Kathmandu University
Research, Development and Innovation

RESEARCH INSIGHTS

Volume 2, 2025

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Research, Development and Innovation

MESSAGE FROM THE VICE CHANCELLOR

It gives me great pleasure to present the second volume of Research Insight, a publication that encapsulates the depth, diversity, and impact of research undertaken at Kathmandu University. This edition not only illustrates our growing academic research capacity but also demonstrates our conscious alignment with Nepal's development priorities and global challenges.

Over the past year, our research ecosystem has witnessed remarkable evolution. From research on climate change, glacial movements, clean energy and hydropower innovations in the country to policy-oriented work in education, governance, and social equity, the projects featured in this edition highlight the efforts and commitment of our faculty, scholars, and students to create and disseminate the knowledge to the community. Our efforts span high-tech laboratories and interdisciplinary research centers to rural classrooms and community health initiatives, demonstrating that research at KU is both globally relevant and locally rooted.

I am particularly proud that this volume highlights projects funded through both internal and external resources. Internally supported research showcases KU's resolve to invest in its scholars, even in the face of limited resources. Externally funded collaborations, on the other hand, reflect our growing recognition and credibility of KU in the international research community.

The Directorate of Research, Development, and Innovation (RDI) has played a pivotal role in fostering a culture of inquiry and engagement. Their continued dedication to strengthening research governance, building institutional partnerships, and ensuring ethical and impactful research is truly commendable.

To our faculty researchers, student scholars, and collaborators, thank you for your unwavering pursuit of knowledge and innovation. Your contributions continue to shape Kathmandu University as a beacon of high-end research, academic excellence, innovation, and societal transformation. These all contribute to make KU a truly a research university of the country and beyond.

May this publication serve as both a celebration of our achievements and a catalyst for further research endeavors that advance sustainable development and greater service to humanity.

Prof. Dr. Achyut Wagle
Vice-Chancellor, Kathmandu University

MESSAGE FROM THE REGISTRAR

A well-known American psychologist, Professor Zimbardo said that academic success depends upon research and publications, and I am very happy to see that the Research, Development, and Innovation (RDI) Directorate is continuously working in the publication of *Research Insights*. Kathmandu University (KU) always believes in its mission to provide quality education for leadership and working tirelessly in maintaining the quality by fostering research excellence and scholarly endeavors.

Our university's research initiatives are based on externally funded and internally funded projects. These externally funded projects have managed to impact at the policy level in various disciplines to enhance academic knowledge but also contribute significantly to societal advancement and national development. These initiatives have engaged a diverse array of stakeholders, including policymakers, industry leaders, and academic experts.

The current issue has highlighted our internally funded projects from the various disciplines which demonstrate the commitment of our researchers in enhancing the research excellence in the university. I believe that the RDI Directorate succeeded in bridging the gap between our institutional achievements and wider public interests through the publication of research updates. Such endeavor of RDI Directorate has helped to reinstate our university's vision to become a world-class university devoted to bringing knowledge and technology to the service of mankind through evidence-based knowledge.

Prof. Dr. Rajeev Shrestha
Registrar, Kathmandu University

FOREWORD FROM THE DIRECTOR

We are pleased to present the second edition of Research Insights, highlighting Kathmandu University's recent achievements, innovations, and impactful research projects.

Since its founding, Kathmandu University has grown into a center of excellence in higher education, built on the principles of academic rigor and ethical research practices. This edition reflects that growth, showcasing diverse inquiries, groundbreaking work by our faculty and scholars, and the growing relevance of our research to Nepal's development and the global scientific community.

The projects featured in this volume cover a wide range of topics—from advanced engineering and green hydrogen technology to education reform, sustainable agriculture, and public health. These initiatives demonstrate our commitment to academic discovery, while addressing national and regional challenges with evidence-based solutions.

As the Acting Director of the Research, Development, and Innovation Directorate, I am inspired by the collaborative approach that drives our research culture. Faculty members, researchers, and students across all seven schools are creating a research ecosystem that is interdisciplinary, globally connected, and focused on social impact.

This volume also highlights our expanding partnerships with government agencies, international organizations, local communities, and private sector stakeholders. These collaborations enhance our research capacity and ensure that KU's work is inclusive, impactful, and forward-thinking.

Importantly, the research and projects presented here align with Kathmandu University's Strategic Plan 2022-2027, reflecting our commitment to fostering innovation and addressing pressing societal needs.

I extend my sincere thanks to all contributors, researchers, coordinators, and collaborators featured in this edition, as well as to the editorial and production teams for their hard work.

We hope this collection serves as a record of our progress and an inspiration for future scholarship, innovation, and meaningful change.

Assoc. Professor Brijesh Adhikary
Acting Director, Research, Development, and Innovation (RDI)
Kathmandu University, June 2025

1 Research History and Culture at KU

Kathmandu University (KU), established in 1991 as an independent public institution, is dedicated to academic excellence and quality education for leadership.

Research has been a vital part of KU's growth, evolving alongside its teaching responsibilities. Over time, KU has cultivated a strong research culture that fosters inquiry, innovation, and impact.

Initially focused on traditional and professional education, KU soon recognized the role of research and innovation in national development. In the early 1990s, faculty-led consultancy projects as well as discussions on research workload and compensation laid the foundation for structured research programs.

1.1 Evolution of Research at KU

The research journey at Kathmandu University (KU) started with faculty efforts in the School of Management and School of Engineering, focusing on consultancy and externally funded projects. This gained momentum with the creation of the **Research Development and Consultancy Unit (RDC-U)** in 1997, following a proposal by Prof. Inge Johansen from NTNU, Norway. The unit was responsible for promoting research funded both externally and internally, supported by an operational policy and handbook developed by visiting faculty Mr. Paul Drinkwater, then Head of Electrical and Electronics Engineering.

By the early 2000s, KU faced challenges in strengthening its research environment. Until late 2001, no research funding applications had been submitted. Dr. Subodh Sharma, then Chairman of RDC-U, played a key role in mobilizing faculty interest, encouraging ethical consultancy, and advocating for higher-quality research. His leadership helped create a more structured and proactive research culture.

By 2003, RDC-U had expanded into a **full-fledged RDC** Committee, with representatives from all KU schools and a mission to promote interdisciplinary research. Leadership figures like Dr. Torger Lode and Prof. Dr. Sitaram Adhikary guided research governance, identifying key challenges, securing funding, and improving ethical research practices.

To further strengthen research, the **RDC Committee** identified seven strategic priorities, including formal donor engagement, graduate research support, and policy development. This led to KU's first Research, Development, and Consultancy Management Policy Document, finalized in 2006 after consultations with the Policy Coordination Committee (PCC) and approved by the Executive Council. This policy introduced administrative structures, funding models, and ethical research guidelines.

In 2015, RDC was upgraded to the **Office of Research, Development, and Consultancy (RDC)**, with a dedicated leadership team including a **Director, Manager, and Finance Officer**, marking KU's shift toward becoming a research-focused institution. Recognizing the growing importance of research, KU restructured RDC as the **Directorate of Research, Development, and Innovation (RDI)** in December 2019, following an Executive Council decision. RDI aims to establish KU as a **"Teaching cum Research**

University", offering clear policies, encouraging faculty involvement, evaluating research quality, and tracking research activities across all seven schools.

This transformation reflects KU's commitment to research excellence, supporting faculty in generating new knowledge to assist the government and communities in driving national economic growth.

1.2 Kathmandu University's Role in Nepal's Development

Kathmandu University (KU) actively supports Nepal's development goals through research, innovation, and strong collaborations. Its research focuses on key areas with high impact and transformative potential.

Green Hydrogen for a Low-Carbon Future

KU is pioneering Nepal's transition to clean energy by researching the full green hydrogen value chain. Studies focus on using hydrogen to reduce pollution in industries like steel production, mining, and fertilizer manufacturing. Researchers are also exploring hydrogen as a fuel for vehicles and its role in balancing seasonal electricity supply from hydropower, which is crucial in Nepal's wet and dry climate cycles. This research positions KU at the forefront of Nepal's green energy revolution.

Health of Water, Soil, and Ecosystems

KU addresses environmental and agricultural challenges by studying soil and water quality, aquatic ecosystems, and their impact on human health. This research supports evidence-based policymaking for sustainable agriculture, resource management, and safe drinking water—especially in rural areas. It also contributes to ecosystem conservation and helps communities build resilience.

Climate Change Adaptation and Resilience

Given Nepal's vulnerability to climate extremes, KU conducts research on climate change impacts, mitigation strategies, and community adaptation. Projects include monitoring temperature fluctuations, biodiversity loss, and early warning systems to help institutions and communities adapt. These research efforts align with Nepal's national and international climate priorities.

Technology for Inclusive Development

KU promotes applied technology to drive inclusive growth. Research focuses on clean energy, sustainable agriculture, and affordable health technologies, ensuring marginalized communities benefit from innovation. KU's technology-driven research also stimulates entrepreneurship and commercialization, creating socio-economic impact.

Evidence-Based Economic Transformation Policy

KU contributes to national economic policy through its trade research center, providing insights on Least Development Country (LDC) graduation, export competitiveness, and digital trade. This research helps shape effective policies for ministries, development partners, and the private sector.

Education Reform and Professional Capacity Building

KU is driving change in Nepal's education system by equipping teachers and educational leaders with improved training, workshops, and postgraduate programs to enhance learning at all levels.

Through these strategic research priorities, KU is strengthening Nepal's path toward a sustainable, inclusive, and knowledge-driven future.

1.3 Three Layers of Research at KU

1.3.1 High-Tech Research (Cutting-edge Labs & Initiatives)

Nepal Technology Innovation Center (NTIC)

Multi-disciplinary Centers

The Nepal Technology Innovation Center (NTIC) at Kathmandu University is a multidisciplinary research facility established with support from the Korea International Cooperation Agency (KOICA). NTIC focuses on three key areas: *agriculture and rural development, alternative and renewable energy, and health-related livelihoods*. Its primary goal is to convert research findings into practical innovations that can improve the quality of life in rural Nepal.

Equipped with advanced research tools and facilities, NTIC supports high-tech and innovative research. These resources are available not only to Kathmandu University researchers but also to other institutions throughout Nepal.

Key equipment includes:

Figure: Automatic DNA Extractor

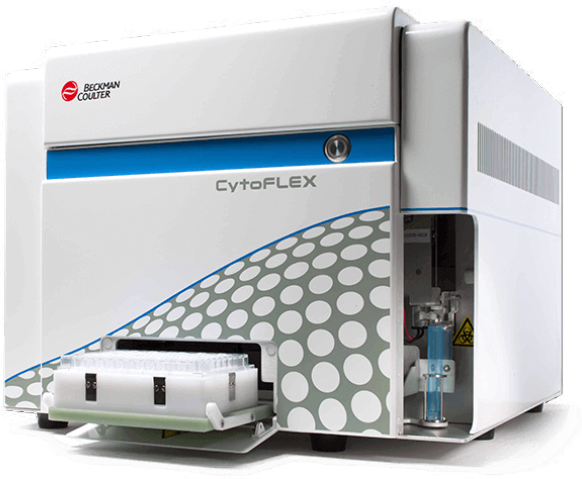


Figure: Flow Cytometer

Figure: Seal Auto Analyzer

Figure: Automatic Oxygen Bomb Calorimeter

Figure: Illumina Miseq Sequencing System

Figure: Real time Polymerase Chain Reaction

Aquatic Ecology Center (AEC)

School of Science

Established in 2003 by the generous financial assistance of German aquatic biologist Mr. Hasko F. Nesemann, the Aquatic Ecology Center (AEC) of Kathmandu University is an environmental research, training, and analytical service center in freshwater ecosystems. The Center is a leading institution for water and soil quality analysis in Nepal.

It provides low-cost analytical services in water and soil analysis, along with research support for aquatic flora and fauna studies. The Center also plays a major role in capacity development through training and in collaboration with governmental and non-governmental organizations.

Webiste: https://aec.ku.edu.np/

WTO Chairs Programme Nepal

School of Management

The WTO Chairs Programme at Kathmandu University School of Management is a dedicated center focused on research and policies related to international trade. Established in 2022 as part of Phase 3 of the WTO Chairs Programme, it is one of 17 new chairs chosen from 120 global applicants, joining a network of 35 institutions working to improve trade knowledge and practices.

The program plays an important role in producing research-based insights on trade policies, developing academic curricula, and engaging with national and international stakeholders. It acts as a central hub for studying trade issues critical to Nepal, such as graduation from least developed country status, enhancing

export competitiveness, digital trade, green energy trade, and informal cross-border trade. By linking academic expertise with practical policy needs, the center supports government agencies, businesses, and development partners in shaping Nepal's trade future.

Webiste: https://wcpnepal.ku.edu.np/

Research and Innovation Center (RIC)

School of Education

The Research and Innovation Center (RIC) at the School of Education, Kathmandu University, is a key academic unit that promotes research, innovation, and academic excellence. RIC supports the University's broader research and development goals by facilitating policy creation, academic audits, faculty research grants, and partnerships with international organizations. The center focuses on strengthening research capabilities and improving academic management through initiatives like faculty development, leadership training, quality assurance, and educational management information systems (EMIS).

Website: https://soed.ku.edu.np/ric

Learning, Innovation, and Knowledge Exchange (LIKE)

School of Arts

Initially funded by the Global Partnership for Education Knowledge and Innovation Exchange and IDRC, LIKE is a social science laboratory focused on addressing socio-economic and socio-political challenges. It aims to develop practical, scalable, and sustainable solutions for issues in the development sector. Its mission is to foster inclusive and equitable growth by connecting scholars, policymakers, and development practitioners.

