



Collaboration with Low and Middle Income Countries

Our Vision: Knowledge for a better world

COLLABORATION WITH LOW AND MIDDLE INCOME COUNTRIES

NTNU has a long tradition of collaborating with low and middle income countries (LMIC). Collaboration encompasses education, research, innovation and capacity building, and contributes to building academic knowledge, mutual value and building awareness for the joint need to address global challenges. Collaboration with low and middle income countries is important in NTNU's contribution to the UN's sustainable development goals.

NTNU wants to increase the institutional anchoring of collaboration with low and middle income countries to increase relevance, build capacity and foster interdisciplinary collaboration. Through these activities NTNU promotes its global ambitions for knowledge for a better world.

Collaboration with low and middle income countries is one of the main priorities in NTNU's International Action Plan for 2018-2021.

OBJECTIVES

NTNU shall strengthen collaboration with institutions in low and middle income countries. Collaboration shall be based on mutuality, interdisciplinarity and sustainability with a long-term perspective

MEASURES

- Faculties shall identify institutions and clusters of institutions in low and middle income countries to develop strategic partnerships with
- NTNU shall establish a working group and arenas to strengthen and coordinate collaboration with low and middle income countries
- NTNU shall develop mechanisms and incentives to support interdisciplinary collaboration with low and middle income countries in dialogue with Norad, the Research Council of Norway and the Norwegian Center of International Cooperation in Education, in addition to other national and international institutions

NTNU conducted a mapping of collaboration with institutions in low and middle income countries in the winter 2017–18 for the period 2010–2018. These first pages show the aggregated statistics, while the following pages show examples of projects and collaborations.

212

COLLABORATIONS
AND PROJECTS

275

COLLABORATING
INSTITUTIONS IN LMIC

59

COUNTRIES

497

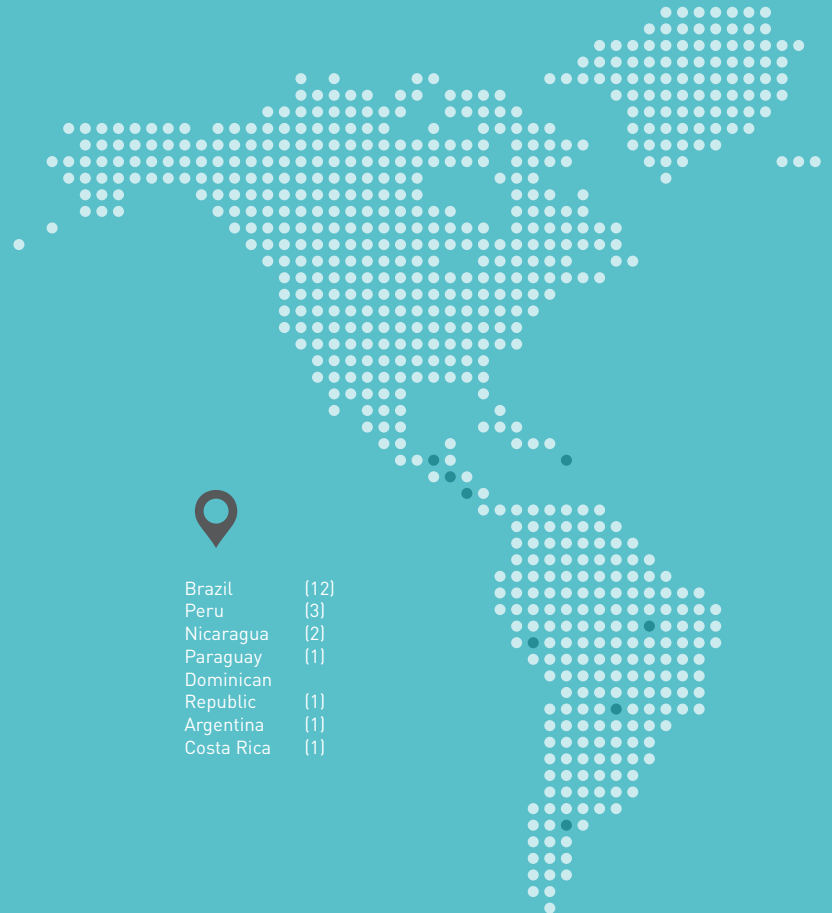
COLLABORATING
INSTITUTIONS IN TOTAL

42

PARTICIPATING DEPARTMENTS
INCLUDING ALL FACULTIES

LMIC Collaborating with NTNU

Number of collaborations





- Russia (10)
- Ukraine (8)
- Turkey (8)
- Bosnia and Herzegovina (7)
- Montenegro (5)
- Romania (5)
- Armenia (4)
- Serbia (3)
- Bulgaria (3)
- Albania (3)
- Macedonia (3)
- Moldova (2)
- Kosovo (1)
- Belarus (1)



