers interact with and purchase goods from online marketplaces in Lahore. In recent years, online marketplaces have seen a major uptake in Pakistan, with dedicated websites (e.g., OLX) and a multitude of "classified groups" on Facebook. Unlike more traditional online retail sites (Daraz, Amazon, etc.), these marketplaces operate informally, with no "set price" and one in which buyers and sellers engage in negotiations, typically through text messages.

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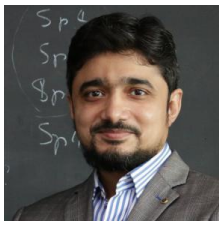

Optimizing the Spread of Information on Social Platforms: A COVID-19 Field Experiment

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

Given the limited capability of Pakistan's health system, disseminating accurate and up-to-date information about Covid-19, and countering misinformation, is an urgent need. This is particularly challenging in the context of a developing country like Pakistan where more than 62% of the population does not have access to the internet. Such under-connected populations include low-literate, non-tech-savvy, poor, remote, marginalized, and visually impaired communities, who lack access and ability to adequately utilize most modern means of communication to gather reliable information. Voice-based social networks have been shown as a promising means to rapidly reach thousands of under-connected users. This study proposes a randomized controlled trial to test two long-recognized approaches for addressing misconceptions. Specifically, should potentially harmful misinformation be suppressed, or should it be directly addressed and contested? These two moderation approaches are tested against a control that relies on the *ex-post* moderation.

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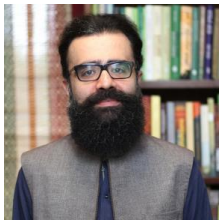

The One with the Rumor: Diffusion of Covid-19 Related Misinformation in Pakistani Twitter Conversations

Sponsor: Social Science Research Council (SSRC)
Funding Amount: PKR 804,134
Project Initiated in: 2020

This project outlines the debates about science, rationality, and medicine that continues to inform the public debate on such a critical issue as Covid-19. This project studies the content of Pakistan-based Covid-19-related tweets with a specific focus on political content, health-related content, risk framing, and rumours. The argument is that by recognizing the historical imperative of responses to modern science and medicine, characterizations of information/misinformation on social media can be more effectively understood. In other words, it is not simply important to document different types of rumours and misinformation circulating on social media but to explore the reasons for which they come into circulation in the first instance and their resonance in a particular political context.

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Countering Deepfake Misinformation among Low Digital-Literacy Populations

Sponsor: Facebook
Funding Amount: PKR 14,249,917
Project Initiated in: 2020

The increasing availability of low-cost mobile internet access in emerging markets has led to growing use of social media platforms among users with limited prior exposure to technology. Concurrently, an increasing trend in the spread of misinformation on such platforms is being observed. The growing complexity of how fake news is presented (e.g., deepfakes) and its many forms (e.g., text, audio, and video) poses a great challenge for communities with potentially higher risks for users with limited digital literacy. This research aims to study the perception, consumption, and engagement of populations with low digital literacy towards non-textual misinformation. It also focuses on the role of prior beliefs and analytical ability in forming perceptions about the accuracy of misinformation. It also seeks to find ways in educating users to identify non-textual misinformation (e.g., audio messages impersonating public figures). A survey and experiment are conducted for measuring the role of prior beliefs and analytical reasoning in determining beliefs about non-textual misinformation.

Evidence-based Educational Interventions for Countering Fake News in Pakistan

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 2,470,800
Project Initiated in: 2021

The increasing availability of low-cost mobile phones and mobile Internet access in developing countries has led to widespread use of social media platforms (e.g., Facebook and WhatsApp) in Pakistan, making them an important source of news and place for social and political activity. This trend has brought many new users online, including those with limited digital literacy skills and little prior exposure to technology. Misinformation can have a substantial impact on individuals and society ranging from election interference, polarization, to violence. The spread of misinformation can affect the beliefs, attitudes, and actions of users, while also reinforcing polarization about social, political, and health issues (e.g., views about COVID-19 vaccines). This project evaluates the effectiveness of educational interventions targeted towards low digital literacy populations that can increase the preparedness to use the internet and social media in a beneficial and responsible way, while bringing about positive social impacts such as reduction in hate speech and polarization by empowering users to identify misinformation. This study caters factors that affect the spread of misinformation, how misinformation affects beliefs and attitudes towards selected topics.

Understanding the Impact of Deep Fakes on the Spread of Political Misinformation

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

The proliferation of mobile phones in developing countries has led to the widespread use of social media platforms (e.g., Facebook and Twitter) and messaging services (e.g., WhatsApp) making them an important source of news and platforms for social and political activity. Unfortunately, we are concurrently observing an increasing trend in the spread of misinformation on such platforms meant to mislead users. Moreover, this trend is expected to be exacerbated with recent advances in artificial intelligence that have given rise to a new technique called deepfakes, that allows any individual's voice or video to be accurately faked. Such a vehicle of misinformation can increase polarization and even lead to conflict. This project team carried out a series of lab experiments to understand how factors, such as format of the news (deepfake or text messages), the content of news, and the individual emulated in a deepfake, affect users' beliefs and sharing behaviour. The results can help us understand the how deepfakes are perceived and acted upon by users, which can help provide ways to identify deepfakes.

Understanding the Impact of Digital Literacy on Misinformation in Pakistan

Sponsor: Facebook
Funding Amount: PKR 6,986,250
Project Initiated in: 2019

This project aimed to study the perception, consumption and engagement of populations having low digital literacy with non-textual misinformation (such as audio deepfakes). It also included the role of prior beliefs and analytical ability in forming perceptions about the accuracy of misinformation. It explored the ways of educating users to identify non-textual misinformation (e.g., audio messages impersonating public figures). A survey and experiment for measuring the role of prior beliefs and analytical reasoning in determining beliefs about non-textual misinformation was conducted. To measure the perceived accuracy of misinformation, users were presented with news stories (true and false news presented as audio deepfakes), randomly varying the content and the personality. Finally, the researchers designed and experimentally evaluated an educational intervention for low digital literacy populations that relies on key influencers within communities to disseminate awareness messages.

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Countering Extremism with Data: A Data-Analytic Framework for Assessing Extremism using Social Media and its Impact on Urban Sentiment

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

This project aims to develop a data analysis framework for extremist content evaluation and moderation. Through the framework, the objective is to investigate the effects of online extremism on urban sentiment. This idea is based on the hypothesis that there are strong links between online social media content and events in the offline world. The data analysis performed on online data available on social media platforms can provide valuable insights about these links. Their identification through appropriate tools, developed also as part of this project, may lead to effective policy level decisions to control, regulate and moderate such content in the long run.

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Social Media as a Space for Rights Advocacy in Pakistan: Democracy's Final Frontier?

Sponsor: LUMS
Funding Amount: PKR 560,000
Project Initiated in: 2022

Social media in Pakistan is increasingly becoming a battleground for political actors. Despite this, research on the relationship between social media and democracy remains scant. This study aims to explore the use of social media as a forum for marginalized groups to assert their rights in Pakistan. It focuses on three movements/campaigns: gender equality, the Pashtun Tahaffuz Movement, and campaigns for the recovery of missing persons. The research aims to provide insights to scholars and policymakers interested in widening the space for democratic expression in Pakistan.

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Pakistan Research on Current Economic Environment for SMEs

Sponsor: Facebook
Funding Amount: PKR 20,096,681
Project Initiated in: 2019

Facebook has been supporting the growth of Small Medium Enterprises (SMEs) in Pakistan through a range of training and capacity building efforts aimed at promoting the use of digital skills to start and grow businesses. Taking this initiative forward, Facebook engaged with LUMS to conduct research in Pakistan. The purpose was to understand the regulatory environment for SMEs across different provinces, assess the use of digital platforms and the barriers and challenges faced by SMEs. As a part of this engagement, LUMS produced and disseminated a position paper with policy recommendations for the government and relevant stakeholders on addressing the needs of SMEs in the context of online commerce.