Website: https://like.edu.np/

1.3.2 Industry-Scale Research

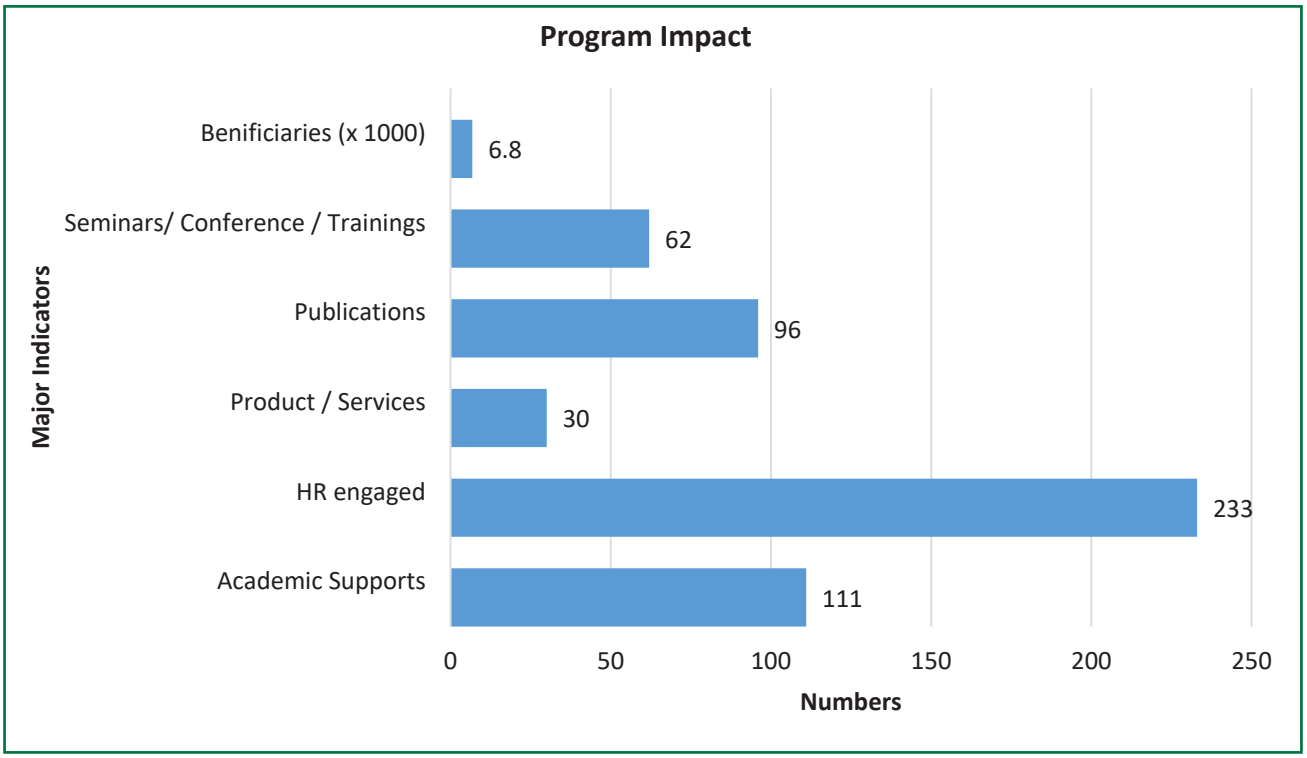
Energize Nepal (ENEP)

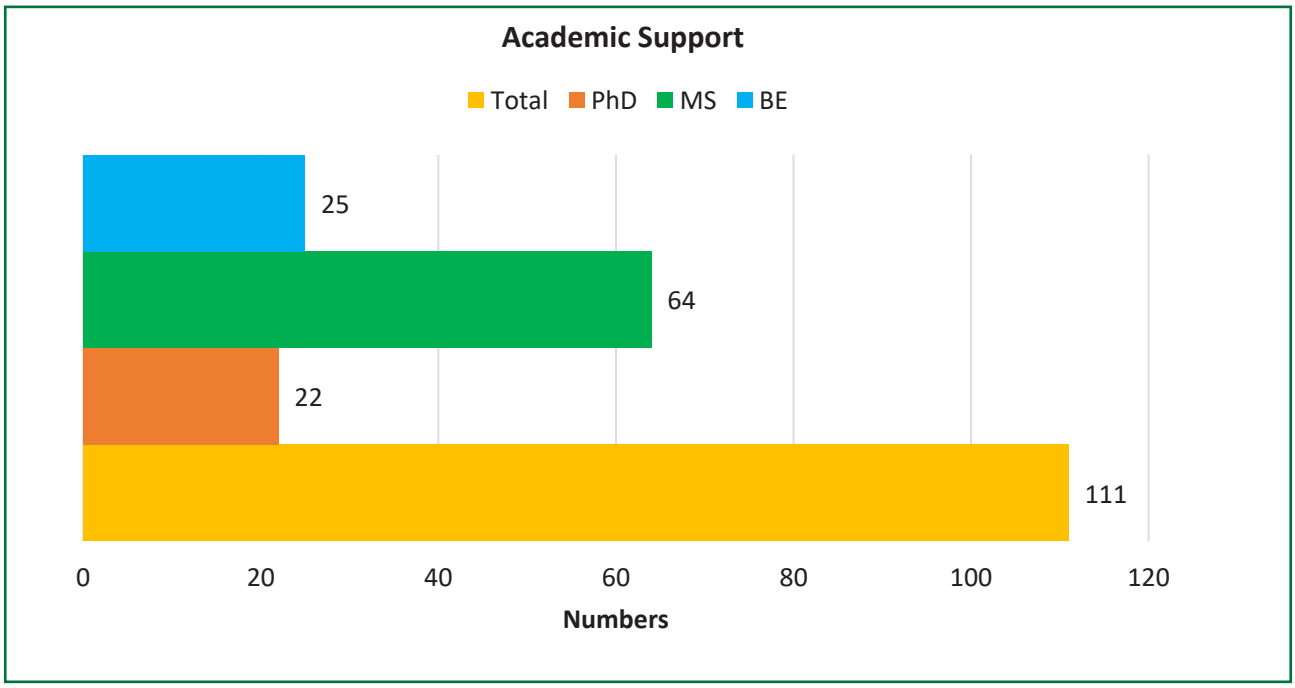
The EnergizeNepal Program was created to support the growth of hydropower and renewable energy systems in Nepal. Its primary goals are to develop cost-effective and efficient technologies tailored to Nepal's needs and build skilled human resources to conduct research and apply the findings to address challenges in energy development.

The program promotes industrial development through research by funding collaborative projects on renewable energy technologies. These projects are carried out by R&D institutions in Nepal alongside local industries and Norwegian partners. Funded by the Norwegian Ministry of Foreign Affairs (MFA), the program is implemented collaboratively by Kathmandu University (KU), NTNU, SINTEF, and Hydro lab, with Kathmandu University managing its operations.

EnergizeNepal focuses on research, innovation, and development. The program has successfully trained over 250 professionals in hydropower and renewable energy R&D and commercialization. It has collaborated with over 75 institutions and played a role in establishing 36 new industries to support Nepal's energy sector.

Webiste: https://energizenepal.ku.edu.np/





Major achievements from EnergizeNepal Program

Since the Program's beginning in 2016, the following are some of the important achievements of the program:

- Collaboration among Turbine Testing Lab (TTL), ENEP-II-RENP-22-01 and 23-03 collaborated to work on conditional monitoring research (Different groups working on different areas like turbine, generator and transmission lines).
- TTL has supported several hydropower projects—including Jhimruk, Mistri Khola, Molung, Maibeni, Khimti, and Daraudi Khola—by offering testing and design validation. Notably, TTL introduced

Nepal's first "Monsoon Runner," a technology adapted for seasonal flow variability, and developed the Turgo Turbine to improve energy access in underserved communities. The Lab also contributed to manufacturing and installing Francis turbines, using locally sourced components in Chauri Khola II MHP in Kavre, and has produced technical manuals to support local turbine design and testing practices.

- Hydrolab: Eco-hydraulic research facility at Upper Arun 1061MW requested for the study ; provided services to 23+ hydropower projects including Tanahu Hydro 140MW, and IPPs including: Model testing service to Simbuwa hydro power project, Nilgiri-1 hydro power project, Rahughat Mangale hydro power project, Middle Mewa hydro power project, Dhudkoshi storage hydroelectric project, Mewa hydro power project, Phukot Karnalai hydroelectric power, Myagdi hydropower project etc.
- In South Lalitpur Rural Community of Lalitpur (SLRC), implementation of the internet based bill payment method was established that reduced the travel time of consumers to pay the bill.
- Development of Design Guidelines for "Energy Efficient Building Design Procedure" which will be a handy tool for designers, architects, researchers and enthusiasts of energy efficient building design.
- KU Tunnel was constructed at Kathmandu University. Along with it 'Rock Mechanics and Rock Engineering Laboratory' was upgraded at civil engineering department at Kathmandu University.
- The infrastructure of lighting laboratory was upgrade through Center for Electrical Power Engineering (CEPE) component in support from Department of Electrical and Electronics Engineering (DoEEE). CEPE assisted in the assessment of Pashupatinath temple's lighting and electrical system and are involved in lighting design of various heritage sites in Kathmandu valley along with Indian National Trust for Art and Cultural Heritage (INTACH).

Manufactured Brass Runner

Meter reading using Android digital payment app

Establishment of Rock mechanics Lab

Francis Turbine runner (75KW)

KU research tunnel

Fuel pellets with proportion of algal

Turbine Testing Lab (TTL)

School of Engineering

The Turbine Testing Lab (TTL) at Kathmandu University stands as a national center of excellence for hydropower research, testing, and training. Established in 2009 with major support from NORAD, TTL was developed in collaboration with the Norwegian University of Science and Technology (NTNU) and modeled after NTNU's Waterpower Laboratory.

TTL is the only facility in the world equipped to perform turbine tests under a 30-meter natural head, enabled by KU's unique topography. The lab is outfitted with high-capacity pumps, variable frequency drives, and flexible configurations to simulate diverse hydraulic conditions. It can accommodate prototype tests up to 300 kW, along with model testing and advanced analyzes such as CFD and FEM.

Beyond research, TTL serves as a meeting point for academia and industry—offering industrial training, facilitating student-industry collaborations, and supporting Nepal's hydropower sector through technology development, predictive maintenance research, and capacity-building programs.

Website: https://ttl.ku.edu.np/

Green Hydrogen Lab (GHLab)

School of Engineering

Kathmandu University's Green Hydrogen Lab (GHLab) is a leading research facility focused on advancing green hydrogen technologies. The lab aims to support Nepal's transition to clean energy through innovative research, pilot-scale production, and policy development in hydrogen-based energy systems.

Equipped with facilities for hydrogen generation, storage, and use, GHLab contributes to reducing carbon emissions and strengthening Nepal's energy independence. Its projects range from ammonia synthesis and synthetic natural gas production to building hydrogen refueling infrastructure, all relying on Nepal's renewable resources. Website: https://ghlab.ku.edu.np/

On August 30, 2024, Nepal inaugurated its first green hydrogen production and refueling station, along with a hydrogen-powered vehicle, at the Green Hydrogen Lab by the Rt. Hon. Prime Minister KP Oli.

Center for Electric Power Engineering (CEPE)

School of Engineering

The Center for Electric Power Engineering (CEPE), established in 2018 under Kathmandu University's Department of Electrical and Electronics Engineering, focuses on research in electric power and lighting technologies. It has contributed over 18 publications to national and international platforms, covering topics like lighting design, power systems, and lightning protection.

CEPE provides lighting design services and has completed projects at more than 15 locations, especially heritage sites and highways. The center upgraded its high-voltage and lighting laboratories with new equipment in 2022 through additional funding and plans further upgrades in 2025.

CEPE offers testing and consultancy services to governmental and private organizations, including NBSM, NEA, Kathmandu Municipality, and Banepa Municipality. It has formed partnerships with several organizations, such as INTACH, LAPLACE at Paul Sabatier University, ASAP Incorporated Pvt. Ltd., Clean Power Pvt. Ltd., and Power System Research Lab (PSRL) at Chulalongkorn University.

Website: https://cepe.ku.edu.np/

1.3.3 Student-Led Academic Research

Kathmandu University offers Master's and PhD programs across seven schools—Arts, Education, Engineering, Management, Science, Law, and Medical Sciences. These programs enable students to conduct research addressing both theoretical and practical challenges relevant to Nepal and the global community.

Student-led research spans a wide range of disciplines, showcasing the diversity of research areas:

School of Arts

Students focus on areas such as Human and Natural Resources Studies, Development Studies, Ethnomusicology, English, and Nepali. Research strongly emphasizes cultural preservation, socio-economic dynamics, and sustainable development.

School of Education

Research activities concentrate on Educational Policy, Professional Development, Curriculum and Pedagogy, Social and Cultural Dimensions of Education, Governance, and Behavioral Studies. Many student projects aim to contribute to inclusive and effective educational practices in Nepal

School of Engineering

Graduate students engage in both applied and theoretical research across fields like Computer, Mechanical, Civil, Chemical, and Electrical & Electronics Engineering. Their work supports advancements in infrastructure, automation, renewable energy, and smart technologies.

School of Management

Research topics include Leadership, Organizational Performance, Strategic Management, National and International Policy and Entrepreneurship. Many theses explore the relationship between theory and practice in public and private sector performance.