- Nepal (26)
- India (26)
- China (19)
- Thailand (6)
- Sri Lanka (6)
- Malaysia (4)
- Indonesia (4)
- Pakistan (3)
- Afghanistan (3)
- Georgia (2)
- Palestine (2)
- Vietnam (1)
- Bangladesh (1)
- Bhutan (1)
- Syria (1)
- Iran (1)
- Myanmar (1)
- Cambodia (1)
- Uzbekistan (1)
- Kyrgyzstan (1)

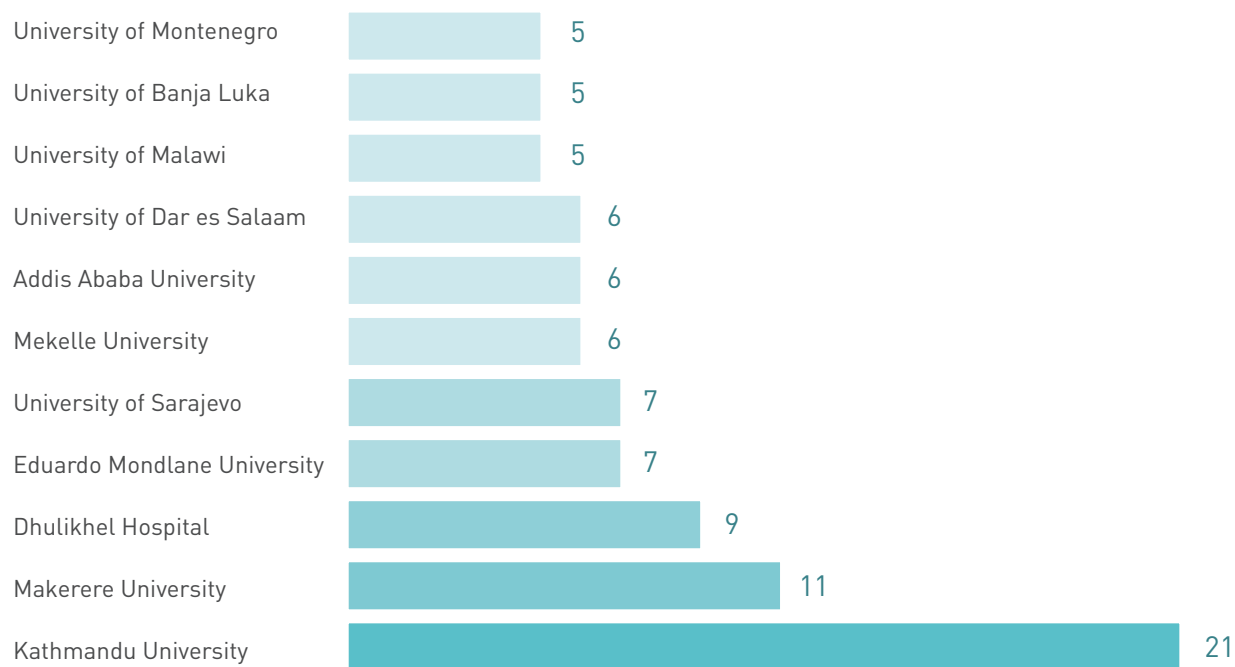


- Tanzania (14)
- Uganda (13)
- Ethiopia (10)
- Mozambique (9)
- South Africa (8)
- Ghana (6)
- Malawi (5)
- Zambia (5)
- Sierra Leone (2)
- Namibia (1)
- Eritrea (1)
- Madagascar (1)
- Somalia (1)
- South Sudan (1)
- Angola (1)
- Nigeria (1)
- Rwanda (1)
- Mali (1)