CULTURE & HERITAGE

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The Economic History of the Punjab Canal Colonies

Sponsor: University of Maryland
Funding Amount: PKR 1,841,533
Project Initiated in: 2021

This project includes developing a natural experiment in colonial Pakistan which varied the number of hereditary village headmen (lambardari) in newly formed "canal colony" villages. Under British rule in the late 1800s, a series of canals were built in the Punjab region, allowing for the formation of thousands of new villages: the canal colonies. The colonial government controlled the rules surrounding village formation and implemented a cut-off rule in village area for the number of headmen. This context allowed the research to study the long-run effects of local political competition using a regression discontinuity (RD) framework. Additionally, the project is intended to increase our understanding of an important period of Pakistan's economic history during which the British created denovo village institutions in the areas that came to constitute the country's most populous province. The project's scope includes but is not limited to, collection of archival documents, digitization of the materials of Punjab Canal Colonies, and analysis of the resulting datasets.

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3D Scanning of Kanishka Casket and Mamane Dheri stela

Sponsor: Prakaś Foundation
Funding Amount: Confidential
Project Initiated in: 2022

The project encompasses a meticulous survey and digitization effort conducted at the Peshawar Museum. The primary focus of the project is to capture the intricate details and historical significance of two remarkable artifacts, namely the Kanishka Casket and the Mamane Dheri stela. Through cutting-edge 3D scanning technology, the project aims to create highly accurate and detailed 3D models of these artifacts, preserving their physical attributes and cultural heritage in a digital format. The resulting 3D models will not only provide a detailed virtual representation of the Kanishka Casket and Mamane Dheri stela but also facilitate remote exploration, interactive displays, and virtual exhibitions, enabling broader public access and engagement with these historically significant artifacts.

Digital Documentation of Heritage Site in Karachi

Sponsor: Kamil Khan Mumtaz Architects
Funding Amount: Confidential
Project Initiated in: 2022

The project involves scanning of the House located at 234 Staff Lines, Karachi, tentatively in the month of June 2022. The project proposes to conduct a survey of a portion of heritage site in Karachi and provide results in the shape of raw scans in a non-proprietary format.

Epigraphic and Petroglyphic Complexes of the Upper Indus: Digital Preservation and Promotion of Written and Visual Cultures

Sponsor: Social Sciences and Humanities Research Council of Canada (SSHRC)
Funding Amount: PKR 45,254,182
Project Initiated in: 2021

Upper Indus sites with concentrations of ancient inscriptions and rock drawings are threatened with inundation in a flood zone of the Diamer-Basha dam. Inscriptions and rock drawings are essential to understanding cross-cultural interactions along passageways through the Karakorum, Hindu Kush, and western Himalayan Mountain chains. Irreplaceable records of local inhabitants, merchants, monks, and other itinerant communities require careful attention. Many sites are endangered not only by the prospect of flooding, but also by human damage. It is therefore imperative to use advanced methods of digital imaging to preserve important evidence of written and visual cultures. The objectives of this project are to understand how Upper Indus inscriptions and petroglyphs expand our knowledge of history and intercultural exchanges in a contact zone between South Asia and Central Asia, and improve access to published documentation, archival information, and findings from field research.

Scanning of the Surkh Posh Bukhari Complex and Bibi Jiwandi Complex in Multan

Sponsor: Group Aid
Funding Amount: Confidential
Project Initiated in: 2020

The project aims to digitally preserve Surkh Posh Bukhari Complex and Bibi Jiwandi Complex. Utilizing advanced scanning technologies, the project captures intricate details, dimensions, and textures. The resulting immersive 3D models offer a virtual exploration of these revered complexes. This digital documentation ensures their long-term preservation and wider accessibility for researchers and enthusiasts. By curating a comprehensive database, the project enhances understanding and appreciation of Multan's architectural heritage. This fusion of technology and cultural preservation showcases the significance of digital documentation in conserving Multan's Surkh Posh Bukhari Complex and Bibi Jiwandi Complex.

Upper Indus Petroglyphs and Inscriptions in Northern Pakistan: A Partnership for Cultural Heritage Preservation and Promotion

Sponsor: Social Sciences and Humanities Research Council of Canada (SSHRC)
Funding Amount: PKR 1,723,118
Project Initiated in: 2018

Irreplaceable concentrations of rock art and inscriptions along the Upper Indus River in northern Pakistan are threatened by plans to construct the Diamer Basha dam, which would submerge the majority of approximately 50,000 petroglyphs and 5000 inscriptions. These vital records of regional and world cultural heritage created by visitors and residents from prehistoric times to the present reflect remarkably diverse visual symbolism, languages, and writing systems, which testify to cross-cultural exchanges, religious transmission, and intertwined networks for migration and trade in the high mountain environment where the Western Himalayas, Karakoram and Hindu Kush ranges converge. This project aims to address urgent challenges of preserving cultural heritage, providing access to high-quality documentation, advancing scholarly and public understanding, and promoting cultural tourism by applying state-of-the-art 3D scanning technology and imaging techniques to sites with petroglyphs and inscriptions on the Upper Indus River and its tributary valleys.

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Revisualizing the Culture, Religion and Architecture Eroded over time due to Urbanization and Geo-political Changes

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

In Pakistan, particularly in the Punjab, the change of rule from the Mughals to the Sikh rulers and subsequently to the East India Company in 1849 and then Partition in 1947 brought about countless changes to the architectural and cultural landscape of this region. Alongside these movements, there have been untiring efforts by a few people to preserve historic sites in Lahore and elsewhere, but their focus has mostly been monuments built by Muslims or better still, the Mughals. Little, or almost no efforts have been made to conserve on-site or document on-paper non-Muslim historic structures, especially the ones built by Lahore's Hindu or Jain residents. None of them are properly enumerated and considered significant enough to be sheltered by the Antiquities Act or listed as UNESCO heritage sites. As a result, a large number of these structures have been silently reduced to rubble. On-site conservation requires more funding and a larger group of workers as compared to digital conservation (in the scope of this project). Therefore, digital preservation of these sites in visual and/or textual form is a logical first step. The project aims to combine authentic archival material with modern technologies of presentation to reimagine the non-Muslim presence in pre-Partition Lahore. The study includes documenting both sacred (places of worship and funerary monuments) and secular places (bungalows and mansions or *havelis*).

The Sikh Artefact Catalogue and the Web Portal

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

This project focuses on the inadequate facilities that Pakistani museums offer to their visitors and viewers. The two major problems are limited accessibility, and inaccurate/incomplete labels and descriptions. To address the first issue, this project aims to digitise museum items and develop an online catalogue featuring those items. Since simple photographs cannot correctly present all aspects of an artefact, the target is to create 3-D models of each object. Furthermore, their historic significance and correct description is not only expected to be presented in the online catalogue but is also to be shared with the concerned museum/gallery authorities to be displayed with the actual objects. To increase awareness about these objects and the rich culture of Pakistan, a printed version of this catalogue is also in preparation.

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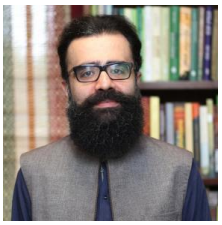

Walking in the City: Mapping Everyday Life in Lahore

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

This project was the part of a course offered at LUMS in fall 2019. It aimed at understanding the meaning of dwelling in the context of Lahore's social, cultural, religious, and political milieus. There have been various representations of Lahore's historical past in academic works and imagining of its rich life in arts and literature. For the modern period, Lahore is a quintessential colonial city dotted with symbolic structures of British political power and its attendant civilizational mission. In the postcolonial period, there is an abundance of literature that nostalgically recounts city life that richly contributed to art, literature, and music. The purpose of this course is to bring these various strands together that helped produce and imagine Lahore in different ways. This project made use of short clips from our trips, added specialist commentary of faculty members involved in the project, and used it for a website and an App specifically made for this project. In this way, the website and App offer an informed overview of Lahore's complex history.