School of Science

Students pursue advanced research in disciplines such as Mathematics, Environmental Science, Biotechnology, Statistics, Pharmacy, and Physics. Their projects address critical challenges in health, sustainability, and scientific progress.

Kathmandu University actively supports these research endeavors with supervision, state-of-the-art facilities, and opportunities for interdisciplinary collaboration.

Additionally, the School of Law and the School of Medical Sciences contribute to academic research activities, further broadening the university's impact and scope in addressing national and global challenges.

PhD Scholar Graduated (as of, Dec 2024)

School	PhD Scholars
School of Arts	14
School of Education	96
School of Engineering	19
School of Science	73
School of Management	4

The presence of more than 200+ PhD scholars highlights KU's dedication to academic excellence, research innovation, and strengthening national capacity in higher education.

2 Ongoing Research at KU

2.1 Impactful Research (Solutions with Real-World Applications)

The following are some of the key research projects at Kathmandu University, each with funding exceeding NPR 10 million

Empowering smallholder farmers' in sustainable agriculture (Sept 2021 to Feb 2026)

School of Arts

This project supports small farmers in adopting sustainable agricultural practices using digital technologies. It focuses on improving productivity, food security, and resilience to climate change by providing timely information, market access, and innovative farming techniques.

- Funding Agency: University of Berne, Switzerland

Enhancing Quality in Education Projects (Nov, 2022 – Jul, 2026)

School of Education

This education-focused research project aims to enhance the quality and impact of educational initiatives through continuous backstopping support and systematic learning. By providing technical assistance, monitoring, and reflective practices, the project strengthens implementation strategies and promotes evidence-based decision-making.

- Funding Agency: Federal Department of Foreign Affairs, Switzerland

Digitalization and preservation of library resources (Mar, 2024 – Jan, 2026)

School of Education

The project aims to ensure that valuable library materials are preserved for future generations, improve accessibility for users across the country, and modernize library services by leveraging digital technologies

- Funding Agency: e-Asia and Knowledge fund (EAKPE) The Republic of Korea

Development of Hydropower Professionals (Ongoing 6 years +)

School of Engineering

The Hydro-Himalaya project focuses on research-based education to train professionals for Nepal's hydropower sector. It enhances technical skills and interdisciplinary understanding to manage hydropower resources sustainably.

- Funding Agency: NORAD

Assessing cryosphere changes and risks (Jul, 2024 – Dec, 2026)

School of Science

This initiative builds capacity to monitor glacier retreat, snow cover, and related hazards in the Hindu Kush Himalaya. It strengthens research infrastructure and supports graduate education through significant investment in laboratories.

- Funding Agency: ICIMOD

Predictive maintenance in Hydropower (Jul, 2023 to Jul, 2026)

School of Engineering

The project aims to improve the reliability of hydro-turbines by using predictive maintenance and fault detection techniques. This reduces downtime and maintenance costs, boosting efficiency in Nepal's energy sector.

- Funding Agency: UGC, Nepal

2.2 Policy-Level Research

Advancing gender equality and social inclusion (Mar, 2024 to Feb, 2027)

School of Arts

This project focuses on understanding children's aspirations and values to promote gender equality and inclusion, especially in underserved communities. It aims to influence educational and social policies for equitable growth.

- Funding Agency: International Development Research Center (IDRC), Canada

Innovations in teaching and learning (Ongoing since 2015)

School of Education

This educational initiative transforms teaching and learning by integrating local knowledge and inclusive approaches. It supports teacher development, curriculum reform, and policy discussions to improve the quality and relevance of education in Nepal.

- Funding Agency: NORHED

Promoting gender equality in academia (Jan, 2025 – Dec, 2027)

School of Management

This initiative integrates inclusive policies and practices to address gender imbalances in higher education institutions. It focuses on raising awareness and building capacity to create equitable academic environments.

- Funding Agency: ERASMUS PLUS (EU)

3 Research Activities beyond Lab

Kathmandu University is committed to expanding its research beyond laboratory settings by building partnerships, collaborating with industries, and supporting communities. These initiatives aim to connect academic research with practical applications that address societal challenges.

3.1 Industrial Exposure

TTL–NEA Collaboration on Hydropower Condition Monitoring

The condition monitoring of hydropower plants in Nepal, owned by the Nepal Electricity Authority (NEA), represents a strategic partnership between academia and industry. This initiative, launched collaboratively by the Turbine Testing Lab (TTL) at Kathmandu University and NEA, aims to detect and address mechanical issues in hydropower stations operated by NEA.

The condition monitoring process, a predictive maintenance technique, is applied to six hydropower stations—Devighat, Seti-Phewa, Puwakhola, Chatara, Gandak, and Kaligandaki. These stations use various turbine types, including Pelton, Francis, and Bulb, with capacities ranging from 1 MW to 144 MW. The focus of the project is to identify problems at an early stage, ensuring the reliability and efficiency of Nepal's hydropower infrastructure.

Green Hydrogen Lab and FNCCI: Fostering Industrial Sustainability

The Green Hydrogen Lab, in collaboration with Conscious Energy and local authorities, conducted workshops with the Federation of Nepalese Chambers of Commerce and Industry (FNCCI) in Pokhara and Butwal. These sessions fostered discussions between academia and industry to promote sustainable practices and strategies for reducing carbon emissions in the Lumbini Corridor. Site visits to businesses such as Sujal Dairy, Pokhara Kattha Industry, and P & Pitta Udhyog facilitated the exchange of ideas on the challenges and opportunities of transitioning to greener operations.

KU–NLCDC MoU: Advancing Wetlands and Lake Conservation

Kathmandu University has entered a Memorandum of Understanding with the National Lake Conservation Development Committee (NLCDC) under the Ministry of Forests and Environment. This agreement aims to enhance collaboration in research, training, and the preservation of lakes and wetlands across Nepal.

The partnership will involve activities such as seminars, workshops, and studies on biodiversity, with a focus on water quality, plant ecology, and wildlife habitats in wetland areas. It highlights the role of academic institutions in supporting national conservation efforts.

Techno- entrepreneurship Exposure through KU–Ncell–MIT Partnership

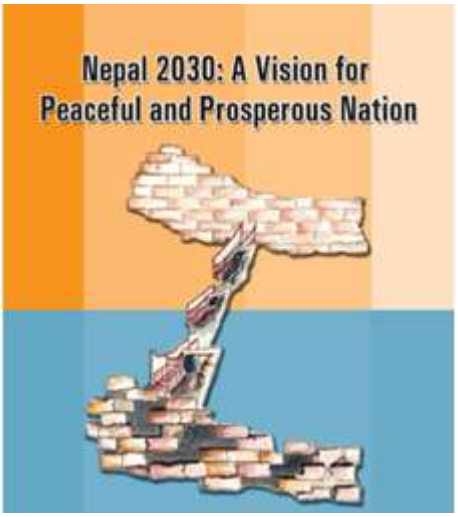
A partnership between Kathmandu University, Ncell Pvt. Ltd., and the Massachusetts Institute of Technology (MIT) promotes technology-focused entrepreneurship. As part of an agreement signed in June 2018, 35 students from KU in the fields of Engineering, Science, Management, and Arts participated in a seven-week intensive training program through the MIT Global Startup Labs initiative. This program combines MIT's innovative approach with Nepal's growing startup environment to provide students with practical experience in product development and business innovation.

Collaborative Learning Environment Center (CLEC): Transforming Classrooms

Kathmandu University School of Education (KUSOED) collaborated with Digital Bridges for Nepal (DB4N) to implement the Collaborative Learning Environment Center (CLEC). This program was introduced in six schools across Nepal, aiming to improve teamwork, technology-based teaching methods, and community involvement.

At KUSOED, CLEC focuses on combining learning with modular teacher training. Research efforts include assessing the program's impact and publishing findings in academic journals. It strives to enhance teaching standards and address digital inequalities in remote learning environments.

KUSOA and Swiss National Center of Competence in Research



Kathmandu University School of Arts collaborated with the South Asia Regional Coordination Office of the Swiss National Center of Competence in Research (NCCR North-South) to publish "Nepal 2030," a shared vision focused on peace, sustainability, and national progress. The book combines academic insights on topics such as the economy, education, gender equality, climate resilience, and development strategies for Nepal. It serves as a platform for interdisciplinary ideas to guide the country's future.

Medical University of Graz and KUSMS Partner for Advancing Health Research

Since 2009, the Medical University of Graz and KUSMS have collaborated on research and academic exchange, with additional support from Erasmus+ starting in 2019. This partnership focuses on improving pediatric healthcare in Nepal and has expanded to include nursing, pathology, and oral surgery research.

Key areas of collaboration:

- Dentistry: Academic exchanges and training in oral and maxillofacial surgery.
- Nursing Science: Observerships in Austrian intensive care units and collaborative research to advance evidence-based nursing practices.
- Pathology: Digitized case reviews and joint diagnoses through microscopy, along with annual traineeships.
- Outreach: Planned exchanges in ENT, gynecology, and transplant surgery, as well as clinical internships at Dhulikhel Hospital for Medical University of Graz students.

These programs demonstrate Kathmandu University's commitment to turning research into practical applications through international cooperation, emphasizing innovation, sustainability, and community development.

3.2 Community Engagement

Kathmandu University (KU) remains focused on promoting sustainable development and improving community welfare through collaborative research, innovation, and outreach. The university actively engages with local communities through various initiatives and projects aimed at addressing critical issues in Nepal. Below are highlights of KU's efforts in community engagement:

Empowering Lives through Prosthetics and Clean Cooking Technologies

School of Engineering

The Design Lab made an impactful contribution by creating and distributing a mechanical prosthetic leg for individuals who had lost their legs. The legs, made with 3D-printed parts, restores both functionality and confidence due to its design. This project highlights the potential of innovation to bring meaningful change and inspire future community-focused initiatives.

Additionally, the Department of Mechanical Engineering studied the health benefits of improved cook stoves in rural Nepalese households. By replacing traditional stoves with modern two-pot mud stoves

in 30 homes, the study found a 35% reduction in exposure to particulate matter and a 60% decrease in carbon monoxide levels in users' breath. These findings emphasize the immediate health advantages of accessible technology and the importance of further research to assess long-term benefits.

Addressing Sanitation and Climate Resilience

School of Science

Kathmandu University, as part of the SCARE Project supported by the Bill & Melinda Gates Foundation, conducted an assessment of greenhouse gas emissions from sanitation systems in Chitwan and Kavre. The project also developed a tool to evaluate the resilience of these systems across nine districts. This initiative is a pioneering effort in low- and middle-income countries to address both climate vulnerability and emissions related to sanitation.

Inclusive Education for At-Risk Children

School of Arts

The School of Arts conducted a regional research program focusing on children out of school and those at risk of dropping out in Nepal, Bhutan, and Bangladesh. The study emphasized equity, inclusion, and gender, examining after-school activities and education campaigns to understand their effectiveness under different conditions. It highlighted the importance of scalable approaches tailored to local needs and active engagement with stakeholders. The findings aim to guide the development of more impactful and adaptable education solutions across South Asia.

Collaboration for Education Transformation in Bhojpur

School of Arts

In Bhojpur Municipality, the School of Arts facilitated a meeting with municipal leaders to discuss strategies for improving Gender Equality and Social Inclusion (GESI) in schools. Participants highlighted the need for research and targeted actions to address challenges, as municipal resources are significant but student performance remains below expectations. This meeting marked an important step in fostering collaboration between local government and Kathmandu University's LIKE Lab to enhance public education quality.

Partnership for Rural Educational Development

School of Education

The School of Education has established a partnership with Ajirkot Rural Municipality to enhance education through teacher training, curriculum development, mentoring programs, and infrastructure support. This initiative leverages the School's expertise in literacy and pedagogy while utilizing the municipality's resources to implement sustainable, long-term improvements for students, educators, and the community.

Engagement through Workshops and Awareness Programs

School of Education

KUSOED has been actively organizing various community-oriented workshops and events focused on topics such as emotional learning, school counseling, teacher and parent well-being, faculty development, effective communication, peer learning, and understanding dyslexia and other learning challenges. These efforts play a vital role in strengthening educational capacity and raising awareness in schools and communities.

Enterprise Development and Economic Empowerment

School of Management

Through its Enterprise and Management Development Center (EMDC), KUSOM connects academic knowledge with practical applications. The Center has provided training in data analytics to employees of major telecom companies and offered a diploma program for cooperative leaders. Additionally, EMDC has conducted research on reducing poverty through cooperatives, supported women-led businesses, and contributed to sustainable livestock projects and brand development. These initiatives highlight the University's dedication to promoting economic growth, professional development, and community empowerment.

These efforts demonstrate Kathmandu University's strong commitment to driving community transformation through innovation, research, and partnerships. From health and environmental programs to educational and economic initiatives, each project reflects the University's role in creating positive, lasting change

3.3 KUSET Introduction

Kathmandu University Journal of Science, Engineering and Technology (KUSET) is a peer-reviewed, online open-access journal that publishes articles under five sections: Original research articles, Short communications, Review articles, Expository articles and Interviews. Established in 2005, KUSET provides a platform for researchers around the world to share their findings in the field of science, engineering and technology. The journal is published biannually (in June and December), and it is also possible to publish conference proceedings in special editions.

The journal maintains a rigorous single blinded peer-review process to ensure the quality and integrity of published articles. KUSET adheres to an open-access policy, providing immediate and free access to its content. Articles are published under the Creative Commons Attribution ShareAlike 4.0 International License (CC BY-SA 4.0), allowing for distribution, adaptation, and commercial use, provided appropriate credit is given and derivative works are licensed under identical terms.