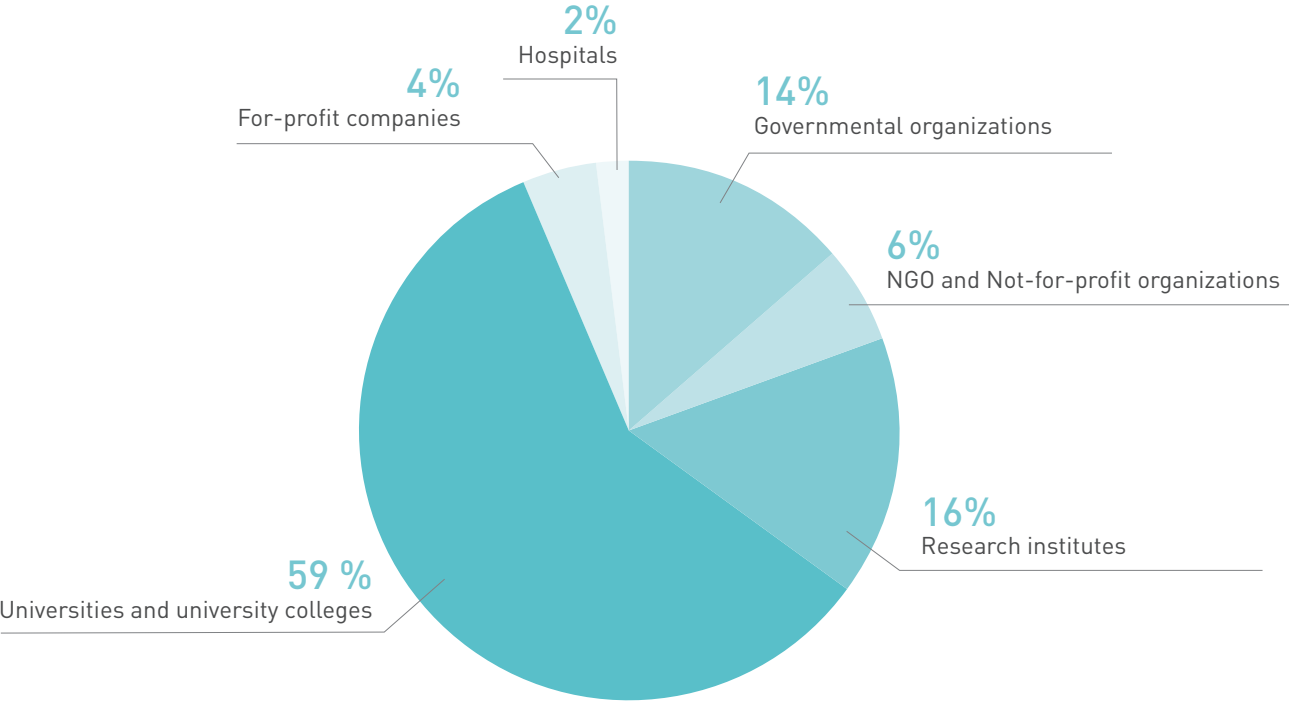


Institutions in LMIC

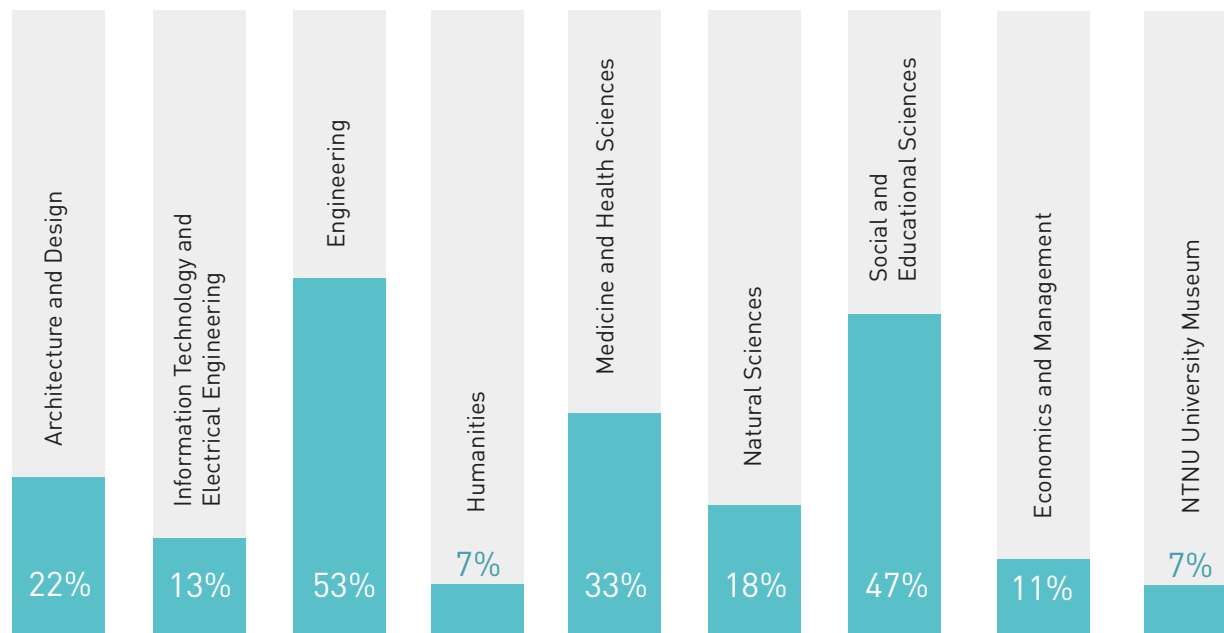
INSTITUTIONS THAT NTNU HAVE MOST COLLABORATIVE LINKS WITH



DISTRIBUTION OF COLLABORATING INSTITUTIONS IN LMICS BY SECTOR/TYPE



DISTRIBUTION OF ACTIVITY BY NTNU FACULTY



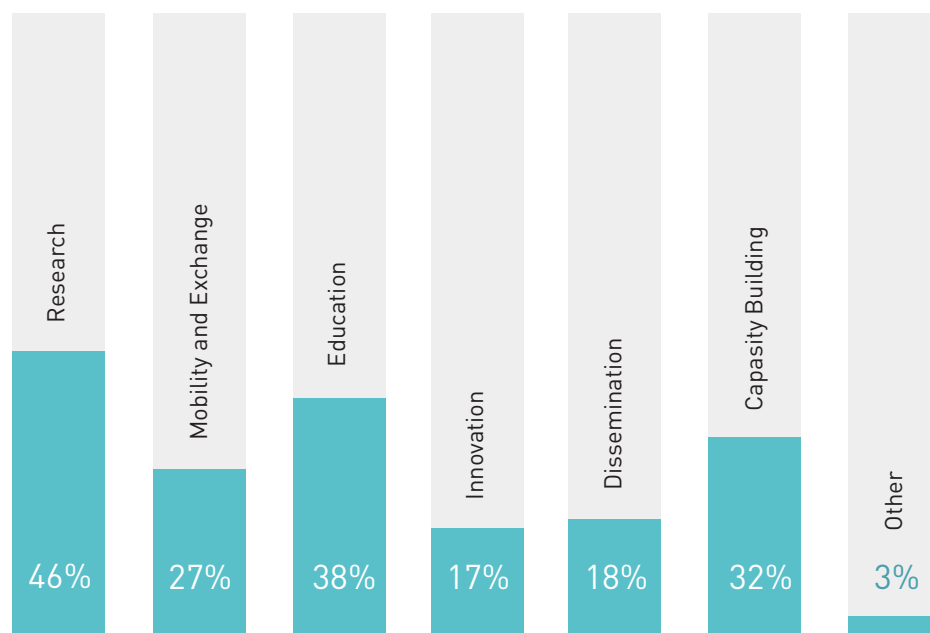
MAJOR FUNDING SOURCES (NUMBER OF COLLABORATIONS)

More than 60 funding sources enable projects and collaboration, including private companies, non-governmental organizations, governmental funding agencies and bodies, and philanthropic organizations.

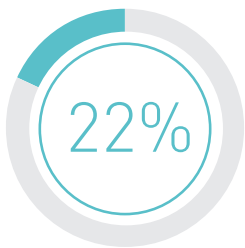


Broad Collaboration

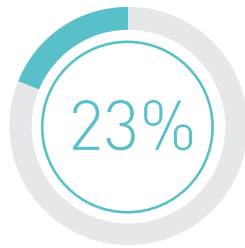
The full breadth of the university takes part in collaboration with low and middle income countries. Most of the cross-cutting thematic research areas of NTNU is being addressed by project collaboration as shown on the opposite page. Most project collaboration address one or more of the project activities below. On the following pages, concrete collaborations are showcased



Thematic Topics of Collaboration



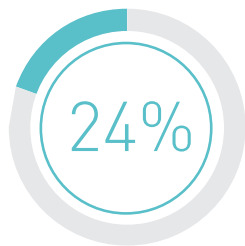
ENERGY



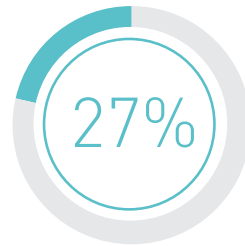
HEALTH



OCEANS



SUSTAINABILITY



OTHER AREAS

Hydropower Technology Development in Nepal



Nepal has a tremendous hydropower potential, and the country is at the starting point to develop this renewable energy resource. Norway has developed much of its hydropower resources and is in the other end of the development stage. It is very interesting for NTNU to follow the development in Nepal in order to maintain and further develop a research-based education within hydropower technology.

NTNU has collaborated with KU within hydropower technology since the 1990s. Master programs within electrical and mechanical engineering started in 2003. Key personnel at KU has received a Ph.D.-degree from NTNU and returned to KU for further development of the education quality and establishment of research facilities within the university. Now, KU offers master by research, Ph.D.-education and they are working on research projects together with NTNU and many other universities. The Turbine Testing Lab at KU is one of its kind research facility in the region, jointly managed by KU and NTNU. This enables high level research publications, yearly student exchange and an annual joint conference in Nepal. This makes the cooperation sustainable. Key to this success is the close relations between NTNU's personnel and KU's personnel who had their Ph.D.-education at NTNU, leadership support from the start of the collaboration and

support from the Norwegian Embassy in Nepal, Norway's Ministry of Foreign Affairs, Norad and the Norwegian Center for International Cooperation in Education.