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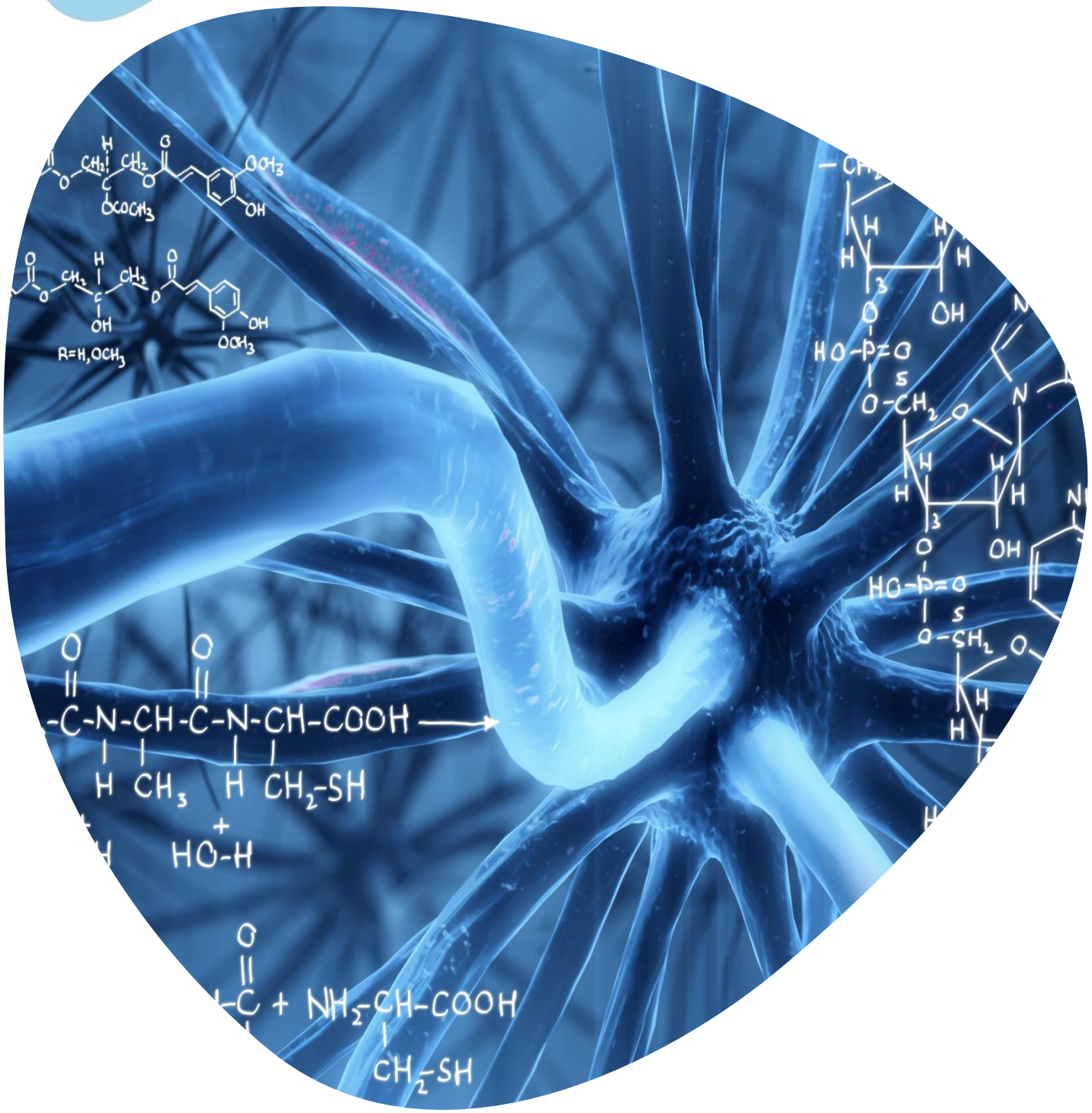
Explaining the Globalization of Aviation through the Greater Middle East

Sponsor: LUMS
Funding Amount: PKR 800,000
Project Initiated in: 2022

This project examines the history of civil aviation in the greater Middle East – the region from Egypt to Pakistan/Afghanistan. This project explores development of Middle Eastern airlines from their formation in the late 1940s through to their massive expansion in the 1960s. By placing this development within the political, social, and economic currents of its time, the project provides much needed historical context for current political debates about impact of COVID on international aviation.



NATURAL SCIENCES

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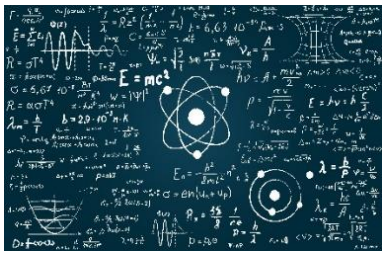
Open Quantum Systems beyond the Born-Markov Regime

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 1,872,324
Project Initiated in: 2017

This project is about studying the dynamics of open quantum systems, that is, realistic quantum systems which interact with their surroundings. The area has attracted tremendous attention due to its importance towards practical implementation of futuristic quantum technologies and the quantum to classical transition. Unfortunately, finding the dynamics is usually very hard, and a variety of approximations and assumptions are made. Therefore, the research project aimed to study open quantum system dynamics without invoking these assumptions as much as possible. In particular, the central aim of this project was to study the effect of initial system-environment correlation using an exactly solvable model.



Theoretical and Experimental Quantum Parameter Estimation

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

The ability to precisely measure unknown quantities - 'parameter estimation' in fancy language - is at the very heart of science and engineering. Advances in technology have made it possible to go towards ever increasing miniaturization, leading to the need for even higher precision in parameter estimation. This project deals with parameter estimation on the microscopic scale, both theoretically and experimentally. The proposed project tries to address the problem of parameter estimation using a detailed quantum mechanical analysis and moreover present a workable hardware prototype experiment to test the theory.

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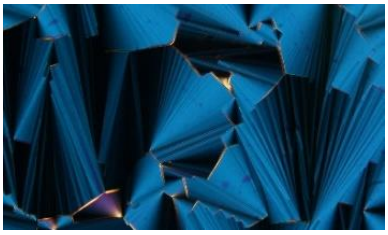

Smart Patterned Liquid Crystal Electrically Modulated Optoelectronic Devices

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2019

Liquid crystals (LCs) are materials that possess physical properties which are intermediate between a crystalline solid and an isotropic liquid. LCs possess a higher degree of orientational and/or positional order than liquids but aren't as ordered as a solid crystal. The fundamental ability of being able to modulate physical properties of LCs by the application of electric fields makes them very useful and versatile from a device applications perspective. This project aims to use LCs in a series of different device architectures to take advantage of their electrically tunable properties.

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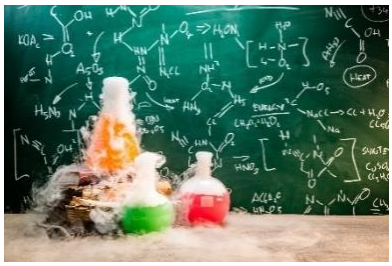


Design and Production of Scientific Equipment for Physics Teaching and Research

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 13,394,000
Project Initiated in: 2019

This project focused on the development of scientific equipment for physics research. This endeavour has two main purposes: to incite a passion for scientific investigation and to create self-reliance amongst our nation. This project has created an array of tools and equipment that can help students learn, scientists do research, innovators transform their ideas into real systems, enthusiasts satiate their scientific curiosity, and laypersons understand their surroundings better. The instruments include programmable and high voltage power supplies, data acquisition devices, motor controllers, nanofiber generating systems, and fog and dust monitoring devices, to name a few. These lab equipment and research-grade instruments, in terms of their robustness and scientific precision, are made to compete against international manufacturers.