One of the major achievements in KUSET's journey is its recognition by Crossref, a non-profit organization that provides **Digital Object Identifiers (DOIs)** for scholarly content. This recognition has helped in increasing the international credibility of KUSET and improving the visibility and accessibility of the research outputs for national and international audiences.

Over the years, KUSET has contributed significantly to the visibility of Nepalese research on the global stage. The scope of the journal includes, but is not limited to civil, electrical, environmental, computer and mechanical engineering, information technology, physics, chemistry, mathematics as well as biotechnology and life sciences. Especially for young researchers and faculty members, KUSET has provided an opportunity to launch their academic careers, offering an opportunity to gain experience in the publication procedure.

In addition to KUSET, Kathmandu University publishes other prestigious academic journals such as the **Kathmandu University Medical Journal (KUMJ), Journal of Education and Research, Journal of Transformative Praxis, Journal of Business and Management Research and Journal of English Language Education Praxis (JELE-Praxis)** each contributing to the university's commitment to high-quality scholarly dissemination across diverse disciplines.

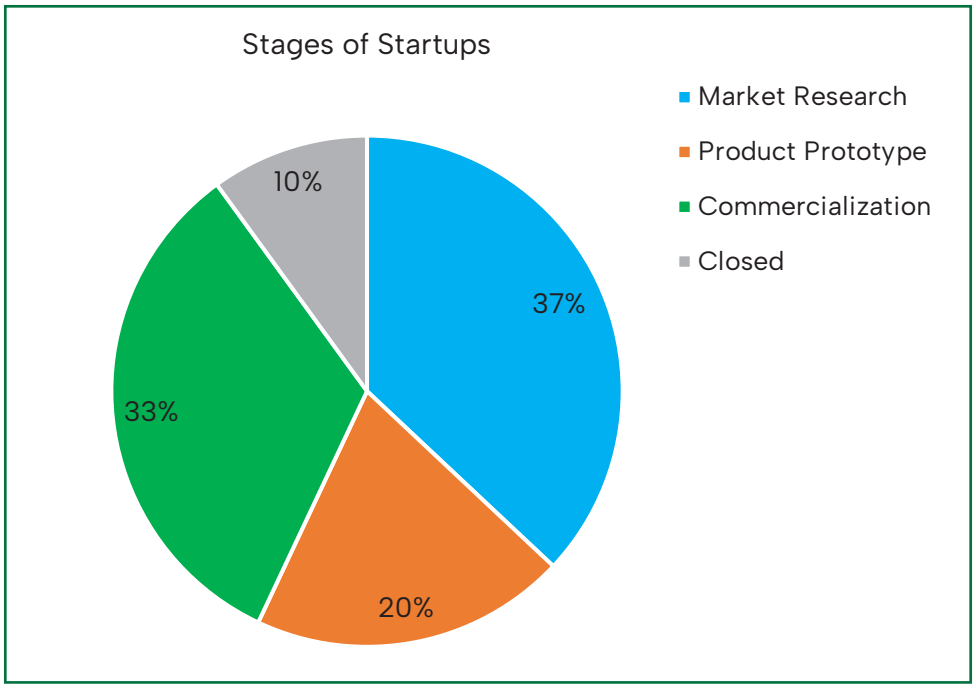
4 Research into Business

Kathmandu University Business Incubation Center (KUBIC) has been instrumental in transforming innovative ideas into viable businesses. In the last fiscal year, KUBIC supported 24 startups across sectors such as health, agriculture, renewable energy, green business, and local handmade enterprises. This initiative aligns with Kathmandu University's commitment to bridging academia and industry, fostering economic growth and social impact.

4.1 Transforming Research into Business Ventures

At Kathmandu University, research is not confined to academic journals - it becomes the foundation for real-world innovation. Through the support of the Business Incubation Center, students and researchers are encouraged to identify practical problems and use their academic findings to develop market-ready solutions. A team researching vehicle repair challenges is designing a mobile app to connect vehicle owners with trusted mechanics, aiming to simplify maintenance and boost local service providers. Such initiatives show how research, when aligned with entrepreneurial thinking, can evolve into impactful businesses that create jobs, solve community problems, and drive sustainable development. Linking research with a business idea means turning innovative findings into practical solutions that address real-world problems.

4.2 Startups Progress



The pie chart illustrates the current development stages of startups incubated at Kathmandu University Business Incubation Center (KUBIC):

- 37% of startups are in the Market Research phase, focusing on understanding customer needs, market trends, and feasibility.
- 20% have progressed to the Product Prototype stage, where they are developing and testing early versions of their solutions.
- 33% have reached the Commercialization stage, indicating they are already offering their products or services in the market.
- 10% of startups have unfortunately closed, reflecting the typical risk and learning curve associated with entrepreneurial ventures.

4.3 Progress Highlights of Active Startups at KUBIC

Over the past few months, several startups incubated at KUBIC have shown promising growth and innovation. Some key highlights include:

- **Product Development and Launches:** A few startups such as NyanoCare Pvt. Ltd., Nepla Fill, Regen Nepal, have successfully developed prototypes and minimum viable products with some already launching their solutions in the market. NyanoCare pvt. Ltd. One of the standout ventures has introduced custom 3D-printed gift items, offering locally made, sustainable, and personalized products. Nepla Fill is working to promote and preserve traditional architecture and heritage sites.
- **Recognition and Awards:** Some of our startups have achived the Awards from different national level competition.

- **Job Creation and Community Impact:** The startups have collectively contributed to local employment and community engagement. So far, they have hired 5 part-time employees and engaged 8 student interns, with a particular focus on involving youth and women in meaningful roles. These ventures are not only creating job opportunities but are also delivering impactful solutions aligned with the Sustainable Development Goals (SDGs), particularly in areas such as climate action (SDG 13), decent work and economic growth (SDG 8), and industry, innovation, and infrastructure (SDG 9).
- **Continuous Mentorship and Capacity Building:** Founders have actively participated in capacity-building workshops and mentorship programs facilitated by KUBIC and its partners, showing strong commitment to learning and growth.

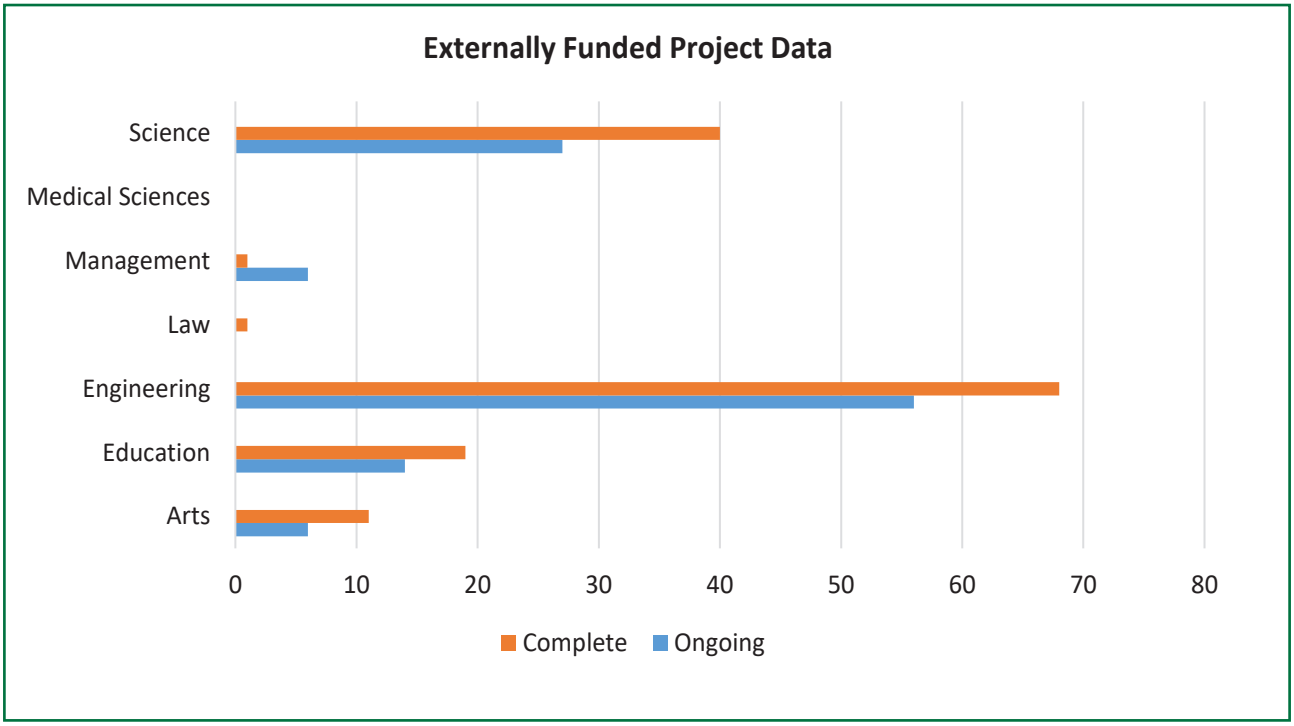
Entreprenureship workshop by KUBIC

International Youth Day Celebration by KUBIC

5 KU Research Portfolio

5.1 Externally Funded Research Projects

Externally funded research projects refer to the projects financially supported by external organizations. Projects funded by international organizations, diplomatic missions, United Nations agencies, or their affiliates are classified as international. Projects supported by local entities, such as government bodies or non-governmental organizations within Nepal, are categorized as local. The chart shows the number of externally funded research projects, both completed and ongoing, across all academic schools at Kathmandu University.

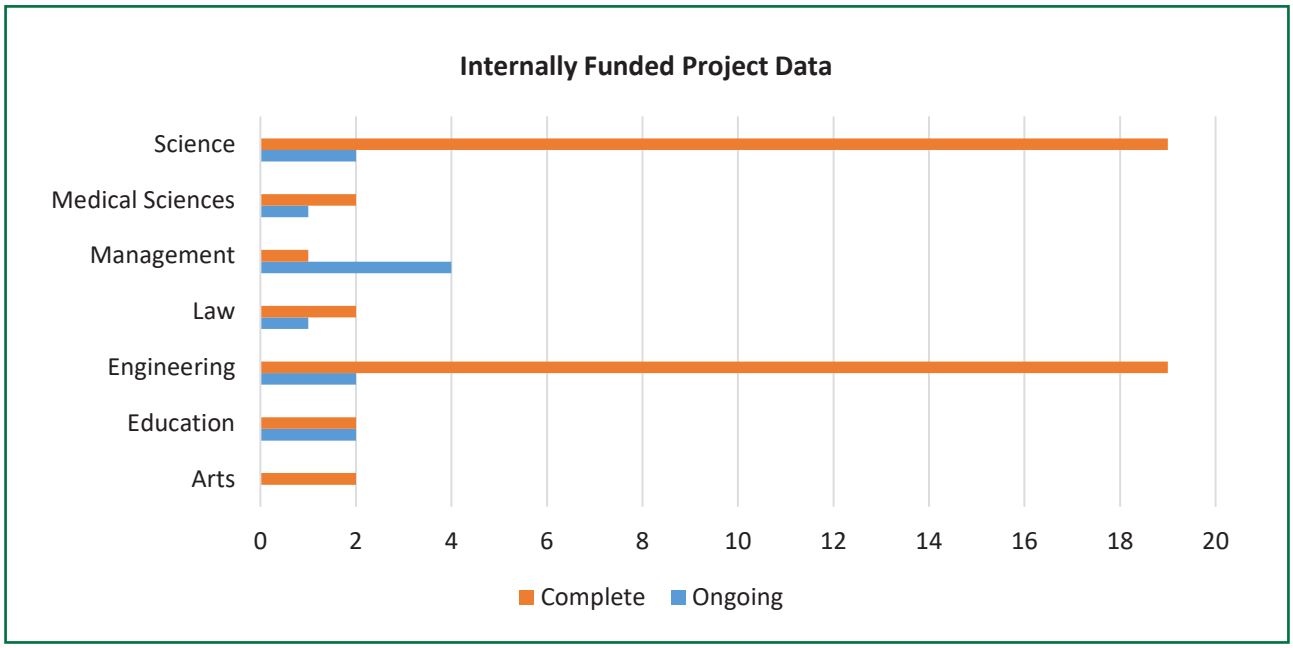


5.2 Internally Funded Research Projects

Internally funded research projects are grants provided through the university's endowment fund to support faculty research. These grants cover **research-related expenses**, such as **equipment, supplies, and field visits**, but do not include direct financial incentives.

The chart shows the number of completed and ongoing **internally funded research projects** across all academic schools at Kathmandu University. The following section summarizes key research projects from **2023/2024**.

For more information visit: https://rdi.ku.edu.np/funded-projects/


Internally Funded Project Data
Science
Medical Sciences
Management
Law
Engineering
Education
Arts
0
2
4
6
8
10
12
14
16
18
20
Complete
Ongoing

5.3 Project Summary of Internally Funded Project 2023/2024

Application of Phosphate solubilizing bacteria for enhanced seed germination and plant growth on Tartary Buckwheat (*Fagopyrum tartaricum* (L.) Gaertn.)

