

STORIES OF COOPERATION AT POLIMI 2017-2021



POLITECNICO
MILANO 1863

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INTRODUCTION

This second edition of **Stories of Cooperation at Polimi** comes 5 years after the first one, in a context where many reference systems have changed.

The ongoing situation, which began as a health emergency in early 2020, is a contingency that is challenging many if not all of our systems related to economic paradigms, service models, consumption and citizens' habits, working methods, teaching and research. Systems which until recently were considered established and undisputed and nevertheless we were able to revise overnight.

During this period, the concept of "Cooperation" became more familiar in everyday language because the health emergency certainly heightened mutual empathy. In view of these considerations, a common hope is that Cooperation activities may be intensified within and across countries, balancing the emergence of new forms of protectionism and the risk of increasingly global uncertainties.

It is an important moment that calls for greater coherence and integration between policies and strategies in which the role and responsibility of academic training and scientific research have been recognised as crucial. Universities are indeed capable of producing innovation and high-level knowledge, that can be used to support both choices and solutions during emergency as well as and policies and strategies with a long-term vision, designed to meet the shared needs of development and equity.

This is the context in which Politecnico di Milano di Milano's Cooperation strategy and initiatives are collected and analysed in this document, which aims to provide an up-to-date overview of the experiences implemented in the university with the aim of making and providing food for thoughts for valorising and enhancing the long-term effectiveness and impact of our initiatives.

The document outlines the activities of Politecnico di Milano in the international context of Cooperation and Development grounded in the architecture of Italian Cooperation provided by the current legislative framework. Beginning with the elements characterising Polimi's Cooperation identified in the first edition, it uses the results of the mapping conducted to suggest a new taxonomy of interventions in Cooperation and Development and examines detailed data also with a geographical focus that highlights the relevance of the African continent within our actions. The document concludes with some reflections on possible strategies to enhance the long-term impact of the University's Cooperation actions.

Given the complexity of the challenges that have been and are still to come, Politecnico di Milano aims to continue experimenting and validating multi-stakeholder collaborations in the field of Cooperation and Development. Once the role and missions of each actor are recognised, these initiatives are indeed able to promote efficient, effective, and high-quality actions to support local development while contributing to promoting Italy's system of culture, innovation, entrepreneurship, and social commitment.





COOPERATION AND DEVELOPMENT WITHIN THE ACADEMIA

International context of Cooperation and Development

The field of Cooperation and Development has always been in evolution, for the very reason that the paradigm of “development” itself is constantly transforming. Since the World War II, history has offered different models of Cooperation (bilateral-governmental, multilateral, and non-governmental) and its subsequent evolution, the first and the most famous example of such Cooperation models is the Marshall Plan.

Such evolution, characterised by failures and successes of decades of interventions, have led to the consolidation of a multidimensional vision of development that can be summarised in the thoughts of the economist and philosopher Amartya Sen, who offers an interpretation of development as “freedom”.

In the past decades Cooperation and Development has been guided by the agendas of the United Nations, as the founding pillars of its multidimensional actions. As early as 2000, the 8 Millennium Goals of Agenda 2015 became the goals of Cooperation, concerning the most critical economies.



The 8 Millennium Goals of the UN 2015 Agenda.

The 2015 Agenda marked a key milestone, followed by the adoption 15 years later of the United Nations 2030 Agenda with its 17 Sustainable Development Goals¹, which apply to all countries.

SUSTAINABLE DEVELOPMENT GOALS



The 17 Development Goals of the UN 2030 Agenda.

¹ <https://sdgs.un.org/2030agenda>

Due to the high global attention that followed, these objectives are at the basis of the international community's efforts to identify, formulate and implement a sustainable development model to deliver **Prosperity** for **People**, preserve the **Planet**, support international **Peace**, and promote the involvement of countries and stakeholders in global **Partnerships**.



The "5Ps" of Sustainable Development: People, Prosperity, Peace, Partnership, and Planet.