We meet these former students in many leading positions in Nepal's hydropower industry, and government. The cooperation has given NTNU and Norway a reputation which is beneficial for Norwegian industry when establishing activities in Nepal.

The first spinoffs in form of new businesses within hydropower technology have been established in Nepal from KU, which demonstrates their ability within education, research and innovation.

Founder and former Vice Chancellor of KU, Suresh Raj Sharma, was in 2014 awarded a Honorary Doctorate from NTNU for his initiative and efforts to develop an open and inclusive university in Nepal.

*Contact person: Professor Ole Gunnar Dahlhaug,
Department of Energy and Process Engineering*

African University Network on Building Energy Development Capacity



Access to energy is an important enabler for economic development and growth, and is interrelated to many of the UNs sustainable development goals. Many East African countries are resource rich, and have abundance of renewable energy sources, especially solar energy. The challenge is to sustainably develop and manage these resources for the benefit of society.

NTNU has collaborated with a group of African institutions for decades within renewable and fossil energy development. The results of a series of network projects with universities in Tanzania, Uganda, Ethiopia, South Africa, Malawi and Mozambique are new master programs in Renewable Energy as well as in Oil and Gas Technology. More than 100 students have graduated with master degrees from the collaboration projects, and are working in leading academic, governmental and industrial positions in East Africa. The collaboration has also contributed to new Ph.D. programs at Mekelle University in Ethiopia and Eduardo Mondlane University in Mozambique.

The research areas for joint PhD studies have been

- Thermal solar power and storage for home cooking and refrigeration applications
- Utilizing biogas and developing gasification plants
- Small and medium scale wind turbines
- Using pumps as small-scale generators for hydropower development

Currently, NTNU professors are also participating in the development of a hydropower test centre at Kikuletwa in Tanzania, at the Arusha Technical College.

The collaboration has developed a strong and sustainable network between NTNU and many East African universities. The focus for the further development of the network collaboration can be taken from master programs to PhD programs, with sandwich based joint PhD research projects and with curriculum development of PhD courses.

Contact person: Professors Ole Jørgen Nydal and Torbjørn K. Nielsen, Department of Energy and Process Engineering

Capacity Building within Oil and Gas



Since striking oil in the 1960s, Norway has gone through an enormous development making Norway world leaders within offshore oil and gas development. Building on this experience, NTNU has contributed in capacity building in many low- and middle-income countries for decades. This is enabling collaborating universities, like University of Dar es Salaam and Eduardo Mondlane University, to educate their own students and conduct own research aligned with local industrial and societal challenges.

Bangladesh, Angola, Tanzania, Mozambique, Nigeria and Pakistan are some of the countries where NTNU has contributed in development of curriculum, courses and educational programs at bachelor and master level. NTNU has educated more than 900 international master students and Ph.D.-candidates since the 1980s, where the first students came to Norway to attend short courses that were held in collaboration between NTNU and SINTEF. Scholarships through Norad have enabled education of many of these students.

Long-term public-private partnerships with public funding from Norad and contribution from the Norwegian Embassy and Norwegian industry with universities in LMIC has been a success recipe for NTNU in many of these projects. Many former students are working in government, industry and academia around the world, and NTNU and Norway has high recognition within the sector that eases future collaboration within oil and gas development and research.

Contact persons: Professors Jon Kleppe and Pål Skalle, and Head of Department of Geoscience and Petroleum Egil Tjøland

Developing Sustainable Urban Planning Practices



In an ever-changing world with more and more people moving to cities and urban areas, changing demographics and migration, climate change and natural disasters occurring, good and sustainable planning is important. Cities around the world are very different, but face many common challenges when it comes to planning. Sharing experiences and getting access to different planning contexts and practices between countries is key to developing more sustainable planning practices, taking both technological possibilities and social inclusiveness into account. Currently, NTNU is jointly researching how to work and deal with uncertainty in planning, where experiences and practices from around the world leads to a broader and more complex understanding benefiting future planning practices and policies.

Since the 1980s, NTNU has collaborated with Nepal related to urban planning, working with local municipalities, governmental planning departments, universities and non-governmental organizations. Later this collaboration expanded to neighbor countries Tibet and India enabling

a South-South cooperation. NTNU has also collaborated with partners in Uganda with the support of UN Habitat. Focus has been on capacity building, education, research and policy work. Building on this activity, an international master program was established at NTNU within Urban Ecological Planning. More than 100 students have graduated, with approximately 90% being from low and middle income countries. Students have long mobility stays in countries like Nepal, India and Uganda, giving them insight into alternative practices, contextual knowledge and a broader perspective for their future professional careers.