Roshan Subedi[1*], Kampan Kafle[1], Nitesh Yadav[1], Anjela Dahal[2],
1 Department of Agriculture, School of Science, Kathmandu University
2 Department of Biotechnology, School of Science, Kathmandu University
* Corresponding Email: roshan.subedi@ku.edu.np

Project Summary

Tartary buckwheat is an underutilized crop mainly grown in high hills and mountainous regions. It is valued for its ability to thrive in marginal soils and its rich content of essential micronutrients and bioactive compounds. The crop is also highly efficient in phosphorus uptake from the soil.Plant growth-promoting rhizobacteria (PGPR), particularly phosphate-solubilizing bacteria (PSB), can support crop growth by sustainably increasing inorganic phosphorus availability in the rhizosphere. In this study, four PSB strains were isolated from Alnus nepalensis and Bambusa sp., named An9, An8, An6, and B9, and tested for their effectiveness in enhancing tartary buckwheat growth. Phosphate solubilization tests showed that the bacterial isolates had solubilizing capacities of 363.08 µg/ml (An8), 467.13 µg/ml (An6), 447.01 µg/ml (B9), and 484.76 µg/ml (An9). Among them, An9 demonstrated the highest seed germination rate (87.5%), followed by B9 (75%), while An8 and An6 showed lower germination rates of 58.0% and 58.3%, respectively. Additionally, An9 exhibited the longest coleoptile (11.8 cm) compared to the other isolates. A pot experiment conducted in a polyhouse using a completely randomized design revealed that plants in the An9-treated pots reached the greatest height (69.02 cm), significantly ($p<0.05$) differing from the control, which had the smallest plant height (48.97 cm). Plant heights in An9, An6, and An8 treatments were statistically similar, while B9 and control treatments differed significantly ($p<0.05$). An9-treated plants also had the highest average leaf number (71.47), shoot biomass (26.88 g/plant), and root biomass (4.56 g/plant). The soil used in the experiment had a low pH (5.41), indicating limited phosphorus availability. The PSB likely enhanced phosphorus solubilization, improving plant growth parameters. This study is possibly the first PGPR application on tartary buckwheat and suggests further field research to evaluate its impact on crop yield.

Keywords: Tartary buckwheat, phosphate solubilizing bacteria, Pot experiment plant growth promoting rhizobacteria.

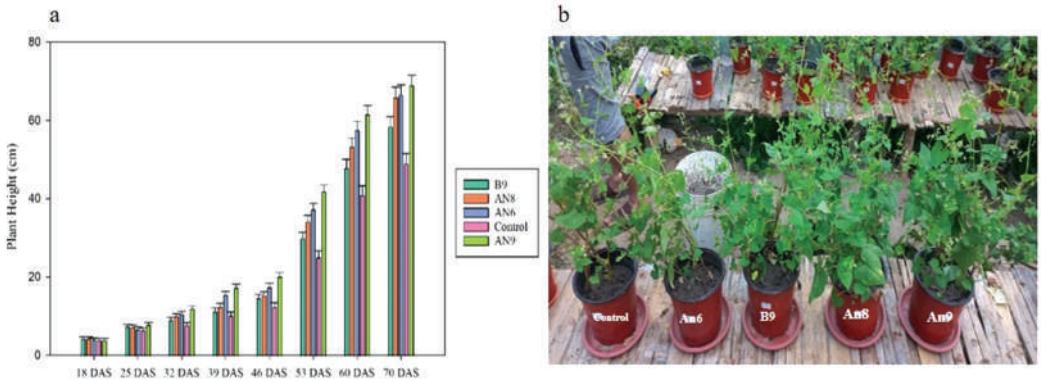


Figure: Plant height at 18–70 different days after seeding (a); Tartary buckwheat at 70 days after seeding (b)

Baseline limnology of a high mountain Ramsar Site- Lake Phoksundo, Dolpa, Nepal

Smriti Gurung*[1] and Sunena Nyachhyon[2]
1 Associate Professor, Department of Environmental Science and Engineering, KU
2 Master's student at the Department of Environmental Science and Engineering, KU
* Corresponding Author: smriti@ku.edu.np

Project Summary

A baseline limnological study was conducted in Phoksundo lake – a high mountain lake as well as a Ramsar site from western Nepal. Composite water samples and micro-habitat-based algal samples were collected during April 2023 for major ions and diatom analyzes respectively. Lake surface water temperature and conductivity ranged from 6.8±0.06 °C to 8.3±0.53 °C and 291±3 µScm-1 to 362.3±4.9 µScm-1 respectively. The lake water was characterized by alkaline pH (8.8±0.6 to 9.31±0.4) and phosphate limitation; and the lake is oligotrophic in nature. The mean concentrations of the cations and anions were in the order of Ca+2 > Mg+2 >Na+> K+ and HCO3- > SO4-2 > Cl- > PO4-3 respectively. The Piper plot revealed that the concentrations of the alkaline earth metals (Ca and Mg) exceeded those of the alkali metals (Na and K); and in case of anions, the concentrations of HCO3- exceeded those of the Cl- and SO4-2; and the lake water belong to Ca-Mg-HCO3 type. Only 19 taxa of diatoms were observed indicating poor diatom diversity probably reflecting the environmental variables typical of Trans-Himalayan region. The preliminary findings of this study could act as a crucial reference data for future limnological researches/studies. Furthermore, the findings also contribute to build on the existing knowledge particularly with regard to aquatic biodiversity on one of the remote Ramsar sites of Nepal.

Keywords: High altitude lakes, Major ions, Diatoms.

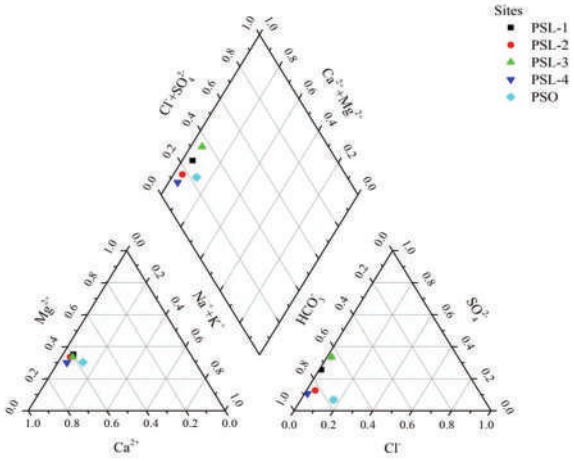


Figure 1: Piper plot of Lake Phoksundo

Figure 2: Gomphonema sp.

Cymbella

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चिसोचूह्लो महाकाव्यमा प्रयोगधर्मिता अनुसन्धानको सार

राम चन्द्र पौडेल
सहप्राध्यापक, स्कूल अफ आर्ट्स, काठमाडौं विश्वविद्यालय
पत्राचार लेखक : ramchandra@ku.edu.np

परियोजना साराशं

बालकृष्ण सम (वि.सं.१९५९–२०३८) आधुनिक नेपाली साहित्यमा विशेष गरी नाट्यसम्राटका रूपमा परिचित छन् । उनी कविताका सबै रूपको संरचनामासक्रिय रहेको देखिन्छ । विशेषत : उनको महत्वपूर्ण योगदान नेपाली नाटकलाई आधुनिकतामा ढाल्न र कवितालाई बौद्धिकस्तर प्रदान गर्न रहेको छ । समका विभिन्न एकाङ्की र पूर्णाङ्की नाटक, कविताका फुटकरदेखि मभ्फौला वृहत् रूप प्रकाशित छन् । उनका म पनि द्यौता मान्छु, मेरो नुहाने कोठा, इच्छा जस्ता फुटकर रचना ज्यादै प्रसिद्ध छन् भने आगो र पानी खण्डकाव्य (२०११) र चिसोचूह्लो महाकाव्य (२०१५) प्रकाशित छन् ।

आधुनिक नेपाली महाकाव्यको इतिहासमा बालकृष्ण समको चिसोचूह्लो महाकाव्य (२०१५) नितान्त नौलो छ । समले प्रस्तुत महाकाव्य रचना गर्दा देवकोटा, सिग्द्याल र पौडयालको महाकाव्य रचना शैलीभन्दा नितान्त पृथक शैलीमा गरेका छन् । ३२ सर्ग भएको चिसोचूह्लो महाकाव्य चम्पूशैली गद्यपद्यमिश्रित) मा लेखिएको छ । यसको कथावस्तु र पात्रचयनमा परम्परित काव्यसिद्धान्तको मूल्य र मान्यताप्रति विरोध गरिएकाले यसमा प्रयोग धर्मिता छ । परम्परित महाकाव्यसिद्धान्तले महाकाव्यको कथावस्तु इतिहास प्रसिद्ध वा ख्यातमा आधारित हुनुपर्छ भन्छ । तर, प्रस्तुत महाकाव्यको कथावस्तु जातमा सन्ते दमाईं र गौरी क्षेत्रिनीबीचमा भएको अभौतिक प्रेमको विषयको वर्णनमा केन्द्रित छ । आमाबाबु विहीन सन्ते दमाईं आर्थिक रूपमा महादरिद्र छ भने गौरी क्षेत्रीनी आर्थिक रूपमा सम्पन्न छे । परम्परित महाकाव्यसिद्धान्तले महाकाव्यको नायक जातमा उच्च, शूरवीर र उदात्तचरित्रको हुनुपर्ने बताएको छ । तर, बालकृष्ण समले चिसोचूह्लो महाकाव्यमा उक्त सिद्धान्तको पालना नगरी त्यसको विरोध गरेका छन् । बालकृष्ण सम आफू उच्च जातमा जन्मिएको र वर्गीय हिसाबले पनि सम्भ्रान्त परिवारका हुन् । तथापि उनले प्रस्तुत महाकाव्यमा दलित युवक सन्ते र गैरदलित गौरी क्षेत्रिनीबीचको अभौतिक प्रेम देखाई जातको आधरमा सच्चा प्रेमीप्रेमीकाका प्रेममा बाधक बन्न नहुने कुरा औल्याएका छन् । नेपाली समाजमा कलङ्कको रूपमा रहेको जातीय र आर्थिक विषमतामा सुधारको आवश्यकतामा सम अडिग रहेका छन् । जबसम्म सन्ते दमाईं जस्ता अतिविपन्न वर्गका मानिसका घरको चूह्लो चिसो रहन्छ, तबसम्म नेपाली समाजमा व्याप्त आर्थिक र सामाजिक विषमताको अन्त्य हुँदैन भन्ने समको ठहर्छ । सन्ते र गौरी यस समाजका उपल्लो जात र तल्लो जातका प्रेमीप्रेमीकाका प्रतिनिधिमूलक पात्र हुन् । यिनीहरूजस्ता प्रेमीप्रेमीकाको प्रेमले सार्थक रूप लिन नसक्नुमा जातीय र आर्थिक सङ्कीर्णता बाधक बनेकोमा समको चिन्ता छ । यसबाट मानवको मानवता हनन हुन पुगेको र यस महाकाव्यमा त्यस कुराबाट मुक्ति पाउनका निमित्त सङ्घर्षको बाटो तय गरेको देखिन्न । आर्थिक, सामाजिक र जातीय विभेदको अन्त्यका लागि प्रस्तुत महाकाव्यका चरित्रबाट विद्रोह नहुनु, बरु लाचार र विवश भई सन्ते लक्ष्यहीन जीवन बिताउँन बाध्य हुनु र गौरीले आत्महत्या गरिदिनाले उल्लिखित विषमताले अझ प्रोत्साहन पाउने कुरामा कुनै शङ्का छैन । यसरी सन्ते दमाईंको चूह्लो जातीय र आर्थिक विषमताको कारण तात्न नसकी सधैं चिसो हुनु मानवताप्रति घोर अन्याय भएकोमा समको असन्तुष्टि छ । यही नै चिसोचूह्लो महाकाव्यको मुख्य सार हो ।

Comparative study on physical and mechanical properties of clay burnt Nepalese brick and stabilized mud mortar

Mahesh Raj Bhatt[1*], Shiva Prasad Timalsina[2]
1 Assistant Professor, Department of Civil Engineering, Kathmandu University
2 Lecturer, Department of Civil Engineering, Kathmandu University
* Corresponding Author: mahesh.bhatt@ku.edu.np

Project Summary

Locally available clay burnt bricks were collected from 5 different sites of Kathmandu Valley, mud were collected from the site near by Boys Hostel at Dhulikhel of Kathmandu University. Collected bricks and mud were tested in the laboratory as per Indian and Nepalese's Standards for the determination of physical and mechanical properties. Furthermore, several types of mortar cubes (cement sand mortar CS, mud mortar MM, mud mortar with cement MC, mud mortar with lime powder ML and mud mortar with Surkhi MS), were tested in compressive testing machine to determine the compressive strength, volumetric shrinkage and density of mortar cubes. For physical test of bricks, conducted experiments were dimension test, shape test, hardness test, soundness test, corner test, structure test, surface finish test, color test, drop test, efflorescence test and water absorption test. Similarly for the mechanical property of bricks, test performed were compressive strength test, splitting test. Mud mortar (MM) and stabilized mud mortar were tested with mixing some percentage of stabilizer (Cement, Lime and Surkhi) and corresponding results were compared.

Results shows that water absorption of bricks obtained is in range of 10% -24%, density in range 1300 kg/cm3 – 1700 kg/cm3, compressive strength range is 2 to 10 MPa at first crack and 5 to 26 MPa at ultimate loading. The 28-days compressive strength of cement sand mortar (C: S, 1:5) is 4.75 MPa and of pure mud mortar cubes is 0.22 MPa. There is no significant effect of 5% cement as stabilizer in compressive strength of mud mortar however compressive strength increases with increase in cement by 10%, 15% and 20%. Compressive strength of mud mortar 0.22 MPa increased to 0.39 MPa when 10% of lime powder is added to it, however it decreased to 0.19 MPa when added lime is 20%. Similarly Compressive strength of mud mortar 0.22 MPa increased to 0.29 MPa when 10% of Surkhi powder is added to it, however it decreased to 0.16 MPa when added Surkhi is 20%. There is no shrinkage for cement sand mortar cubes however there is 14% volumetric shrinkage for mud mortar.