A new culture of sustainable development is needed worldwide, as well as innovative solutions and strategies to combine economic growth with multidimensional goals, including environmental protection and social inclusion.

In this international setting, academia and the scientific community are being called upon to play a key role in reshaping and updating their traditional educational mission. This requires both the introduction of cross-cutting expertise on sustainable development and the broadening of research practices to include an attitude toward social responsibility. Such attitude can lead to products, processes, services or business models able to generate an impact on sustainable development, for the benefit of individuals and communities.



The “Architecture” of the Italian Cooperation

In addition to the international context, a central reference point for Italy is represented by the recently revised structure of the Italian Cooperation, which relies on the Law 125/2014², which defines the Italian Cooperation systems and outlines an essential connection with sustainable development.

LAW 125/2014*

* free translation from the Italian law

Article 1

1. International Cooperation for sustainable development, human rights and peace, hereinafter referred to as “development Cooperation”, is an integral and qualifying part of Italy’s foreign policy. It is inspired by the principles of the United Nations Charter and the Charter of Fundamental Rights of the European Union. In accordance with the principle laid down in Article 11 of the Constitution, its action shall contribute to the promotion of peace and justice and shall seek to promote solidarity and equality between peoples based on the principles of interdependence and partnership.
2. Recognising the central role of the human being, in his or her individual and community dimension, Development Cooperation pursues, in accordance with the international programmes and strategies defined by the United Nations, other international organisations and the European Union, the fundamental objectives aimed at:
 - (a) eradicate poverty and reduce inequalities, improve people’s living conditions, and promote sustainable development;
 - (b) to protect and uphold human rights, the dignity of the individual, gender equality, equal opportunities and the principles of democracy and the rule of law;
 - (c) preventing conflict, supporting processes of peacebuilding, reconciliation, post-conflict stabilisation, consolidation and strengthening of democratic institutions.

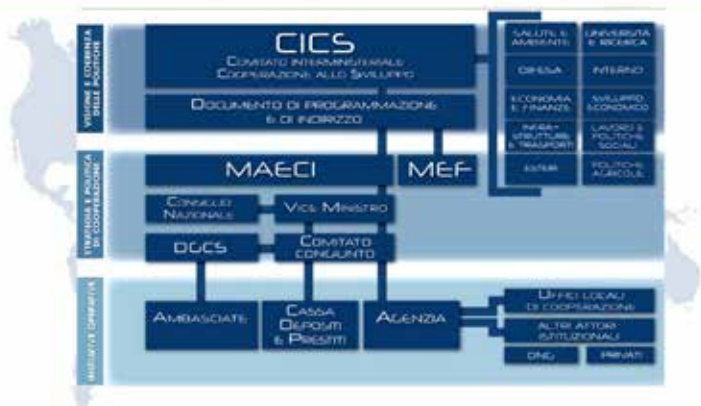
The law establishes a new framework in which the Cooperation becomes a qualifying pillar for the national and foreign policy. In this asset, the role of the traditional actors - such as civil society organisations and regional cooperation stakeholders - is to be complemented by other experiences and skills from the universities, research centres and the private sector, which are called upon to contribute in an increasingly proactive manner to cooperation actions.

Inspired by northern European Cooperation systems, the law aims to create institutional and multi-stakeholder coherence, from the strategic vision of the Italian policies to the congruence of the strategies adopted, to guide the implementation of initiatives in a synergic manner.

Sustainable development is an inclusive and global paradigm to be addressed using a holistic approach where technological solutions, socio-economic models, policies, anthropological issues, and human factors can be integrated and mutually reinforced. Universities and other higher education institutions are increasingly recognised as key players: the innovation, knowledge, skills and expertise they bring are needed to address the challenges of Cooperation and sustainable development in partner countries.