Through NTNU Live Studio, an initiative that works in close collaboration with the program on Urban Ecological Planning, architecture students engage in social entrepreneurship based on concrete challenges in dialogue with external partners. Live Studio projects have taken place in Uganda, Bosnia and Herzegovina, Senegal, Thailand, and Norway. This provides students with the possibility to develop their artisanship and design skills, learning by doing and increased awareness related to ethical responsibility in development.

*Contact person: Associate Professor Rolee Aranya,
Department of Architecture and Planning*

Gender, Migration and Development



How technological development, natural disasters, crisis and conflicts affects migration, post-crisis recovery and livelihood in South-East Asia seen from a gender perspective has been important topics for research, education, capacity building and dissemination at NTNU for close to 40 years.

Some examples of projects:

- Migration and collectives as pathways out of poverty among fishing communities in Asia
- Re-visiting gender and complexities in changing Asia
- Building capacity for reconstruction and recovery after the 2004 tsunami in Sri Lanka
- Post-crisis reconstruction in Sri Lanka
- Mobile livelihoods and gendered citizenship in India, China and Laos
- NTNU's research group on Forced migration (several Asian and African countries)
- The Internal Displacement Project
- Working Women in Norwegian industry in Malaysia and China

Collaborating across disciplines, across sectors and across borders with academic institutions, governmental and non-governmental organizations from Sri Lanka, India, Cambodia, Laos, Thailand, Malaysia and China has been key: combining practice and research to get entry, insight and better understanding. Here, comprehensive capacity building projects have been combined with excellent research projects funded by the Research Council of Norway and the European Commission.

Broad dissemination targeted towards practitioners, policy makers, researchers and society has been important. Through publishing together with researchers from the region in local and regional journals in addition to publishing in international review books and journals, the projects have contributed towards a culture for research and research dissemination and increased the quality of local journals. The research and experiences have also enabled NTNU to provide research-based education and curricula within development studies, geography and gender studies based on own research.

*Contact person: Professor Ragnhild Lund,
Department of Geography*

Sustainable Natural Resource Management in Asia and Africa



The Xinjiang region in China as well as part of Tanzania are areas where sustainable utilization of water resources is critical for agriculture and development. As with other natural resources, management and governance of water resources can be challenging, especially if water is scarce and there are weak institutional capacities. Good governance and sustainable management is also a great challenge in East African countries that are now developing local petroleum resources. Management of natural resources is often a source of social and environmental conflicts, and often represent dilemmas between conservation and economic development.

Legislation and policies have in many cases reflected top-down bureaucratic approaches that have not facilitated active participation of local communities in natural resource management. This calls for reforms to facilitate more sustainable management of water and petroleum resources to benefit the local communities, regions and nations. To increase capacity in relations to petroleum development in

East Africa, NTNU together with partners are developing educational programs and research focusing on biodiversity conservation, environmental monitoring and transparency, impact on rural livelihoods as well as gender aspects. Since the 1990s, NTNU has actively conducted research in these regions, and built capacity through educating master students and Ph.D.-candidates and collaborated with local institutions. Dissemination to decision makers and policy developers has been important in development of legislation and policy for more sustainable management of natural resources.

*Contact person: Professor Haakon Lein,
Department of Geography*

Sustainable and Locally Driven Development of the Serengeti-Mara Region



The Serengeti-Mara region in Kenya and Tanzania is one of the most biodiverse rich ecosystems on earth. It is the natural habitat of lions, elephants, buffalos, leopards and rhinos, and site for the famous wildebeest migrations. This ecosystem is under severe pressure from population growth, increase in tourism, climate change and infrastructure development.

NTNU has over the last 30 years conducted research with basis in evolutionary biology focusing on conservation, human-wildlife conflict, population dynamics of animals, and animal behavior in relation to human activities. NTNU has also focused heavily on building capacity in East Africa to enable local sustainable management of these natural resources with more than 20 East African Ph.D.'s and 30 master students graduated during this period.

Tanzania is among the poorest countries in the world, and tourism in the national parks and conservation areas is one of the most important sources of value creation. To improve communication between remote villages, roads connecting Lake Victoria to the Tanzanian shoreline are being developed. These roads cross the Serengeti-Mara ecosystem, and are under heavy debate. Through the project AfricanBioServices, a major EU funded project lead by NTNU, the objective is to better understand these complexities, and use this information to derive novel solutions for future sustainable development.