EE Technology Product Development Fund

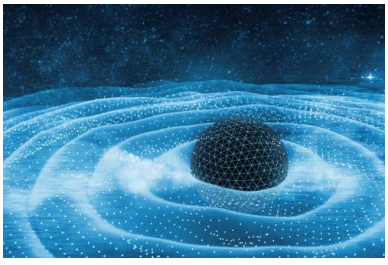
Sponsor: Consortium
Funding Amount: PKR 3,000,000
Project Initiated in: 2022

The primary purpose of this project is to support the triple helix model of innovation to solve local problems and global challenges. Led primarily by the Electrical Engineering Department, the TPDF is set up as an accelerator fund to take academic research outcomes to the next stage for productization and commercialization leading to local job creation, indigenous high value-added products, increasing exports of high value-added products and reversing the de-industrialization of Pakistan. TPDF aims to provide the long-term sustainable platform and connect innovative minds to local industrial partners for the commercialization of prototypes and solutions related to eelectronics and embedded Systems, renewable energy and smart power grids, industrial automation and intelligent systems, biomedical devices and systems and green technologies for sustainability and environment.

First Steps Towards Establishment of a Laboratory for the Ultrafast Characterization of Spintronic, Photovoltaic and Quantum Materials

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 16,373,907
Project Initiated in: 2020

This project aimed to establish an experimental facility that allowed characterisation of physical processes on the ultrafast (>femtosecond) time scales. This is achieved by a femtosecond laser oscillator in which the active medium is a titanium-sapphire single crystal. The seed pulse is split into two pulses, a pump beam that falls onto the sample of interest and a subsequent pulse, called the probe delayed by a time interval ranging from femtoseconds to nanoseconds that subsequently negotiates the out-of-equilibrium state of the material as a function of time. Spatial sampling of the beams also gives the possibility of spatial mapping of processes. The processes that were investigated as test experiments are novel and include some interesting aspects in the burgeoning field of Femtomagnonics. This work provided impetus to foray into topological materials and will be the steppingstone for follow-up and alternative funding applications to purchase additional components that allow a complete setup to be built that utilises higher energy pulses allowing us to access non-perturbative regimes and excitations far from equilibrium.



Outreach and Learning with Cosmic Ray Muons, Augmented Reality and Astrophysics Laboratory Experiments

Sponsor: National Centre of GIS and Space Applications (NCGSA)
Funding Amount: PKR 8,004,000
Project Initiated in: 2021

This is a multi-faceted project whose main aim is to create awareness in the public sphere and educational institutions. The project promises the creation of new linkages, a new curriculum for astrophysical investigations in the astronomy, physics, or astrophysics laboratories. New products, processes, software, and firmware are also expected to emerge from this research.

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UV Printable Functional Interfaces: Fabrication of Sensor and Antimicrobial Surfaces

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

The practice of overlooking environmental impact, and impact on the health for that matter, of human activities in quest of achieving economic robustness is alarmingly prevalent in the developing countries. The origin of the poor state of health of the population of a country can be traced back to malnutrition that results in the compromised immune system that ultimately makes the population more vulnerable to the effects of environmental contaminants. Pathogenic microorganisms (e.g., bacteria, viruses, parasites, fungi), and chemical contaminants (e.g., toxic metals, toxic gasses) are among the chief environmental contaminants that have direct impact on health. Such a dismal state demands urgent attention in terms of development of facile technologies for monitoring and countering these intertwined challenges, and the current project precisely aims at addressing these issues. Specifically, this project aimed to develop UV printing technology for the development of two types of functional interfaces: sensors for the detection of toxic contaminants and antimicrobial surfaces to combat against pathogenic microorganisms and multidrug resistance. The proposed activity will lead to the development of easy to fabricate and low-cost sensors to monitor toxic chemical contaminants.

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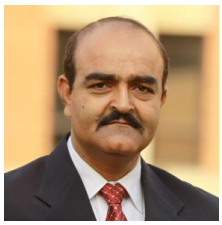

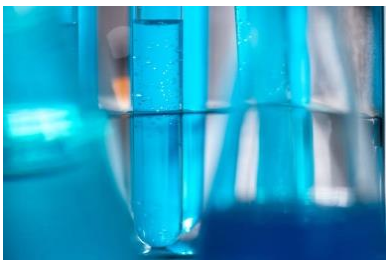

Characterization and Development of Chemicals and Materials of Commercial Value

Sponsor: Cmyk Research & Development
Funding Amount: PKR 600,000
Project Initiated in: 2020

Acrylate based polymers are used as adhesives, binders for paints and printing inks, lacquers, etc. These acrylate-based polymers can be synthesized through several routes. This study is focused on developing polymers using the esterification process. The monomers required for acrylate-based polymer synthesis can be produced through the esterification process. Therefore, research is conducted in the development of relevant monomers which can then be polymerized into the required molecular weights for desired properties. Currently such polymers are being imported in Pakistan. The project is aimed at developing these polymers by doing R&D at LUMS Chemical Engineering Research Centre.

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Fused (hetero) ArylPyrazines for Potential Applications in Material and Biological Sciences

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 14,952,000
Project Initiated in: 2022

This project aims to design and synthesize some novel aromatic building blocks that are highly sought in the fields of optical/electronic organic materials and organic polymers. Some of the synthesized new heteroaromatics are also expected to have interesting biological activities (anti-bacterial and anti-cancer). Specifically new structural patterns of fused heteroaromatics such as phenazines can be synthesized and completely characterized. They are analysed for their medicinal properties.

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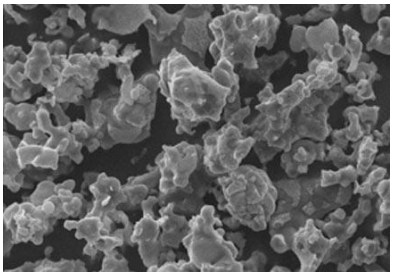

Development of Functional Materials for Energy Efficient Separation of Oxygen from Air using Chemical Looping Air Separation

Sponsor: LUMS
Funding Amount: PKR 990,000
Project Initiated in: 2021

The demand of medical oxygen has seen a significant increase owing to COVID-19 pandemic as it is the primary treatment for most patients suffering from severe respiratory issues. With limited medical oxygen production facilities and a substantial increase in demand, a serious shortage of medical oxygen has been identified during the COVID-19 pandemic. Medical oxygen contains at least 82% pure oxygen and is free from any contaminations. It is typically produced by the cryogenic distillation of air and is provided to the hospitals in cylinders filled at industrial gas plants. Cryogenic distillation is both a cost and energy-intensive process. Chemical looping air separation (CLAS) is a promising alternative to the cryogenic air separation to produce pure oxygen. CLAS is a two-step process in which a solid oxygen carrier facilitates the separation of oxygen from air. This project aims to synthesize and characterize novel oxygen carrier compositions that can further lower the operating temperature range of CLAS operation, thereby making it more energy efficient.

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Determination of Epigenetic Mechanisms Underlying the Differentiation of Trophoblast Stem Cells

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

Most polyploid cells in the human body serve a specialized purpose and do not divide. When polyploid is induced in normal cells through genetic or biochemical manipulations, they quickly undergo programmed cell death or apoptosis. This means that these cells cannot tolerate or maintain a polyploid genome. Thus, a fundamental question in biology is how nature allows some cells to become polyploid but not the others? Another equally important question is what makes polyploid cells resistant to apoptosis? This area of biology remains largely unexplored. This project aims to study the epigenetic mechanisms underlying the differential gene expression during placental development using TS and TG cells. Overall, the findings are expected to help in understanding placental development in mammals at molecular level and provide insights into how polyploid cells avoid apoptosis in diseases such as cancer and Alzheimer.