Many opportunities to experiment and validate public-private partnerships - while acknowledging their respective mission mandates - are now open. This actions, scaled at national level, may promote joint, efficient and effective actions with a strong local impact through a new integrated approach which is also useful to promote Italy’s ecosystem of culture, innovation, entrepreneurship and social commitment.

² www.gazzettaufficiale.it/eli/id/2014/08/28/14G00130/sg



The Italian Cooperation System (source: *INTERNATIONAL BRICK PROJECT DESIGN WORKSHOPS*).

Role of universities in Cooperation

In keeping up with the international framework and the Italian Cooperation structure, the **University Network for Cooperation and Development** (“**Coordinamento Universitario per la Cooperazione allo Sviluppo**” - CUCS) has been supporting the cultural debate on the role of universities in Cooperation since 2007. In its statutes, the CUCS emphasises the need to work in three crucial directions: I) **enriching the educational paths of graduates and training skills in Cooperation**; II) **promoting research as a driver of native development and innovation**; III) **strengthening the value of partnerships and networks**.



CITIZENSHIP AND COMMON GOODS

University and international cooperation for safety, environment and sustainable development

Trento 19-21 September 2019



Banner for the 2019 CUCS Congress held in Trento, Italy.



COOPERATION AND DEVELOPMENT AT POLITECNICO DI MILANO

Characteristic elements of Politecnico di Milano's interventions until 2016

In line with the mission to build an academic institution committed to dialogue with society and capable of serving communities and addressing major social issues, since 2005 the vision of Cooperation and the potential role for Politecnico di Milano in development have been evolving and refining, giving way to an alignment with the national and international framework.

In the last four rectoral mandates and in accordance with the trend, already reported in the first edition of the book **Stories of Cooperation at Polimi 2011-2016**⁸, the University has institutionalised its vocation for Academic Cooperation, starting from a characterisation linked to the interest and commitment of individual professors who, over time, have been able to lay solid foundations to build a more inclusive institutional interest and participation on. Some characteristic elements had already emerged in this first edition, which had led to the analysis of more than 30 projects and numerous teaching activities.

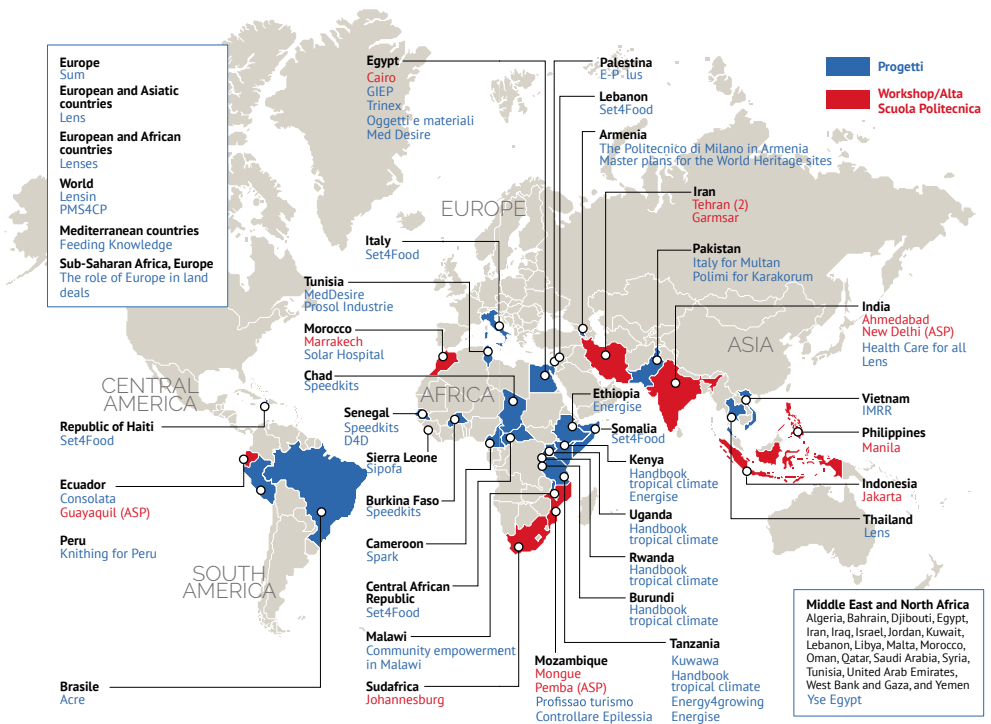
- 1) The focus on training was a central element of the initiatives. Politecnico di Milano has always believed in the pressing need to integrate the logic of sustainable development into the curricula of its students, who will inevitably work in global contexts.
- 2) The project direction was pioneeringly aligned with the 5 thematic areas of the 2030 Agenda.
 - **Person**, interpreted as the main protagonist of the intervention who, not only as beneficiary of the actions, is the main resource for promoting long lasting local development;
 - The focus on integrated resource management for the **Planet's** preservation points to an inclusive vision capable of bringing together the interests of People and Earth;