Keywords: Bricks, Water absorption, Compressive Strength, Mud Mortar, Stabilized Mud Mortar.

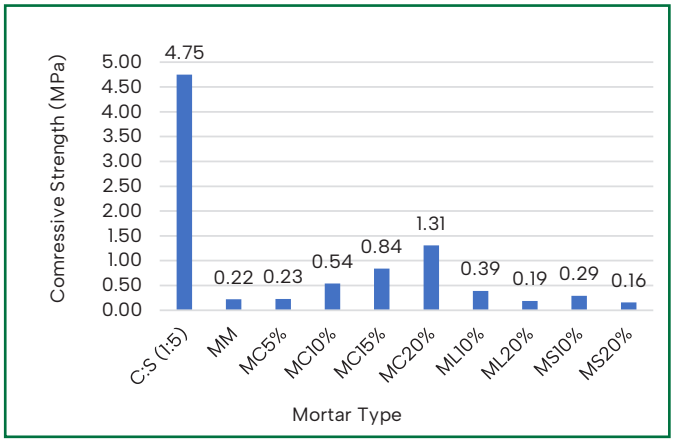


Figure 1: Compressive strength of different mortar cubes.

Figure 2: Preparation of mortar cubes mud and others.

Design and fabrication of 3-axis CNC milling machine

Dr. Krishna Prasad Shrestha[1*]
1 Associate Professor, Department of Mechanical Engineering, Kathmandu University
* Corresponding Author: kp@ku.edu.np

Project Summary

A 3-axis CNC milling machine with a workspace of 300mm x 300mm x 150mm was successfully designed and fabricated based on fixed gantry style. The primary goal was to develop a precise and efficient machine, complemented by a CNC simulator for operational visualization. Integrating mechanical and control systems iteratively, the machine was built to achieve high precision up to 0.1mm in all 3-axis.

The mechanical structure, made from mild steel, ensures rigidity and incorporates ball screws and profile rails for smooth movement along the X, Y, and Z axes. The control system employs a closed-loop motor control mechanism, powered by a Raspberry Pi Pico microcontroller, for real-time path planning and communication. A G-code parser developed in C++ allows the machine to execute complex operations automatically. Key findings include development of G-code parser, and an optimized structure validated through Finite Element Analysis (FEA). The machine is capable of machining materials up to a Brinell hardness of 2.75, such as common aluminum alloys. High-resolution encoders, NEMA 23 stepper motors, TB6600 motor drivers, and an 800W air-cooled spindle were utilized for reliable performance. The project also developed a tool path generator with error handling and collision detection, enhancing operational accuracy and efficiency.

Keyword's: CNC Milling Machine, G-code Parser, Closed-loop Control, Path Planning.

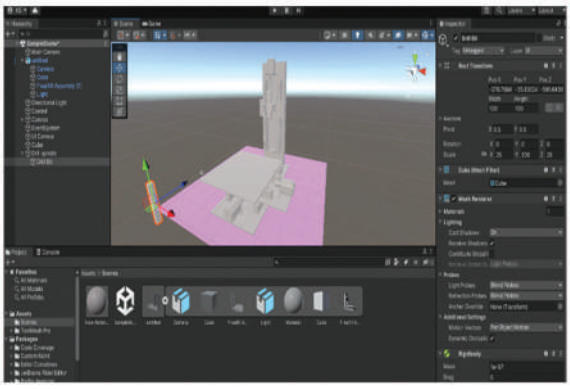
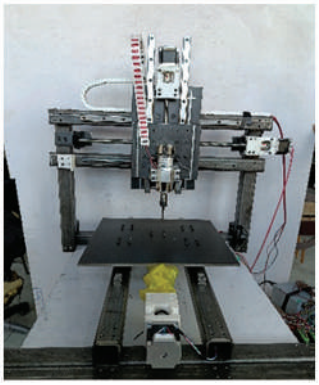


Figure: CNC simulator in unity.



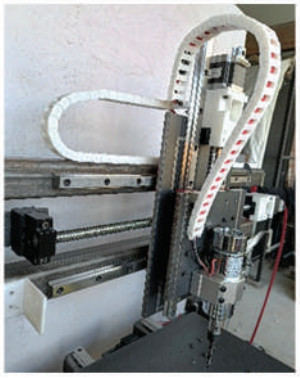


Figure: CNC milling machine.

Election candidates' commitment mining using deep learning

Prakash Poudyal*, Amrit Dahal, Rajani Chulyadyo, Sameer Tamrakar
Department of Computer Science and Engineering, School of Engineering
* Corresponding Author: prakash@ku.edu.np

Project Summary

Elections are the fundamental parts of democratic systems through which people can choose to elect the candidates of their choice. To win the trust of people, the candidates make commitments on various development agendas during their election campaigns. The candidates are expected to fulfill their commitments once they are elected and take their position in the office. Once the election is over, the candidates' commitments in the form of election manifestos, posters, pamphlets, videos, and other sources are not archived. All those promises just fade away eventually. In democratic rule, it is very essential for the elected candidates to be accountable to their constituents and the people. One of the ways to measure the success of elected candidates is to track the commitments made by them during the election campaigns. This research on Election Candidates' Commitment Mining is about analyzing commitments made by candidates or political parties during the election campaigns to their voters on various development agendas. This research work has developed a gold standard dataset by mining the commitments of the candidates. To develop the dataset, we first collected the data from different sources-mostly the audio, video, pamphlet, election manifesto, etc. and converted into digital text format. We extracted texts based on OCR. The validation of the data was done with four different expert annotators. Experts were hired to annotate the commitment in the digital text format. Once the annotations were finished, they were compared and the inter-rater agreement was determined and finalized the gold standard of political commitment. Further, this research has developed a system that can structure the commitment made by the candidates during the election time. In this study we have developed a model that extracts the commitment based upon deep learning technology to detect and analyze the publicity information that is released by the election candidate automatically. The outcome of the research is demonstrated in the mobile app so that common people can access it. The commitments that are made by the candidates can be visualized in the mobile app with the help of generative AI.

Keywords: Commitments, Election candidates, Machine learning, Deep learning, Generative AI.

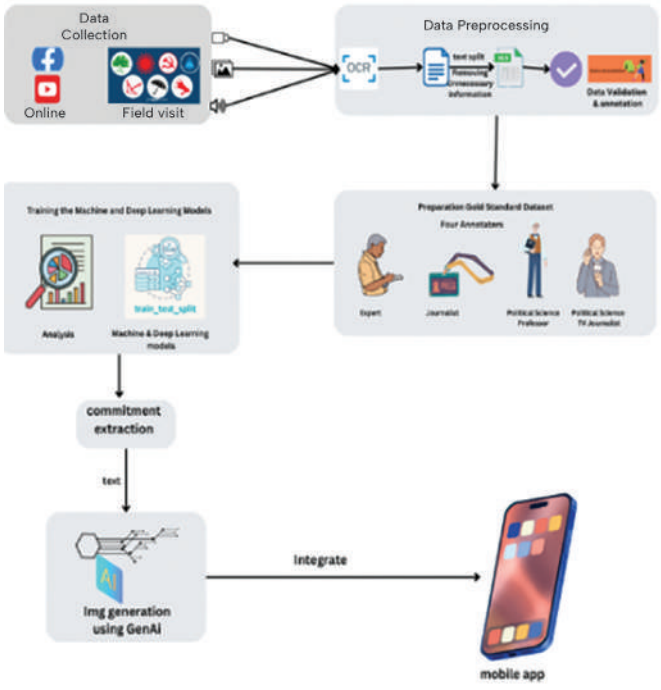


Figure 1: Proposed architecture.

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Enhancing municipal solid waste incinerated (MSWI) fly ash for use in cement industry

Dilip Kumar Rajak[1], Bibek Uprety[1]*
1 Department of Chemical Science and Engineering, Kathmandu University, Dhulikhel, Nepal.
* Corresponding Author: bibek.uprety@ku.edu.np

Project Summary

This research focused on the sustainable reuse of municipal solid waste incineration (MSWI) fly ash, specifically its potential application in cement clinker production. Key steps included the preparation and characterization of MSWI fly ash using analytical methods like XRF, XRD, and FTIR. Fly ash samples were processed through sieving, drying, and high-temperature roasting to reduce impurities like chlorides and sulfates. The impurity removal was verified through a reduction in peak intensities in XRD patterns, indicating successful purification.

Clinker sample was prepared by mixing treated MSWI fly ash with $CaCO_3$ (1.5:1) and heating to 950 ± 10°C. FTIR analysis revealed the removal of detrimental elements (sulfates, chlorides) and formation of clinker phases. XRD confirmed the presence of OPC phases. The reduction in NaCl peaks indicated chloride volatilization. Both analyzes confirmed the clinkers' composition aligns with OPC, suggesting MSWI fly ash's potential in sustainable cement production.

Further, a simulation model of a local cement industry was prepared to perform the economic and environmental assessment of using MSWI fly ash instead of the currently imported coal fly ash for cement production. This study demonstrated the feasibility of converting MSWI fly ash into a viable raw material for cement production, supporting sustainable waste management.

Keywords: Waste management, Resource recovery, Simulation.

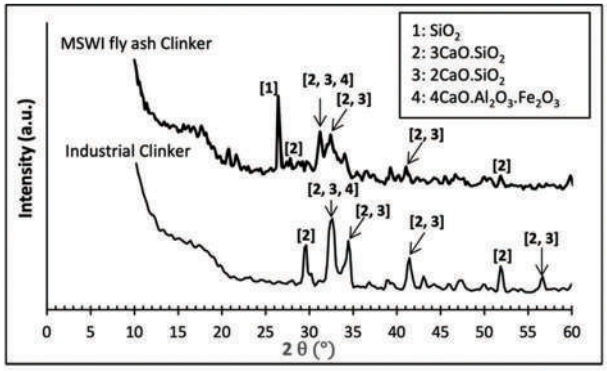

Figure 1: XRD of industrial and MSWI fly ash clinker.

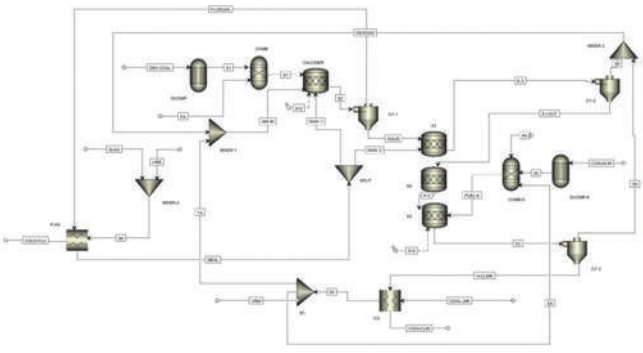

Figure 2: Simulation model of a clinker plant.

Evaluation of antimicrobial activities of secondary metabolites in Glycyrrhiza Glabra via computational and biomolecular methods

Asbin Khanal, Archana Kumari Jha, Pawan Bhatta, Sushant Bhujel and Simon Kumar Shrestha[1*]
*1 Assistant Professor, Department of Biotechnology, School of Science, Kathmandu University
Corresponding Author: simon.shrestha@ku.edu.np

Project Summary

Antimicrobial resistance (AMR) is a rising global health issue, mainly caused by the irrational use of antibiotics and bacterial adaptation to these drugs. AMR could be accountable for 10 million deaths per year by 2050. We investigated the antibacterial properties of phytochemicals from Glycyrrhiza glabra against four bacterial strains, viz, Escherichia coli (NRRL B3054), Enterococcus faecalis (ATCC 19433), Staphylococcus aureus (ATCC 12600), and Streptomyces griseus (NRRL B2165). In summary, the methanol extracts demonstrated higher antimicrobial activity, with zone of inhibition of 19.33±0.5 mm against E. faecalis and the MIC of ethanol extract was lower than the methanol extract for all the pathogens.

GC-MS at IIT Delhi identified 61 compounds in methanol extract and 143 compounds in ethanol extract. LC-MS at IIT Bombay showed the presence of 100 compounds in both positive and negative modes for methanl and ethanol extracts. and evaluated their antimicrobial properties.

Furthermore, molecular docking identified the phytochemicals: GlyinflaninG, Licoagrone, Quercitrin, Glucoliquiritin, and Kanzonol Y have higher binding affinity to potent target proteins. E.g., GlyinflaninG could inhibit Undecaprenyl diphosphate synthase (4H8E) involved in cell wall synthesis. These phytochemicals showed drug likeliness through ADME analysis. The docked poses were supported by stability of protein-ligand complexes using RMSD, RMSF, Rg, Hydrogen bond, SASA results of MD simulations conducted through Gromacs at Active Learning Lab at KU.

Keywords: Molecular docking, Molecular dynamics, Phytochemicals, GC-MS, LC-MS, *Glycyrrhiza Glabra,* Antimicrobial assay.

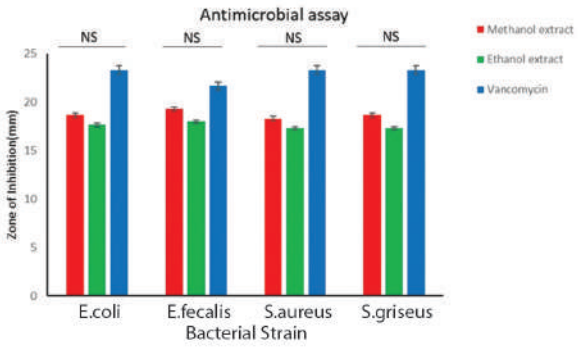

Figure 1. Bar graph representing the zone of inhibition against four bacterial strains viz. E.coli, E. fecalis, S.aureus and S. griseus. Values represent mean± SE NS: P> 0.05, No significant difference between our antibiotics and extracts.