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Reverse Genetics Approach to Link Epigenetic Cell Memory and Cell Signalling

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 9,659,998
Project Initiated in: 2017

The project aims to employ a combination of ex vivo and in vivo genome-wide RNAi screens to achieve genome-wide search for all the PcG and TrxG regulators, i.e., kinases and gene regulatory networks, and functionally validate the candidates in vivo. The primary goal of this project is to accomplish a genome wide survey of genes that regulate the PcG and TrxG activity in Drosophila, identification and validation of new genes is carried out using the available Drosophila ex vivo and in vivo whole genome RNAi libraries.

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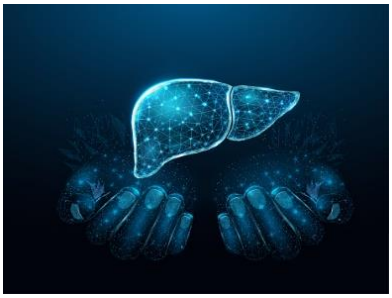

Identification of New Inhibitors of Drug Resistant Variants of Hepatitis C Virus RNA-Dependent RNA Polymerase and its Structural Investigation

Sponsor: German Pakistani Research Cooperation Program - DAAD
Funding Amount: PKR 3,235,975
Project Initiated in: 2021

Hepatitis C virus (HCV) infections occur in approximately 2.8% of the world population and these infections continue to be a major global health concern. In Pakistan, over 5% of the population is infected with this virus. In recent years, several direct acting antiviral (DAA) regimens against HCV have been approved that can treat the infection. However, due to a rapidly evolving nature of the virus, drug resistant viral variants emerge quickly – resistance against most of the currently used DAAs have already been reported in 10 to 30% individuals. This scenario signifies a continuous effort to develop new drugs against HCV against drug resistant variants. HCV is a positive sense RNA virus that requires RNA-templated RNA synthesis during its replication. Viral RNA-dependent RNA polymerase (RdRp) catalyses this process of new viral RNA synthesis thereby playing a crucial role in viral replication, and therefore represents an important target for therapeutic intervention. This project aims to identify new inhibitors of RdRp of HCV genotype-3a that is the most prevalent genotype in Pakistan and of its drug resistant variants and solve crystal and/or cryo-EM structures of these RdRps in complex with identified inhibitors or smaller fragments.

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Advanced Photonic Devices using Two-dimensional Semiconductors

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

This project proposes the development of a quantum light photonic device based on 2D semiconductor which can not only be useful for traditional photonics application but also employable in futuristic quantum technology applications. The project utilizes the resources available within Physics department as well the central labs at LUMS to fully develop the device from material processing to device fabrication to testing and characterization. The resulting procedures can form a template for further research within LUMS for the development of advanced photonic devices not only for traditional photonic industry as well as devices meant for quantum technology applications.

SPECTRAL THEORY

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Rayleigh-Faber-Krahn inequalities for Dirac Operators

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

The main idea of the proposed project is derived from an old conjecture by Rayleigh which was based on the observation that: given two regions with the same volume, the one with the largest boundary should be the one that loses heat the fastest. This project focuses on RFK type inequalities for a Dirac operator defined on metric graphs. Dirac operators can be considered as formal square root of the Laplacian. One of the key challenges involved in this study is that, unlike Laplacian, the spectrum of Dirac operator has no bottom and hence the idea of lowest eigenvalue does not make sense, as there is no lowest eigenvalue. One of the most recent developments in the spectral analysis of Dirac operators is the availability of a variational principle. This principle allows one to concentrate on a fixed interval containing a part of the spectrum. This research is planned to exploit this feature and study the positive spectrum.

Surgical Transformations and Spectral Estimates of Quantum Graphs

Sponsor: LUMS
Funding Amount: PKR 960,000
Project Initiated in: 2020

This research project is aimed at the spectral estimations of quantum graphs. Quantum graphs can be imagined as a vibrating network of strings. If any of the strings are plucked, vibration carries along the whole network. Standing waves are formed at certain fixed frequencies of the vibration. These frequencies are called eigenvalues, or more generally, spectrum of the network. The corresponding standing waves are called eigenfunctions. The objective of this project is to develop analytical tools to estimate these eigenvalues. One of the main ideas in estimating the eigenvalues is surgical operations on graphs. By surgical operations it means the set of transformations which changes the basic geometry of a graph with a predictable effect on the eigenvalues. Basic surgical operations include cutting the graphs at certain edges or vertices, gluing together different vertices and/or edges, and increasing or decreasing the overall volume of a graph. By using these surgical operations one can transform a given graph into a relatively simple network whose eigenvalues provide certain bounds on the original graph. The aim of this project is to explore the connection and precise dependence of the spectrum on the topological properties of quantum graphs to develop ideas and techniques for establishing sharp estimates on the spectrum in terms of topological parameters of the underlying graph.

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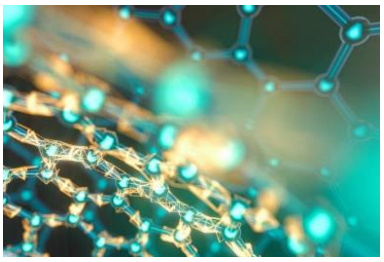

Building from Scratch: How Nanomaterials can Help Resolve Membrane Scaffold Geometry and Function

Sponsor: Human Frontier Science Program
Funding Amount: PKR 33,756,478
Project Initiated in: 2016

Life depends on the membrane compartmentalization of the cell. Membrane proteins and their organizing scaffolding proteins maintain the flow of information and materials across the membrane. This project advances the characterization of membrane and membrane associated proteins by developing novel electron microscopy and biochemical experiments enabled by new nanomaterials.

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Making Green Chemistry Greener: Exploring a Shorter Synthetic Route for the Production of Important Industrial Intermediate

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

With the increasing awareness about environmental pollution and its detrimental effect on human (and other living organisms) health, efforts are being made to develop new green chemical processes that are more environment friendly. Green chemistry, also called as sustainable chemistry, is an area of chemistry focused on the designing of products and processes that minimize the use and generation of hazardous substances. This research focused on the development of a shorter, atom economical synthetic route for the preparation of arylboronic esters that are extremely important industrial intermediates and are extensively used in drug synthesis as well as in discovery programs, synthesis of agrochemicals, organic electronic materials, polymers etc. These efforts resulted in the reduction of one step in the synthetic route of this class of industrially important compounds, significantly reducing the amount of waste generated, number of solvents consumed, time, as well as the energy utilized during the synthesis.

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Design and Development of Highly Efficient Photocatalyst for the Capture and Conversion of Carbon Dioxide to Fuel - A Step towards Carbon Circular Economy

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

This project proposes to develop composites of gold doped titania nanoparticles, MOPs, and graphene acting as a channel for carriers' transport and improve the efficiency of carriers' separation and transport; and solve the key problems in the photoconversion of CO_2 such as weak adsorption ability of traditional catalysts for CO_2 molecules, low conversion efficiency, and selectivity, through the pore structure design of microporous polymer and the adjustment of the metal catalytic activity center.