⁸ E. Colombo, M.C. Pastore, S. Sancassani, Storia di Cooperazione Politecnica 2011-2016, Polisocial - Politecnico di Milano, 2016.

- **Prosperity** understood as a multidimensional framework where technology, research and innovation become tools to overcome cultural, economic, environmental, and social boundaries that may limit sustainable development.
 - Technology can become an element of **Peace** when its availability can mitigate the inequalities between social groups within and among countries in critical contexts;
 - **Partnerships** as a strategic asset, since only a combined effort of several stakeholders with their diversified expertise can lead to equitable and sustainable solutions.
- 3) Academic Cooperation at Polimi has always been characterised by collaboration with other universities in developing countries, with a special attention to the **strategic geographical area of the African continent**.

POLIMI COOPERATION PROJECTS AND WORKSHOPS FROM 2011 TO 2016



Mapping of Cooperation initiatives

Despite the unique role that Cooperation and Development plays within the academia, the full taxonomy of its actions is still to be consolidated. For the purposes of our internal mapping, an effort was made to combine the international dimension (with reference to the “DAC List of ODA Recipients” for 2020 issued by the **Organisation for Economic Cooperation and Development**⁹) and maintaining a national alignment with the guiding principles of Law 125/2014 (art. 24).

⁹ According to the OECD-DAC Arrangement, the recipient country's per capita income must not exceed the maximum thresholds set by the World Bank on a three-yearly basis <http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/DAC-List-of-ODA-Recipients-for-reporting-2020-flows.pdf>