Contact: Professor Eivin Røskaft, Department of Biology

Building Surgical Capacity in Sierra Leone and Beyond



Worldwide, approximately five billion people lack access to safe, affordable and timely surgery. This has devastating consequences for patients, families and societies, and hamper economic growth. Extreme shortage of surgical providers is the main obstacle why low-income countries fail to offer basic lifesaving surgery. In 2015, the WHO Member States unanimously adopted a World Health Assembly resolution to strengthen emergency and essential surgical care as a component of universal health coverage. It urges member states to initiate: "...more effective use of the health care workforce through task-shifting..."

Since 2011, the Norwegian non-governmental organization CapaCare has been training non-doctors to perform advanced surgery in Sierra Leone. To date, 30 have graduated, another 20 are currently undertaking the three-year long training. Combined, trainees and graduates have participated and performed more than 40 000 surgical operations in Sierra Leone since the initiation of the program. Given that it is only 10 surgeons working in governmental hospitals in the country, this is a substantial contribution.

NTNU have been key in evaluating the effects, quality and potential of this innovative human resource strategy. Through the private-public partnership between CapaCare and NTNU, three PhDs, 16 medical student thesis and 4 master student theses has developed new evidence for task-sharing in surgery.

The initiative has received substantial interest worldwide, as reflected by several high impact scientific papers, opinions pieces, editorials, and presentation of the programme for the Lancet Commission on Global Surgery. In 2015, an editorial in Nature concluded: "There is debate over the ethics of task-shifting: some worry that it risks exposing patients to substandard care. But the [Ebola] epidemic shows that the people trained by CapaCare are extraordinarily committed to their patients. In this setting, many people faced a choice of being cared for by Jawara, Batty and their counterparts [CapaCare graduates] or receiving no care at all."

*Contact person: Dr. Håkon A. Bolkan,
Department of Clinical and Molecular Medicine*

Raising Awareness about Domestic Violence against Pregnant Women



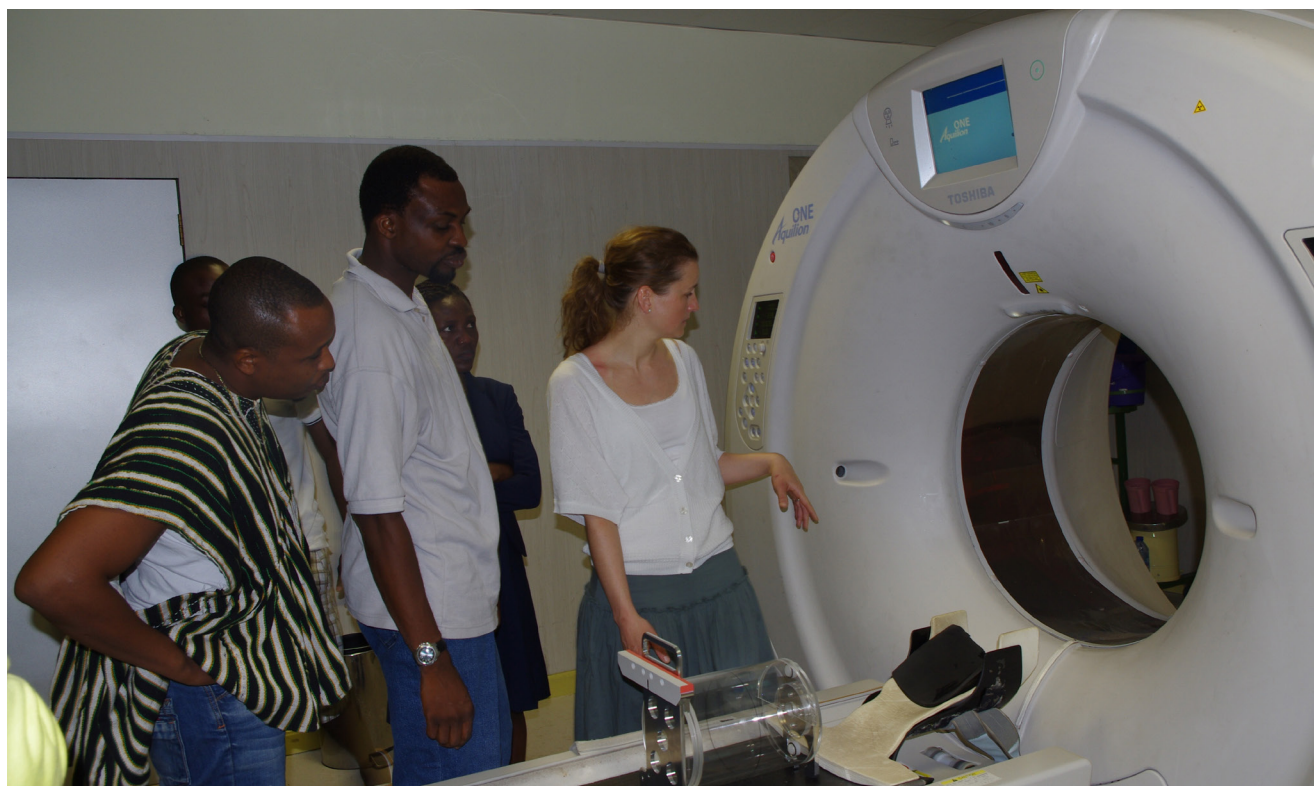
One in five women in Nepal experience domestic violence during pregnancy, making them less prepared for childbirth and more likely give birth preterm. Kunta Devi Pun was a nurse and became the first professional midwife in Nepal, educated in Australia, 13 years before a midwifery school started in the country. Kunta is now head of the midwifery education at Kathmandu University School of Medical Sciences. She is the first midwife in Nepal with a Ph.D. degree, which she received at NTNU.