Organic-Inorganic Hybrid Microporous Polymeric Nanocomposites for the Capture and Conversion of CO_2 - Applications in Environment and Energy Technologies

Sponsor: Pakistan Science Foundation (PSF)
Funding Amount: PKR 6,300,000
Project Initiated in: 2021

The capture and conversion of carbon dioxide (CO_2) has the most important significance to alleviate the global warming and greenhouse gas effect by reducing the reliance on fossil fuels energy. However, the capture and conversion of low concentration of CO_2 in the atmosphere under mild conditions is a formidable challenge in this regard. In order to address the problems associated with low adsorption capacity and low efficiency of catalytic conversion of CO_2 (photocatalysis and chemical conversion), this project proposes to combine the high specific area of hyper crosslinked microporous polymer (HCPs) with highly efficient nanocatalysts through the cooperation of China and Pakistan by exploiting the research experience of both sides to achieve high efficiency of CO_2 adsorption and chemical/photo reduction under mild conditions.

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Complete Valorization of Crop Residues into Industrially Relevant Chemicals via Efficient Catalyst Design

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

Efficient utilization of biomass in a biorefinery to produce fine chemicals requires the isolation of its stubborn constituent lignin followed by its selective breaking to obtain aromatic compounds. However, the refractory nature of bonds contained by lignin makes its degradation challenging. Additionally, all attractive forces (bonds) among the building blocks of lignin must be broken to achieve a high yield of monomeric products. This project aims to develop such materials (catalysts) capable of breaking attractive forces in the lignin to achieve a high yield of chemical products.

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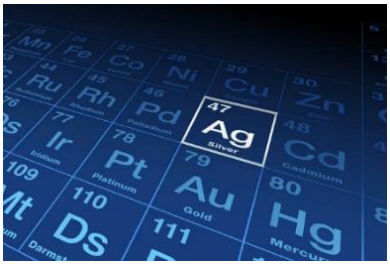

Synthetic Applications of Transition Metal Catalysed Borylation and Suzuki Coupling

Sponsor: University of Hail
Funding Amount: PKR 1,414,873
Project Initiated in: 2021

There are multiple synthetic routes available to create small organic molecules for the pharmaceutical and agrochemical industry. Recently, efficient "coupling" reactions have been developed, combining two molecules to form a new carbon-carbon (C-C) bond. The Suzuki coupling reaction is a useful method that earned its inventors the 2010 Nobel Prize in Chemistry for its broader significance in building complex molecules. This reaction uses arylboronic esters to form C-C bonds, which are traditionally prepared through a long synthetic procedure. However, a new iridium-catalysed reaction has been developed that forms organoboron compounds directly from hydrocarbon feedstock, making it a highly efficient method that is tolerant to a variety of functional groups. This technology has been extensively applied to various aromatic derivatives, but its application to heteroaromatics such as substituted pyridines has not been fully examined. This research project aims to synthesize new heteroarylboronic esters of pyridines, which are highly sought after building blocks in the pharmaceutical and organic electronic materials industries. The aim is to demonstrate the application of arylboronic esters in the preparation of bioactive molecules, such as carbazoles and agrochemicals like Boscalid derivatives.

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Maximization of Boiler Efficiency through Process Simulation and Optimization

Sponsor: Bulleh Shah Packaging
Funding Amount: PKR 1,276,000
Project Initiated in: 2022

This project aims at optimization of boiler powered by multiple biomass resources. More specifically, the main objective of this project is to maximize boiler efficiency by optimizing key operating parameters, such as air temperature in the combustion chamber, feed water temperature, air to fuel ratio, biomass moisture content, etc. As biomass quality is a big challenge in achieving high boiler efficiency, therefore, this research also investigates the impact of biomass pre-treatment before its combustion. The most notable pre-treatments would be biomass shredding and dehydration that may help in a smooth and controlled process with improved efficiency.

AGRICULTURE

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Social Network Analysis for the Adoption of Conservation Agriculture Practices in Pakistan

Sponsor: LUMS
Funding Amount: PKR 980,000
Project Initiated in: 2021

The proposed research aims to analyse one of the largest online communities of progressive farmers in Pakistan that operates primarily through WhatsApp groups under the umbrella of an NGO Pedaver. The objective is to understand the structural aspects of this community and to analyse its potential role in the diffusion of these novel conservation agricultural practices throughout the country.

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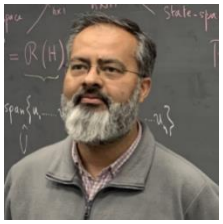

NCRA Agricultural Robotics Lab

Sponsor: Higher Education Commission (HEC)
Funding Amount: PKR 100,888,000
Project Initiated in: 2018

The proposed lab aims to setup a state-of the-art national precision agriculture facility, with a focus on agricultural robotics and automation, and a clear path from scientific problem solving to technology roll-out for each theme. Moreover, the project proposes technological advancements that fall under the general philosophy of assistive technologies that are respectful of the human labour-automation dynamics in our current society and may gain easier acceptance over fully autonomous solutions.

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Model-Based Assessment of Agrivoltaic Farming in Pakistan for Synergized Food-Energy-Water Solutions

Sponsor: LUMS
Funding Amount: PKR 996,000
Project Initiated in: 2020

This project proposes to design a programmable energy balance system that can autonomously adjust the balance of incident sunlight between solar panels and the specific crop in the AV farm based on the real-time light requirements considering local climate conditions in Pakistan. This includes developing solar tracking algorithms for the panels and the crop yield predictions under varying sunlight patterns based on established crop models throughout the year. The goal is to propose optimized AV farm designs for the major crops of Pakistan such as wheat, cotton, rice, and vegetables etc., and identify which crops are more suitable to be integrated in an AV farm.

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Integrating Remote Sensing and In-Situ Sensor Data for Reliable Irrigation Decision Support in Smart Farming

Sponsor: LUMS
Funding Amount: PKR 996,000
Project Initiated in: 2022

The project aims to revolutionize the hydrologic monitoring systems in Pakistan by leveraging cutting-edge computational and statistical methods. This project represents a crucial step towards bridging the gap between indigenous tools and global satellite data, ensuring more accurate and reliable irrigation decision support in the face of rapidly changing climatic conditions. By integrating remote sensing and in-situ sensor data, the project seeks to enhance the precision and efficiency of smart farming practices, empowering farmers with timely and informed irrigation management strategies. Through this transformative initiative, the project team envisions a sustainable and resilient agricultural sector that can adapt to the challenges posed by a changing climate and secure food production for the future.

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Development of Commercial Use of Lime being produced at Fatima Fertilizer Company Limited

Sponsor: Fatima Fertilizer Company Limited
Funding Amount: PKR 1,300,000
Project Initiated in: 2020

The crucial importance agriculture holds in Pakistan cannot exclude fertilizer as an important supplement when it comes to increasing productivity of the land and producing quality crops. There are three main fertilizer manufacturers in Pakistan: Fatima Fertilizer Company Limited (FFL), Fauji Fertilizers, and Engro Fertilizer. FFL is the sole producer of Calcium Ammonium Nitrate (CAN) in Pakistan. The goal of this partnership is to ensure the maximum utilization of Calcium Chloride (CC) at CAN plant by recommending any changes in the process or suggesting any post-treatments for CC; providing potential buyers suggesting any valuable product to FFL where this CC can be converted; and the development of new products where CC can be used as feedstock.

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Water-Energy-Food Nexus: An Integrated Approach for Active Demand Management of Surface Water in Pakistan

Sponsor: LUMS
Funding Amount: PKR 980,000
Project Initiated in: 2019

The objective of this project is to improve the overall agricultural productivity in Pakistan by designing a system level policy for an efficient and fare distribution of surface water resources at the farm level. The primary contribution in this research project is the design of a novel mechanism for the distribution of available surface water at the farm level. Instead of having a fixed schedule, the project proposes an active demand-based mechanism in which farmers can communicate their crop water requirements to the concerned departments and receive surface water when their crop needs it the most.