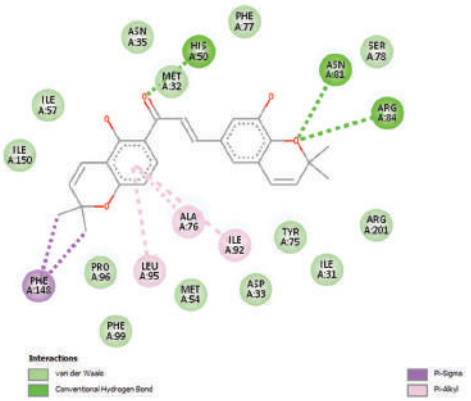

Figure 2. 2D interaction of best docking result of GlyinflaninG and 4H8E with a binding energy of ΔG equal to -11.60 kcal/mol

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Exploration of the academic programme and curriculum development practices at Kathmandu University

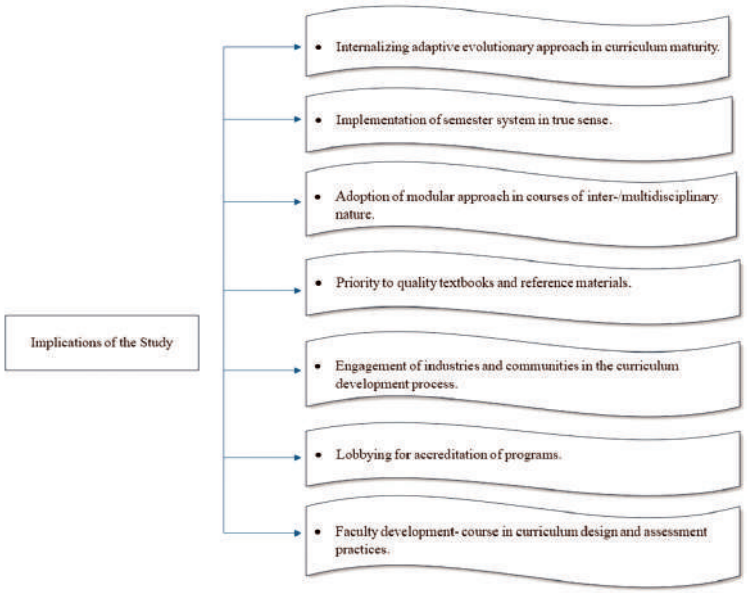
Hem Raj Kafle, PhD
Professor, Department of Language Education, School of Education, Kathmandu University
Corresponding Author: hemraj@kusoed.edu.np

Project Summary

This qualitative study explores the curriculum development practices at Kathmandu University (KU). It is mainly based on in-depth interviews with the founders and the faculty members serving in different leading positions. The study also analyzed documents related to curriculum development. The exploration would lead to a systematic documentation of the experiences and memories of KU's founding and succeeding leadership, which would serve as a reference text for a thorough understanding of the context, vision, and programs of KU from its inception.

The findings showed that KU is committed to an effective, market-driven, and context-sensitive curriculum for its fundamental programs, like the Intermediate Science, to advanced degrees. The study explored the struggles of founders and faculty members to establish all programs' curricula with national and international standards. The curriculum development teams first explored the existing curricula of the universities of the nation and developed curriculum through a participatory and context-sensitive approach emphasizing inclusivity and relevance. It was also found that faculty members played a central role consulting national and international experts, including alumni, industry stakeholders, schoolteachers, and policymakers, in the curriculum development process.

The study highlighted that the founding members' personal motivation for novelty in educational offerings, the zeal for fostering an autonomous learning environment, and avoiding duplication with existing universities enabled them to develop curricula that could integrate the global trends, indigenous knowledge, and local culture to create meaningful learning experiences. Overall, the findings revealed that the development of curriculum is committed to producing personnel who can adjust in national and international settings. The implication of the study can be as shown in the figure.



Interspecific grafting of tomato (Solanum lycopersicum): an alternative technology to manage the root-knot nematode and bacterial wilt disease without altering the fruit quality

Briksha G.C., Rachana Magar, Bitisha Subedi and Kumar Lama*
Department of Agriculture, School of Science, Kathmandu University
* Corresponding Author: kumar.lama@ku.edu.np

Project Summary

Grafting involves joining of two different parts of one or more plants in such a way that both parts unite and continue their growth as a single plant. In this study, splice grafting was performed in tomato cv. Srijana and brinjal cv. F1 hybrid seedlings to evaluate the success rate of interspecific grafting, effect of root stock in tomato fruit quality and resistivity of tomato, brinjal and wild brinjal seedlings to bacterial wilt disease. Brinjal seedlings of age 35 days having 0.7 mm stem diameter size and tomato seedlings of age 20 days having 0.6 mm diameter size were selected for grafting as a rootstock and scion respectively. A modified low cost healing chamber was developed and humidity was maintained manually to boost the success rate of interspecific grafting. Grafted plants were kept in modified healing chamber for 9 days and 3 days at growing chamber before removing grafting clip. Particularly, 67.9 % of total interspecific grafted plants were observed successfully joined between the scion and rootstock with proper graft union. The physical appearance of tomato fruits from grafted plants were observed similar with the non-grafted ones. Interestingly, Total Soluble Sugar (TSS) and Titratable Acidity (TA) were noted significantly higher in fully ripe fruits of grafted plants compared to non-grafted fruits. The pathogenicity test of seedlings confirmed the wild brinjal seedlings are resistant to bacterial wilt disease. Thus, a low cost optimized protocol for interspecific grafting of tomato and brinjal seedlings was achieved with potential to adopt by farmers in the future.

Keywords: Grafting, Tomato, Bacterial wilt, Fruit quality.

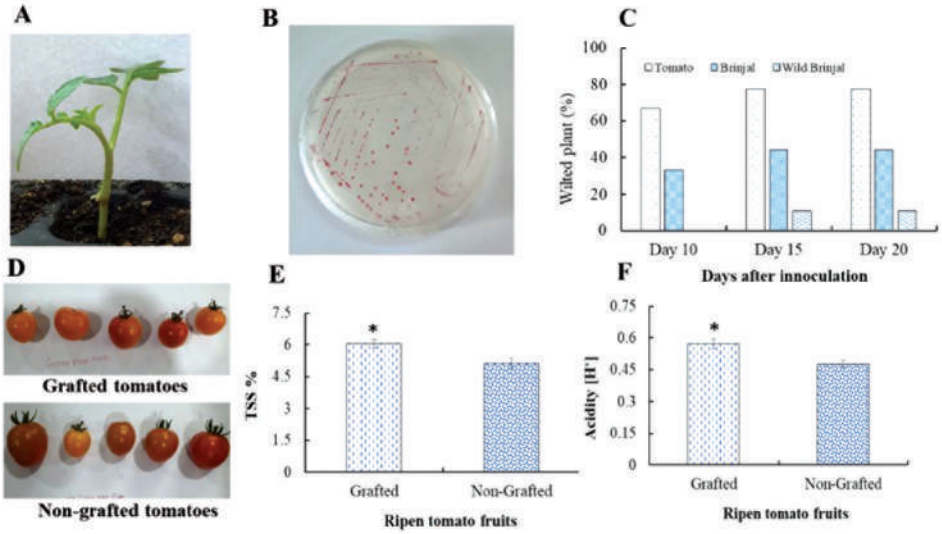


Figure: Interspecific grafting of tomato and brinjal. A. Grafted seedling of tomato – scion and brinjal – root stock; B. Isolated Ralstonia solanacearum in CPG agar media; C. Percentage of wilted seedlings during the pathogenicity test; D. Tomato fruits from grafted and non-grafted plants and E&F. TSS and TA in grafted and non-grafted fully ripe tomato fruits. Significant differences compared with control were determined by Student's t-test: *P<0.05.

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Integration of Nepalese traditional craftsmanship with 3D printing technology in metal casting for industrial design

Tejesh Man Shakya*[1], Yogesh Niroula[2], Jebin Shakya[3], and Manjistha Tuladhar[4]
1 Academic Lecturer, Craft and Design Program, School of Arts and School of Engineering, Kathmandu University
2 Undergraduate Student, B.E.Mech., Department of Mechanical Engineering, School of Engineering, Kathmandu University
3, 4 Undergraduate Student, BCDes, Department of Art and Design, School of Arts, Kathmandu University
* Corresponding Author: tejesh.shakya@ku.edu.np

Project Summary

This research explores the integration of Nepalese traditional craftsmanship with 3D printing technology to innovate metal casting processes for industrial design while preserving cultural heritage. Focusing on Lost Wax Casting Methods and their adaptation through additive manufacturing along with 21st century's invention Lost PLA Casting Methods, the study aims to bridge traditional artistry with post-modern precision, scalability, and efficiency.

The project has documented traditional Nepalese lost wax casting techniques, emphasizing their historical significance, material choices, and intricate processes. It has also experimented with FDM 3D-printed Polylactic Acid (PLA) models as substitutes for beeswax in metal casting by integrating theories of Lost Wax Casting Method and Lost PLA Casting Method. Advanced CAD tools enabled the digitization of intricate designs of traditional and contemporary brass faucets, which were transformed into PLA prototypes using a 3D printer.

The prototypes underwent rigorous testing, integrating PLA models with Nepalese molding materials like local ceramic or refractory clay, cow dung, and rice husk to preserve traditional aesthetics while ensuring structural integrity. Brass casting trials demonstrated the successful amalgamation of digital technology and manual craftsmanship, yielding industrial design products like brass faucets with enhanced precision and scalability.

This interdisciplinary effort has revealed the potential of 3D printing and Lost PLA Casting to enhance traditional casting techniques while maintaining cultural authenticity. The findings showcase opportunities for scalable production in industrial applications, retaining the organic, handmade appeal of Nepalese artistry. As the research progresses, further optimizations and knowledge transfer initiatives are anticipated to advance this novel integration and contribute to preserving Nepal's rich heritage.

Keywords: Nepalese craftsmanship, Lost wax casting, 3D printing, Lost PLA casting, Industrial design.

Figure 2: Three dimensional (3D) scanning process of faucet.

Figure 3: Brass faucets after casting.

IoT based humidifier for indoor farming system

Ram Kaji Budhathoki[1], Santosh Shaha[2]
1 Professor and Head, Department of Electrical and Electronics Engineering.
2 Department of Electrical and Electronics Engineering.
Corresponding Author: ram.budhathoki@ku.edu.np

Project Summary

In this project, we assessed the design and implementation of an Internet of Things (IoT)-based humidifier control system, aimed at optimizing environmental conditions by efficiently managing indoor temperature and humidity levels of an indoor farm. The system leverages a network of sensors, real-time data monitoring, and a central microcontroller to autonomously regulate the indoor climate by controlling a humidifier. The proposed solution integrates a web interface, providing users with a seamless interaction point for adjusting environmental settings, viewing real-time data, and receiving notifications for any deviations from predefined thresholds. The web interface is designed with a responsive, user-friendly layout, utilizing HTML, CSS, JavaScript, and PHP for dynamic user interaction and data handling. The back end ensures smooth data transmission and server-side operations, while the front end offers features like a login page, user registration, real-time analytics, and data visualization. The controller, built on the ESP-32 microcontroller platform, processes sensor input and adjusts the humidifier's output based on defined thresholds, ensuring an optimal indoor environment. The system is designed for scalability, cost-effectiveness, and ease of future expansion, making it suitable for various applications in residential, office, and industrial settings. This work demonstrates the potential of IoT systems in providing precise climate control solutions, contributing to improved comfort, well-being, and operational efficiency.

Keywords: IoT, Humidifier, Control, Indoor farm.

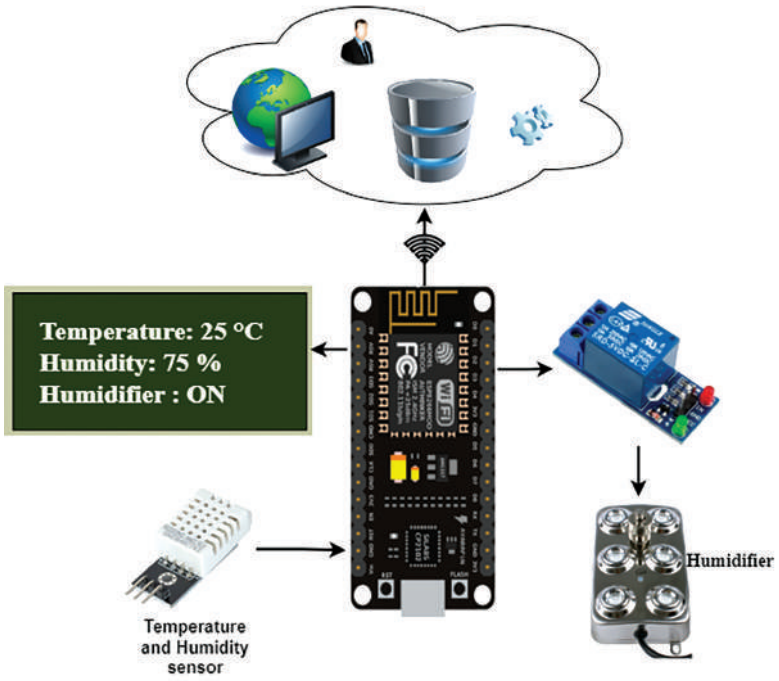

Figure: Block diagram of IoT based humidifier.