Kunta studied domestic violence against pregnant women in Nepal. Kunta's research emphasized the importance of integrating systematic assessment of domestic violence in antenatal care. This was done using tablet-based technology with head phones, enabling women to answer sensitive questions about family violence at regular antenatal visits. Based on focus group interviews in Nepal, participants suggested actions and strategies to address continuing violence, which indicated a societal transition toward increased awareness and changing attitudes and practices.

NTNU has a long-lasting history of collaboration with Nepal within global health. Several Ph.D.'s from Nepal have graduated from NTNU, and the global health master program receives students from all continents. NTNU is also the host for a national research school in global health for Ph.D.'s from all Norwegian universities, and hosts a global health day annually with contributors and participants from all over the world.

*Contact person: Professor Elisabeth Darj,
Department of Public Health and Nursing*

Developing Medical Technology Programs



There is a lack of medical physicists, infrastructure and training programs in many low and middle income countries, in addition to low awareness among decision makers on the potential and cost-effectiveness of these technologies for medical treatment. Building on the experience in teaching and research at the longest lasting program in biophysics and medical technology in Norway, NTNU is contributing to capacity building in Ghana and Pakistan.

Ghana has the only approved training center by the International Atomic Energy Association (IAEA) for the English speaking countries in Africa. Ghana also has formal certification of medical physicists, something that is not in place yet in Norway. NTNU together with St. Olav University Hospital are collaborating with the University of Ghana, other universities and teaching hospitals in Ghana, the Ghana Atomic Energy Commission and professional associations of medical physicists and radiographers in both countries to exchange experiences and build capacity through joint summer schools and student exchange. This 5 year project is funded through the NORPART programme.

The summer school brings together students and practitioners from several disciplines, contributing to lowering the barrier for interdisciplinary collaboration. At the University of Cape Coast in Ghana, a new Erasmus+ project will start where NTNU will contribute in the development of a master program in biophysics and medical technology and developing joint research on the use of nanoparticles to treat malaria. This will have impact for several African countries, due to the regional role of Ghana and the IAEA training center.

NTNU has contributed in the establishment of the Nanomedicine Research Labs at the National Institute of Lasers and Optronics (NILOP), at the Pakistan Atomic Energy Commission. This collaboration has introduced new equipment in Pakistan, and researchers from Pakistan have been at NTNU for training. As part of this collaboration, several international symposiums and training workshops on nanotheranostics have been held in Pakistan with contribution from NTNU and international experts.

Contact person: Associate Professor Pål Erik Goa and Professor Catharina de Lange Davies, Department of Physics

Saving Babies with Smartphone Technology



Jaundice is the cause of death for more than 100 000 babies per year globally, and more than 60 000 children per year develop serious brain damage. Most of these are in low- and middle income countries.

To reduce the number of deaths and serious brain damage caused by jaundice, researchers from pediatrics and biomedical optics at NTNU and St. Olav University Hospital joined forces to develop a solution for cheaper diagnostics using conventional technology. The result is establishment of the spin-off Picterus that is developing an easy-to-use smartphone app to diagnose the degree of jaundice in babies cheaply to save lives. To verify the technology, research projects are ongoing with partners in Nepal and Tanzania.

Picterus has won several innovation prizes over the last years: DNB Healthcare award, Venture Cup in Trondheim og Angel Challenge in Oslo.

Contact persons: Gunnar Vartdal, Picterus AS, Dr. Anders Aune, Department of Public Health and Nursing and Professor Lise Lyngsnes Randeberg, Department of Electronic Systems