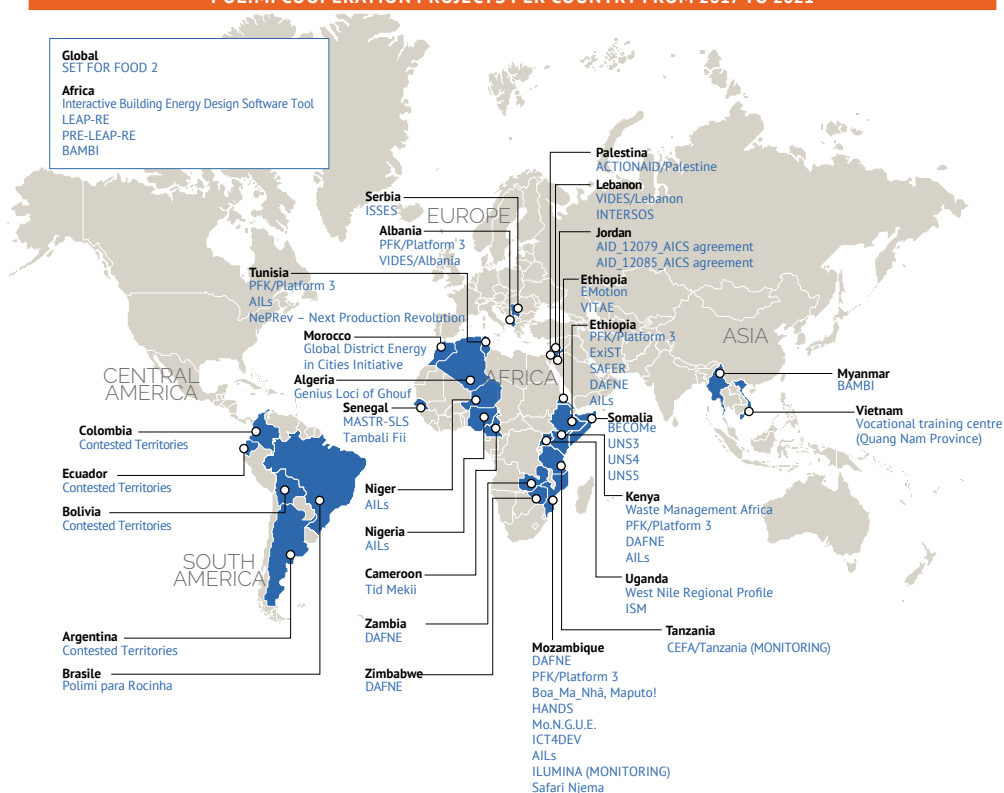
This review represents an opportunity to define a method shared within Polimi to provide researchers with an overview of the data to be collected during their research, to monitor the long-term impact of projects (present and future) and identify a potential framework for long term evaluation of initiatives. At a central level, two tools were used to initiate the survey and to provide departments with a complete picture.

The mapping starts with reference to the first edition of the **Stories of Cooperation at Polimi 2011-2016**. The information was then complemented with information collected for the annual **Report on the Implementation of Cooperation and Development Policy**, part of the **Notification of Italian Official Development Assistance Data for the OECD-DAC Memorandum**, which is submitted every year to the Ministry of Foreign Affairs and International Cooperation.

Finally, an in-depth survey was conducted within Polimi. A Google Form was set up and shared by the **Social Responsibility Projects unit**. The mapping was completed in December 2020, but numerous updates were received up to August 2021.

The analysis of the collected data reveals a rich and articulated overall picture of more than 100 initiatives carried out by the departments, involving more than 60 countries worldwide.

POLIMI COOPERATION PROJECTS PER COUNTRY FROM 2017 TO 2021



SCIENCE DIPLOMACY

CUCS

UNESCO CHAIRS/UNITWIN NETWORK

Joint Italian-Somali Scientific Committee

IDEA LEAGUE

High Level Platform on Sustainable Energy Investments

Fondazione IHEA

PFK

Somalia

Africa

Africa

Africa, with a focus on the Horn of Africa

Afghanistan, Albania, Bolivia, Cuba, El Salvador, Egypt, Ethiopia, Eritrea, Kenya, Lebanon, Jordan, Mozambique, Myanmar, Niger, Pakistan, Palestine, Senegal, Sudan, Tunisia

General overview

It should be noted that Politecnico di Milano, with its **12 Departments**, actively participates in Cooperation initiatives, which involve developing countries on all **5 continents** and cover the categories of interventions defined at national and international levels.

Of more than **100 initiatives mapped**, **more than 60% has a focus on Africa**.

Initiatives activated at Polimi were mainly funded by the Italian Agency for Development Cooperation (AICS). Additional funding comes from the Ministry of the Environment and the Ministry of Foreign Affairs.

As far as European Union is concerned, the main financial backers are **DG DEVCO** (previously the European Union's Department for International Development Cooperation - Europe Aid) and the **European Commission's DGRTD** through channels such as Horizon 2020. Some funding is also provided by **DG ECHO for actions in refugees camps**. With regards to international organisations, there are numerous contributions from **UN-Habitat**. Other funders are **private or bank foundations and philanthropic bodies**, both at Italian and international level.