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Determinants of knowledge, enrolment, and utilisation of national health insurance services among adult patients attending a tertiary health facility in Pokhara

Dr Durga Dhungana
Assistant Professor, Department of Internal Medicine, Manipal College of Medical Sciences, Pokhara, Nepal
Correspondent Author: durga2008@gmail.com

Project Summary

This study explored the determinants of knowledge and enrolment in National Health Insurance services among adult patients attending Manipal Teaching Hospital of Pokhara, Nepal. This quantitative, cross-sectional study with multi-stage sampling (n=644) (322 samples each of insured and non-insured population) was performed using a semi-structured questionnaire containing sociodemographic details as well as questions on knowledge about government health insurance(GHI). Chi-square tests and binary logistic regression analysis was done to assess for the effect of different independent variables on the outcome.

The main source of health insurance information was from healthcare workers (56.5%) and bema sahayogi (14.9%). Mean duration of the insurance enrolment was 2.83 years (S.D=0.09). Among 322 insured respondents, 62.42% cases had paid for services not included under the GHI scheme and 41.92% cases had taken services from non-GHI sites. Except six respondents, rest told that they would advise other non-insured people to get enrolled into GHI. 78.2% respondents reported that they were satisfied with GHI services. Among the 322 non-insured respondents, thirty-one people told that they have not heard of the insurance system. The main reasons cited for not getting enrolled into GHI were not being sick often (39.13%), lack of information about registration for GHI (18.63%) and enrollment into other insurance schemes like ECHS (15.52%). One hundred and seventy-eight (55.28%) non-insured respondents were willing to get enrolled into GHI.

On analyzing the factors affecting the enrollment into health insurance system, those likely to get enrolled were married individuals as compared to the unmarried individuals. Moreover, those having family members on long-term medications as well as having elderly family members with chronic illnesses were likely to get enrolled into GHI scheme as compared to non-insured respondents. On regression analysis, it was found that having family members on regular medications and married status were the statistically significant contributing factors for GHI enrollment. Entering knowledge factor into the next block, adequate knowledge level was the only significant factor. Those having adequate knowledge were 10.950 (7.401-16.200) more likely to get insured as compared to those having inadequate knowledge.

56.2 % of the respondents had adequate knowledge regarding health insurance. On comparing between insured and non-insured groups, 82.9% of the insured and only 29.5% had adequate knowledge ($p<0.001$). On Univariate analysis, the significant sociodemographic factors affecting the knowledge about GHI were found to be married status as compared to unmarried, having employment as compared to unemployed status, having family members on long-term medications and having any elderly members with chronic illness or psychiatric illness or disabled. On multivariate analysis, married status, employment as self or job and having family members on regular medications were found as the significant factors.

Keywords: Determinants, Enrolment, Health insurance, Knowledge, Nepal.

Perceived sources of stress among dental undergraduate students and its impact on academic progress and oral hygiene status

Dr. Arjun Hari Rijal[1*], Dr. Simant Lamichhane, Dr. Gitanjali Subedi, Dr. Sachita Thapa
* Corresponding Author: drarjunrijal@kusms.edu.np

Project Summary

Dental education institutions are renowned for their rigorous and high-pressure academic settings. Current curricula expect dental students to master a wide range of skills, encompassing theoretical understanding, clinical aptitude, and effective interpersonal communication. This type of stressful situation may have direct impact on academics and oral hygiene status of students. So, the main objective of current study is to find out perceived sources of stress among dental undergraduate students and its impact on academic progress and oral hygiene status.

Total 187 students participated in the present study, 47, 49, 50, 41 students from first year to the fourth year respectively. Out of the 28 (15%) were males and rests were female. Most of the participants were stressful to the clinical training, workload and performance pressure.

The study successfully demonstrated a significant association between biological stress markers (cortisol) and academic progress, supporting the hypothesis that higher stress levels may negatively impact academic performance. However, the association between stress and oral hygiene status was not statistically significant, though trends in cortisol levels suggest that students with better oral hygiene tend to have lower stress. The use of multiple stress assessment methods (both cortisol and DASS-21) reveals some variability in the findings, highlighting the complexity of stress and its impacts on both academic and oral health.

Keywords: Stress, Oral hygiene status, Dental working environment.

Table 1: Association between oral hygiene status and cortisol level

Oral hygiene	N	Mean	Standard Deviation	F-value
Good	53	4.89	3.39	0.964
Fair	124	4.93	3.46	
Poor	10	5.22	4.58	
Total	187	4.94	3.49	

Table 1: Association between cortisol and academic status

	N	Mean	Standard Deviation	P-value
Excellent	19	4.0984	2.45103	0.000
Good	60	3.5192	2.20133	
Satisfactory	56	4.6070	1.82282	
Poor	52	7.2477	4.99217	
Total	187	4.9406	3.49002	

Table 3: Association between gingival health and cortisol level

Gingival_ index	N	Mean	Standard Deviation	P-value
Normal	3	5.19	4.32	0.221
Mild	87	4.53	2.87	
Moderate	94	5.20	3.84	
Severe	3	8.25	6.72	
Total	187	4.94	3.49	

Table 4: Association between Academic Performance and DASS_21

		DASS_21					P-value
		Normal	Mild	Moderate	Severe	Extremely severe	
Academic performance	Excellent	8(42.1)	4(21.1)	2(10.5)	5(26.30)	0(0.0)	0.756
	Good	19(31.7)	9(15.0)	14(23.3)	14(23.3)	4(6.7)	
	Satisfactory	17(30.4)	12(21.4)	7(12.5)	14(25.0)	6(10.7)	
	Poor	16(30.8)	10(19.2)	6(11.5)	13(25.0)	7(13.5)	
	Total	60(32.1)	35(18.7)	29(15.5)	46(24.6)	17(9.1)	

Planning and design of a robotic data logging system for WEIR-Laboratory at Kathmandu University

Santosh Chaudhary[1*], Prof. Dr.-Ing. Ramesh Kumar Maskey[2]
1 Assistant Professor, Department of Civil Engineering, School of Engineering, Kathmandu University
2 Professor, Department of Civil Engineering, School of Engineering, Kathmandu University
* Corresponding Author: santosh.chaudhary@ku.edu.np

Project Summary

The robotics data logging system collects diverse information from various sensors mounted on a 2-axis gantry that moves along the X and Y axes. These sensors automatically gather data types, including distance, depth, and environmental factors like temperature and flow characteristics, either autonomously or via user commands. The data originates from specialized instruments such as flow meters and LiDAR systems, calibrated for high precision. Sorting is crucial for ensuring accuracy and utility, systematically organizing data by type distinguishing depth from flow rates and environmental metrics and by source, associating readings with specific sensors. This meticulous process aligns each data point with its corresponding spatial coordinates on the riverbed, which is essential for accurate mapping. For example, depth measurements from a LiDAR system must correlate precisely with flow readings from a flow meter at the same X, and Y coordinates. Proper organization enables meaningful analysis, facilitating the creation of detailed and reliable visualizations of the riverbed and its environmental conditions. This structured data forms the basis for further analyzes, such as identifying patterns, modeling sediment deposition, and optimizing hydrological and hydraulic models.

Keywords: Automatic data sensing and acquisition, LiDAR system, Spatial mapping, Hydrological modeling, Hydraulic modeling, River environment analysis.

Figure 1: Stone Piled up for 3D scanning.

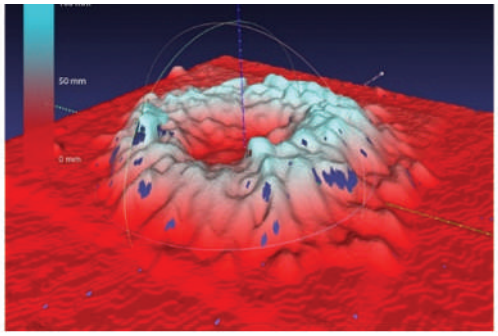

Figure 2: Result-3D spatial mapping.

Figure 3: Old gantry placed over the system.

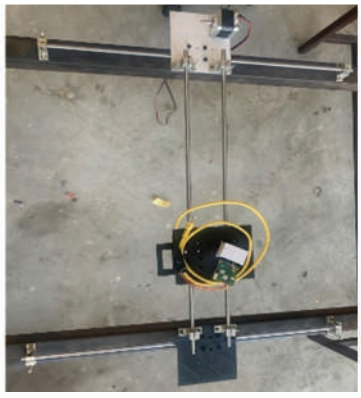

Figure 4: RoDaLo system

6 RDI Activities

RDI Agreement Signing and Orientation Program of Internally Funded Project 2025.

Kathmandu University and DAAD Explore New Horizons for Academic Collaboration.

Proposal Presentation for Internally Funded Project 2025.

Final Review and Evaluation Program of Internally Funded Projects 2023/24.

Interaction Program between the Vice-Chancellor and current PhD scholars 2024.

Meetings held with the PI's of ongoing Externally Funded projects of KUSOS, KUSOE, KUSOL and KUSMS.

Falling Walls Lab Kathmandu 2025 brought together over 100 participants, with 13 finalists presenting innovative three-minute pitches addressing global challenges. The event, which was also held in 2024, highlighted research and entrepreneurial ideas from students and professionals before a distinguished jury.

7 Event and Conferences

From 2023 to 2025

National Conference on Filmmaking in Nepal: Exploring Diverse Perspectives

- Date: April 4–5, 2024 (22nd–23rd Chaitra 2080 B.S.)
- Venue: Kathmandu University, School of Arts, Hattiban
- Organized by: Department of Languages and Mass Communication, School of Arts (KUSOA)
- Theme: AI in cinema, diversity on screen, sound dramaturgy, historical narratives ,digital transformation in cinema, gender and inclusion, sustainability, cultural narratives

STAR Global Conference 2024

- Theme: Engaging Communities, Leaders, and Practitioners: Advancing Transformative Research and Education
- Dates: December 8-14, 2024
- Organized by: STAR Scholars Network in collaboration with Kathmandu University School of Education

International Conference on Technical and Vocational Education and Training (TVET)

- Theme: Deeper Links, Stronger Institutions, Decent Jobs – Building Better TVET Systems
- Date: 15–16 September 2023
- Venue: Kathmandu, Nepal

WCP–Nepal 3rd Annual Conference Climate Change and Trade Sustainability in South Asia

- Dates: 11–12 January 2025
- Venue: Kathmandu University School of Management (KUSOM), Lalitpur, Nepal
- Organizer: WTO Chairs Programme – Nepal

National Conference on Contemporary Management Education and Practices

- Date: 19 May 2023
- Venue: Kathmandu University
- Theme: Evolving landscape of management education in Nepal

Second International Conference on Criminal Justice

- Theme: Changing Dimensions of Administration of Criminal Justice in the Contemporary Era
- Date: March 28–29, 2025
- Organizers: NMIMS Indore School of Law and Kathmandu University School of Law

International Conference on Federalism, Devolution of Power, and Inclusive Democracy in Nepal and Asia

- Theme: Federalism, Devolution of Power, and Inclusive Democracy in Nepal and Asia
- Date: November 22–23, 2023
- Venue: The Malla Hotel, Kathmandu
- Organizer: Kathmandu University School of Law (KUSoL)
- Supported by: Subnational Governance Program (SNGP), implemented by The Asia Foundation in partnership with The Australian Government

Fourth International Nursing and Midwifery Conference 2025

- Theme: Opening New Horizons in Nursing Science: Health Care Innovation and Beyond
- Date: 20–21 February 2025
- Venue: Skill Lab Auditorium Hall, Dhulikhel Hospital, Kathmandu University
- Organized by: Nursing and Midwifery Department, Dhulikhel Hospital, Kathmandu University Hospital, Kathmandu University School of Medical Sciences

National Conference on Data & Computing (NCDC 2024)

- Date: October 4–5, 2024
- Venue: Kathmandu University, Dhulikhel, Nepal
- Theme: Mathematics, computing, data science, and statistics

International Conference on Mountain Hydrology and Cryosphere

- Date: November 9–10, 2023
- Venue: Kathmandu and Dhulikhel, Nepal
- Organized by: Nepal Committee for the International Association of Hydrological Sciences (IAHS), Himalayan Cryosphere, Climate and Disaster Research Center, Kathmandu University (HiCCDRC, KU), and The Small Earth Nepal (SEN)
- Theme: Glacier dynamics, groundwater hydrology, and disaster risk related to snow and ice avalanches

National Biotechnology Conference 2023

- Date: May 11–12, 2023
- Venue: Kathmandu University
- Organized by: Department of Biotechnology, Kathmandu University
- Theme: Challenges and Prospects of Biotechnology in Nepal

Third International Conference on Applications of Mathematics to Nonlinear Sciences

- Date: May 25–28, 2023
- Venue: Pokhara, Nepal
- Organized by: Association of Nepalese Mathematicians in America (ANMA), Nepal Mathematical Society (NMS), Central Department of Mathematics (Tribhuvan University), and Department of Mathematics (Kathmandu University)

Communications and Information Processing Nepal Conference (CIP-N 2023)

- Date: April 7, 2023
- Venue: Kathmandu University, Dhulikhel, Nepal
- Organized by: Department of Electrical and Electronics Engineering, Kathmandu University
- Theme: Competence-Innovation-and-Partnership (CIP) for Technological Readiness Yield (TRY)

KU CAP-24 Networking Conference

- Date: December 4, 2024
- Organized by: Kathmandu University, School of Engineering, Department of Electrical and Electronics Engineering

CORRESPONDENCE

Director, Research, Development and Innovation (RDI)
Email : research@ku.edu.np, rdi_office@ku.edu.np
Website: https://rdi.ku.edu.np/
Contact Number: +977-011-415100, 415200