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Agricultural Supply Chains

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2022

Farming remains the predominant occupation and source of income for 48% of the population of Punjab. Recent studies have also provided suggestive evidence on the exploitation of farmers by middlemen through low offer prices and informal loans. Furthermore, agents that conduct the auctions push up the bid price for essential commodities leading to inflated retail prices and large welfare losses. Very little research has been conducted to investigate this influential position occupied by the different tiers of middlemen in the agriculture supply chain in Pakistan and no steps have been taken to find alternatives. This study is expected to generate evidence on the facilitative or exploitive role played by middlemen during natural calamities. It is seeking to uncover avenues through which the agents' role can be improved or minimised with alternatives to the current archaic market mechanism through a partnership with the Government and the private sector.

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Agri-business Sector Diagnostics

Sponsor: Adam Smith International (ASI)
Funding Amount: Confidential
Project Initiated in: 2020

Sustainable Energy and Economic Development (SEED) is a £37.5 million programme that aims to support provincial economic development and sustainable energy in Pakistan. It supports the province of Khyber Pakhtunkhwa (KPK), to plan and finance the infrastructure and investment it needs for growth, jobs, and prosperity. The programme also addresses Pakistan's energy crisis by providing innovative financial solutions to industry for the adoption of sustainable energy practices. The objective of this partnership is to support the SEED program in mapping the current and potential landscape of the Agri-Business sector in KP; identifying and analysing key sector players to enhance sector outreach and engagement; provide a gap analysis and identify opportunities for provincial level investments and interventions in the sector.

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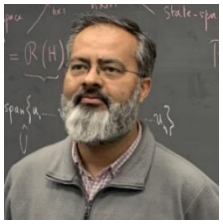

A Hydro-Informatics Test-Bed for Smart Irrigation and Flood Prediction Applications in the Namal Valley

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

This project aims to mathematically describe the dynamics of Namal Lake. Due to the lack of instrumentation in the current setting of the lake, first physical modelling is expected to be explored based on the historical data sought from the Irrigation Department, and in the meanwhile, instrumentation can also be pursued. Later, with the availability of data, system identification models can be sought and used to propose better control and monitoring strategies for the lake.

AMS-HyRes (Autonomous Mobile Sensors for Hyper-Resolution Hydrology)

Sponsor: University of Kaiserslautern
Funding Amount: PKR 10,008,574
Project Initiated in: 2021

River basins around the world are facing rapid large-scale environmental changes brought about by natural forces that have been unleashed by climate change. The impact of these changes is felt the most in water sector, in poor management of irrigation networks, depleting groundwater, deterioration in water quality, poor sanitation and difficulties in preservation of ecosystems. Difficulties in collection of water samples from remote or inaccessible locations and the challenges in continued structural monitoring of resources has prompted the need to propose robotic sensing solutions. This study aims to develop and deploy semi-autonomous sensor floats that can produce surveys of water channels using standard techniques of simultaneous mapping and localization. A framework to incorporate the robotic surveys into hydrodynamic models for increasing the temporal and spatial resolution of existing surface hydrology models will be set up.

Analysis of Water Channel Beds in Pakistan Using 3D Point Clouds and Identification of Obstacles

Sponsor: Hawk Eye
Funding Amount: Confidential
Project Initiated in: 2021

This project is based on a collaboration between Hawkeye and LUMS for providing support to LUMS Water Informatics and Technology (WIT) Centre and its sister unit NCRA Agriculture Robotics, to work together on the analysis of water channel beds in Pakistan using 3D point clouds and identification of obstacles over it. The aim of the

study is to find technological solutions that can efficiently analyse water channel beds underwater. Additional outcomes include the publication of research outcomes in peer-reviewed journals and conferences with acknowledgment of Hawkeye's support.

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A Regional-Scale Integrated Risk Assessment and Predictive Modelling and Simulation Framework for Arsenic Water Management and Remediation

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2021

The proposed research aims at advancing science in the priority area of water management and sustainability in Punjab. The research objective is to develop an integrated and validated risk assessment and predictive modelling framework for arsenic water management and remediation for Punjab. This work provides a basis for a nation-wide management framework for other contaminants.

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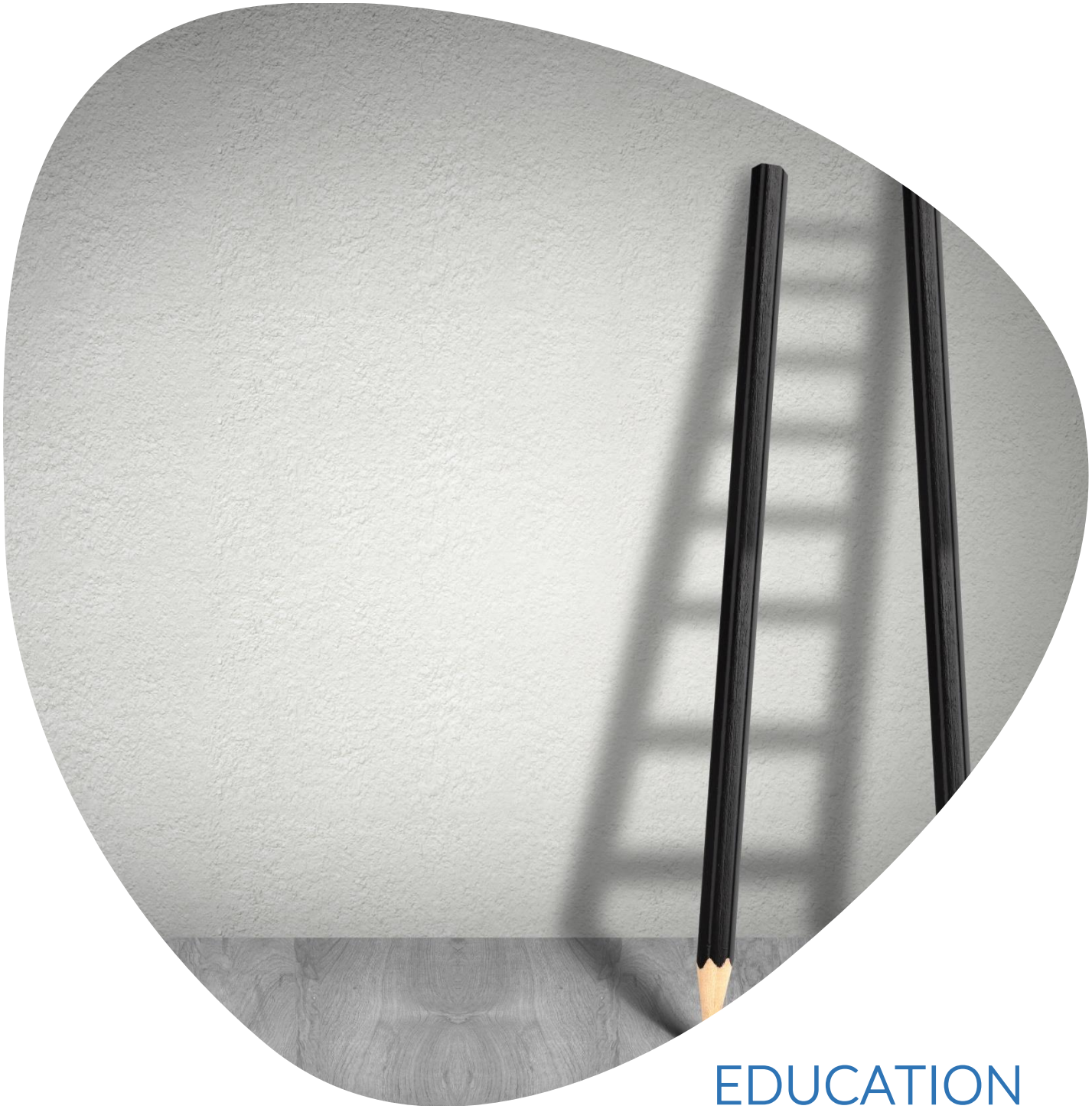

EDUCATION

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Islamic Corporate Financial Reporting: AAOIFI standards, interpretation, and application

Sponsor: LUMS
Funding Amount: PKR 975,000
Project Initiated in: 2020

This project involves developing an up-to-date academic textbook for students of Islamic accounting which can be used as the main resource when taking a course on the subject. The textbook is expected to provide a complete technical coverage of the updated Islamic accounting standards with comprehensive guidance, explanations, examples, and end of chapter questions. An important feature of each chapter is a discussion of how the Islamic accounting treatment compares with the mainstream IFRS accounting and reporting regulations. Again, this comparison includes worked examples illustrating clearly where the similarities and differences lie. In addition, complete student and instructor resources are developed including question banks, power point presentations and a solutions manual. This is intended to be a very user friendly and easy to read textbook and reference guide for all types of students and learners (including undergraduate, masters and industry practitioners).