As for Polimi, it is worth mentioning the self-funding associated with the **Polisocial Award** competition in support of scientific research with high social impact, supported by 5 per Mille IRPEF funds and included in the Third Mission policies. The initiative promotes projects in a variety of scientific areas and involves all departments: since its creation in 2013, A total of 46 research projects have been funded, 18 of which are related to Cooperation and Development initiatives, with **10 non-EU countries** as the geographical reference context: **Mozambique, Cameroon, Senegal, Tanzania, Eritrea, Somalia, Egypt, India, Pakistan, Brazil**. The initiative, which is unique at national level, has strengthened several constructive interactions between Polimi and the outside world. The combination of traditional forms of knowledge transfer and a "horizontal" exchange with stakeholders has consolidated the social role of Polimi as a mediator and/or spokesperson for disadvantage categories, while promoting a close relationships campus-community.

The initiative, conceived as a seed-fund, has been able to attract considerable new resources to develop follow-ups. In addition, there are meaningful intangible outcomes, such as the empowerment of people and disadvantaged groups; the development of autonomy paths by beneficiaries; opportunities arising from the relationship of different interlocutors.

The implementation of the projects during the 7 editions of the Polisocial Award has strengthened a culture of university-society collaboration with numerous partners involved, including public and public service bodies (local authorities, hospitals, etc.), universities and research centres, associations, NGOs, international organisations, foundations, companies, and schools.

Teaching and Cooperation

A category related to Academic Cooperation for Sustainable Development is represented by initiatives in the field of **teaching**: the launch of structured or extra-curricular courses dedicated both to Politecnico di Milano students and external attendants, aimed to contribute to the training of aware professionals and global citizens. The experience, gained by researchers in the field of Cooperation and research projects and given back to course students in the classroom, represents an extremely valuable resource. This document gives some highlights on asset of experiences in the curricular, extra-curricular and international mobility fields activated at Polimi.

1 Master's degree of I and II level	1 track in Energy Engineering (Energy for Development)	1 specialising course
1 Honours Programme (extracurricular training)	4 curricular courses	2 Passion in Action courses
5 MOOCs (Massive Open Online Courses)	4 sprint MOOCs	21 MOU with universities in developing countries

Curricular activities

The logic of sustainable development is increasingly being integrated in the university's First Mission, as demonstrated by the consolidation of dedicated curricular courses.

In the School of Engineering, for instance, since 2010, the **Energy for Development** track of the Master's Degree in Energy Engineering has introduced more than 1,000 students to Cooperation issues.

The School of Architecture, thanks to the specialising master's course **Coopera(c)tion. Knowledge and Skills for Sustainable cities in the Global South** has trained over 100 architects on issues relating to the South of the World. Additionally, the I and II level Master's degree **Design for Development Architecture, Urban Planning and Heritage in the Global South** programme was launched.

Extracurricular activities

Since 2019, the curriculum has been enriched by 2 **Passion in Action**¹⁰ courses, while the **Honours Programme "Engineering for sustainable development"**, during three editions, has introduced 36 students to sustainable development issues through extracurricular courses, seminars and the graduation theses dedicated to global issues.

A growing number of MOOCs dealing with Cooperation issues has been made available through the Polimi Open Knowledge (POK) platform: the 9 courses have been completed more than 6,700 times by students and external users.

COOPERATION-RELATED EDUCATIONAL PATHWAYS AVAILABLE AT POLIMI



Bilateral mobility

Politecnico di Milano can count on solid relations with universities in developing countries: to date there are 72 active **Memoranda of Understanding** with universities in 24 countries of the Global South, including 6 universities in 5 African countries.

The European **Erasmus+** programme has also made it possible to launch 12 **KA107 agreements**¹¹ with 12 universities in 9 developing countries. Additionally, over 30 **student and staff mobility projects** have been activated with partner universities in target countries.

An interesting collaboration among the **IDEA League** network member universities has initiated the preparation of joint projects with African higher education institutions. This joint initiative aims to increase the number of courses, summer programmes, masters or P.h.D programmes co-designed and managed with universities in the partner countries.

¹⁰ "Passion in Action" is a catalogue of open participation teaching activities that the Politecnico offers to students to support the development of transversal, soft and social skills and to encourage/facilitate students in enriching their personal, cultural and professional experience. This opportunity is open to everyone.

¹¹ KA107 agreements provide for an academic exchange experience based on a project that benefits the countries involved.



THE TAXONOMY OF COOPERATION AT POLITECNICO DI MILANO

The analysis, carried out in 2020 along with the collection of files and the processing of data help to portray the evolution of Cooperation within Politecnico di Milano by identifying a path which opens towards a **new taxonomy** of Politecnico di Milano interventions in this field.

The mapping confirms Politecnico di Milano as an institutional actor with a wealth of knowledge, experience, methodologies and relationships, able to contribute, with a profound sense of responsibility, to strengthening the role and impact of its actions and the technical and scientific credibility of our country in international circles and contexts.

In accordance with the CUCS and the dialogue within the CRUI on Academic Cooperation, the contribution that the University can offer to the Italian Cooperation System is threefold and tackles all three areas of the academic mission.

In this framework and taking cues from the evolution of Cooperation in the international context, three categories of initiatives have been proposed:

- **Higher Education and Capacity Building**
- **Research for local Development**
- **Science Diplomacy**

The three-category taxonomy also aligns with the exercise currently underway at national level among the network of universities that have joined the AICS and CUCS Partnership for Knowledge (Pfk) programme¹².

Each category contains a number of sub-categories which, especially for the research part, are subject to specific adaptation depending on the approach that the differentia may give to their areas of competence in Cooperation.



¹² www.aics.gov.it/home-eng/fields/human-development/pfk/

Higher Education and Capacity Building

The category “Higher Education and Capacity Building” refers to the process of reinforcing training paths with new professional skills, both for Italian students destined to work (directly or indirectly) in the world of international Cooperation, and for students from partner countries to be trained and specialised in specific subject areas in Italy and/or in their country of origin.

It is also a matter of equipping the economies of the least developed countries to prevent and manage the onset of crises resulting from external shocks (economic, environmental, political and social).

Universities, as “universitas”, must prepare professionals on global issues capable of playing a more active role in the transformations of society, both in the North and in the South. Training methods and content must consider the new global challenges and sustainable development issues to be integrated into the curricula of young people (whatever their educational background) from both a theoretical and operational point of view.

This urgent need for training is combined with the possibility of offering a new vision of the idea of internationalisation, seen not only as the ability to open to the opportunities offered by international markets but also as a response to the need to build up the skills needed to promote local development in less developed countries.

The specific competencies for Cooperation require the creation of education, training and planning paths as well as scientific outreach in the field, thus boosting the training of new generations of researchers, lecturers and professionals able to work directly or indirectly in the fields of Cooperation and Development.

Higher Education and Capacity Building for Politecnico di Milano is mainly outlined along the following lines:

- **Scholarships**
- **Support to Universities or Local Authorities**
- **Transnational Education**



Italy. AILS program reunion at the MIP of Politecnico di Milano.



Mozambique. Meeting with District representatives in Boane (2019). Project: BOA_MA_NHÃ, MAPUTO! - A study for the integrated development of the region Boane, Moamba, Namaacha (Mozambique). Project funded by the Polisocial Award 2018.

Research for local Development

This type of research provides advanced scientific investigation tools designed to produce innovation for development and to elaborate methods and models for evaluating processes in line with international best practices.

The Academia has a long tradition of scientific Cooperation characterised by dialogue with local stakeholders in a mutual learning perspective. In this sense, scientific research becomes a tool for development and can be used to innovate Cooperation practices and improve their efficacy through the elaboration of participatory development and technology transfer models, capable of creating autonomous development.