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Translanguaging Practices in English Language Classrooms in Pakistan

Sponsor: University of Reading
Funding Amount: PKR 6,532,573
Project Initiated in: 2022

This project focuses on carrying out research on classroom interactions in primary and lower secondary to identify the language mixing, also called as translanguaging, that occurs in peer-to-peer and teacher-to-learner interactions as well as the teaching strategies that are currently used in linguistically diverse settings across Pakistan. The project aims to establish successful translanguaging practices that are used in schools along with development of course outline and content that is required by primary teachers of English to prepare subject learners for transition to lower secondary and the medium of English, and the materials that are essential to harness the enormous potential of translanguaging for the learning of English in formal schools.

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Online Teaching Platforms: A Panacea to Pakistan's Educational Woes?

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

In the face of a spiralling upward demand for education, the pressure on students to secure top marks in national matriculation and intermediate exams is tremendous. In this scenario, there is a rise in students resorting to tuition centres which may act either as substitutes for or complements to the conventional education system. In the same vein, mobility restrictions for women, and the sheer dearth of quality teachers in some areas of Pakistan mean that there is a pressing need to connect students to other resources. The online education platform proposed for this project serves both these functions. By connecting students to classes provided by teachers known to deliver results, it fills the vacuum for those students that lack access while also supplementing access to quality material to those who are looking to score well on their exams. This project studies the impact of the chosen online platform during peak exam preparation time (February and March 2020) when demand for the online platform is highest. Through a free trial, the research proposes setting up two arms to isolate the causal impact of an online teaching platform on test scores for a national education exam in Pakistan.

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Experiential Workshop on Evolving Math Circles Outreach in Pakistan

Sponsor: Pak Alliance for Math and Science
Funding Amount: PKR 1,399,300
Project Initiated in: 2022

The aim of this workshop is two-fold: firstly, providing the motivation for the math-outreach programs and value, secondly, providing hands-on experience to participants about conducting math circles. This workshop is intended to equip the participants with the skills and resources to launch math circles, independently at their respective institutes. This workshop is an excellent platform to build a network of math enthusiasts for evolving the math circle outreach culture in Pakistan.

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Better Health through Partnership in Higher Education and Bilateral Student Mobility: Collaboration between Pakistan and Norway

Sponsor: University of Bergen
Funding Amount: PKR 24,808,078
Project Initiated in: 2022

The aim of this project is to create a bridge between students and faculty from Norway and Pakistan for enhancing the quality of higher education and training in global health. The purpose is to develop theoretical skills for understanding challenges regarding global health and conduct joint courses for health systems management, health care policy, and entrepreneurship & innovation in health care. Another important objective of the project is the need to conduct seminars and workshops to emphasize on gender equality in health sector. Lab based and field-based internships are being offered to students from Norway through Indus Hospital, Institute of Public Health, and Gulab Devi Hospital for developing relevant practical competencies and finding solutions to global health challenges.

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Contested Identities; Competing Accountabilities: The Making of a 'Good' Pakistani Public School Teacher

Sponsor: University of Pennsylvania
Funding Amount: PKR 6,822,272
Project Initiated in: 2020

This study aims to dig deeper and explore a teacher's career paths and the need to take proper measures to assess learning. It is shaped to reform the education in Pakistan and targeting areas like accountability measures, financial redistribution, devolution of authority, and more technical points such as curriculum and assessments. Elite and ethnographic interviews were carried out for field work, data analysis, interpretation and coordinating the collaborative relationship between LUMS SoE and UPenn. This research has a potential to positively change the teaching mechanism in Pakistan by targeting the most important pillar of any education system, i.e., the school teacher. It is significant in developing a sustainable and reliable educational system in the country.

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GCRF Development Award: Education, Justice and Memory Network

Sponsor: University of Bristol
Funding Amount: PKR 12,951,593
Project Initiated in: 2019

The proposed Education, Justice and Memory Network (EdJAM) comes together to contribute towards Sustainable Development Goal, which aims to ensure inclusive and equitable quality education and to promote lifelong learning opportunities for all. A crucial part of SDG4 is its target 4.7, which specifies the kinds of skills, knowledge, and attitudes that education should develop in all learners and includes knowledge and skills to promote a culture of peace and non-violence. This project aims to support the development of sustainable and equitable partnerships in Pakistan. This study enables opportunities for learning and the development processes for safeguarding and risk mitigation and management within EdJAM.

UKRI GCRF: Education, Justice and Memory Network (EdJAM)

Sponsor: University of Bristol
Funding Amount: PKR 7,126,425
Project Initiated in: 2020

This project works to amplify, connect, and develop an evidence base about various approaches, drawing on the disciplines and practices of transitional justice, memory studies, history, heritage studies, politics and education and working with leading civil society partners in Cambodia, Colombia, Pakistan, and Uganda who are doing this pioneering work. This focus enables EdJAM to connect to other SDG challenges, particularly SDG 16 (just, peaceful, and inclusive societies) and SDG 17 (global partnerships) and to ensure that learners in focus countries have a chance to develop the skills and knowledge to build a culture of peace. EdJAM intends to support researchers in Cambodia, Colombia, Pakistan, Uganda and elsewhere in the global south, and researchers in the UK who are early in their career to develop their research capacity, to share new knowledge, and to shape future research agendas. It can commission research to identify and learn from creative approaches to teaching about the violent past through a series of small grants that can produce both academic and creative outputs (e.g., curriculum resources, museum displays, photo exhibits, online materials). EdJAM can commission large grants to explore outcomes of creative approaches to teaching about the past, developing new ways of measuring progress towards SDG target 4.7.

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Doing or Undoing Inclusive Education? The Construction of the Other in Private and Public Primary Schools in Pakistan?

Sponsor: LUMS
Funding Amount: PKR 1,000,000
Project Initiated in: 2020

Research has shown that schools can recapture and reinforce unjust social structures, they claim to challenge. It is important then that we scrutinize the direction of our own educational systems in Pakistan to ensure that we hold true to our commitment to offer inclusive and equitable, quality education to all. School curriculum and textbooks may be the starting point of this exploration to evaluate how the term 'other' is constructed, represented, or excluded in the discourse of textbooks. The study explores the preparation of the Pakistani educational institutions for inclusivity of the marginalized, defined in terms of disability, gender, minority religious and/ or refugee status.

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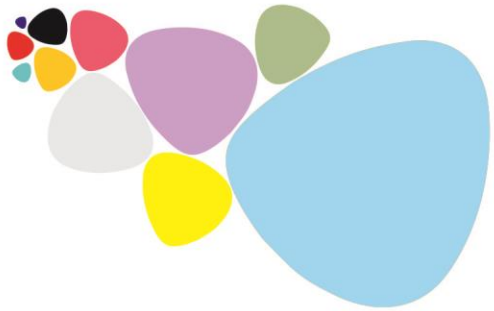

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