Development challenges are linked to integrated issues that cut across traditional disciplines: Cooperation practices that imply dialogue with local stakeholders in a mutual learning perspective are crucial. Technology transfer and knowledge innovation in all areas, including the Human Sciences, are increasingly proving to be essential tools for human and sustainable development.

Furthermore, more effective methods and models are needed both to assess the long-term impact of Cooperation actions and to shape future strategies.

The main areas in which Politecnico di Milano operates in research projects that touch on Cooperation issues can be summarised as follows:

- **Regional Development and Cultural Heritage**
- **Management of Resources and Services**
- **Innovation and Enterprise**



Mozambique. View of Mongue. Project: Mo.N.G.U.E. - Mozambique Nature Growth University Education. Project funded by the Polisocial Award 2016.



Eritrea. The road along the mountainside between "The Devil's door" gorge and Arbaraba (by A. Castiglioni, 2012). Project: EMotion - Eritrea mobility and cultural heritage: new frontiers of the Horn of Africa. Project funded by the Polisocial Award 2018.



Senegal. Samples collection. Project: MASTR-SLS - Mapping Schistosomiasis Transmission Risk. Project funded by the Polisocial Award 2016.



Senegal. Fish market. Project: Tambali Fii. - Creation of a technological and social innovation cluster for the growth in Senegal of the boating and seafood chain. Project funded by the Polisocial Award 2016.

Science Diplomacy

In accordance with the recent initiatives and declarations of the European Commission and with reference to the message of the Commissioner for Innovation, Research and Youth¹⁵, it seems necessary to develop more and more scientific Cooperation initiatives able to:

1. **increase public interest and trust** in science, counteracting misinformation, and ideologically driven approaches (People)
2. **deliver research results for the benefit of humanity**, to solve global challenges through evidence-based policies (Planet)
3. **promote new paradigms** for international Cooperation in research and technological innovation in support of foreign policy and international relations (Prosperity).

This way of interpreting science diplomacy is fully in line with many of the actions that Politecnico di Milano has implemented within its **national and international networks**.

It is also necessary to contribute to the **development and strengthening of institutional capacities** by placing the university in triangulation with the public and private sectors, making the most of both transfer contributions and the indigenous creation of entrepreneurial/craft activities, and in this way enhancing the heritage of international scientific relations already in place.

The relationships that universities have with other universities and research institutions around the world, and beyond, represent an invaluable network of learning, mutual knowledge and dialogue. Politecnico di Milano has always contributed to training the future leaders of our partner Countries, in Cooperation with international organisations, the private sector and civil society, recognising the strengthening of knowledge and skills to be a preferential route to local development.

Science Diplomacy networks aim to increasingly strengthen the ties that these scientific ambassadors can maintain with our country.



Politecnico di Milano is a current member of CUCS and coordinated the network from its foundation (2007) until 2019.



Politecnico di Milano holds two UNESCO Chairs in "Architectural Preservation and Planning in World Heritage Cities" and "Energy for Sustainable Development" since 2012. The UNITWIN Network on "GREENOMICs - Green Chemistry Excellence from the Baltic Sea to the Mediterranean Sea and beyond" was established in 2017.

¹⁵ "Science diplomacy is not new, but it is more important than ever due to the scientific dimension of current global challenges. The COVID-19 crisis has also shown that Cooperation at international level in research and innovation is more important than ever, including thorough open access to data and results. No nation, no country can tackle any of these global challenges alone. An important role for science diplomacy is to build bridges between science, technology and innovation practices, national interests, as well as global challenges".

Mariya Gabriel, Commissioner for Innovation, Research, Culture, Education and Youth, 29th October, 2020

<https://www.science-diplomacy.eu/insights-from-commissioner-mariya-gabriel-towards-science-diplomacy-in-the-european-union/>

Where IDEA League Universities Collaborate with African Universities

Number of IDEA League collaborations per country



- ETH Zürich
- Delft University of Technology
- Politecnico di Milano
- Chalmers University of Technology
- RWTH Aachen University

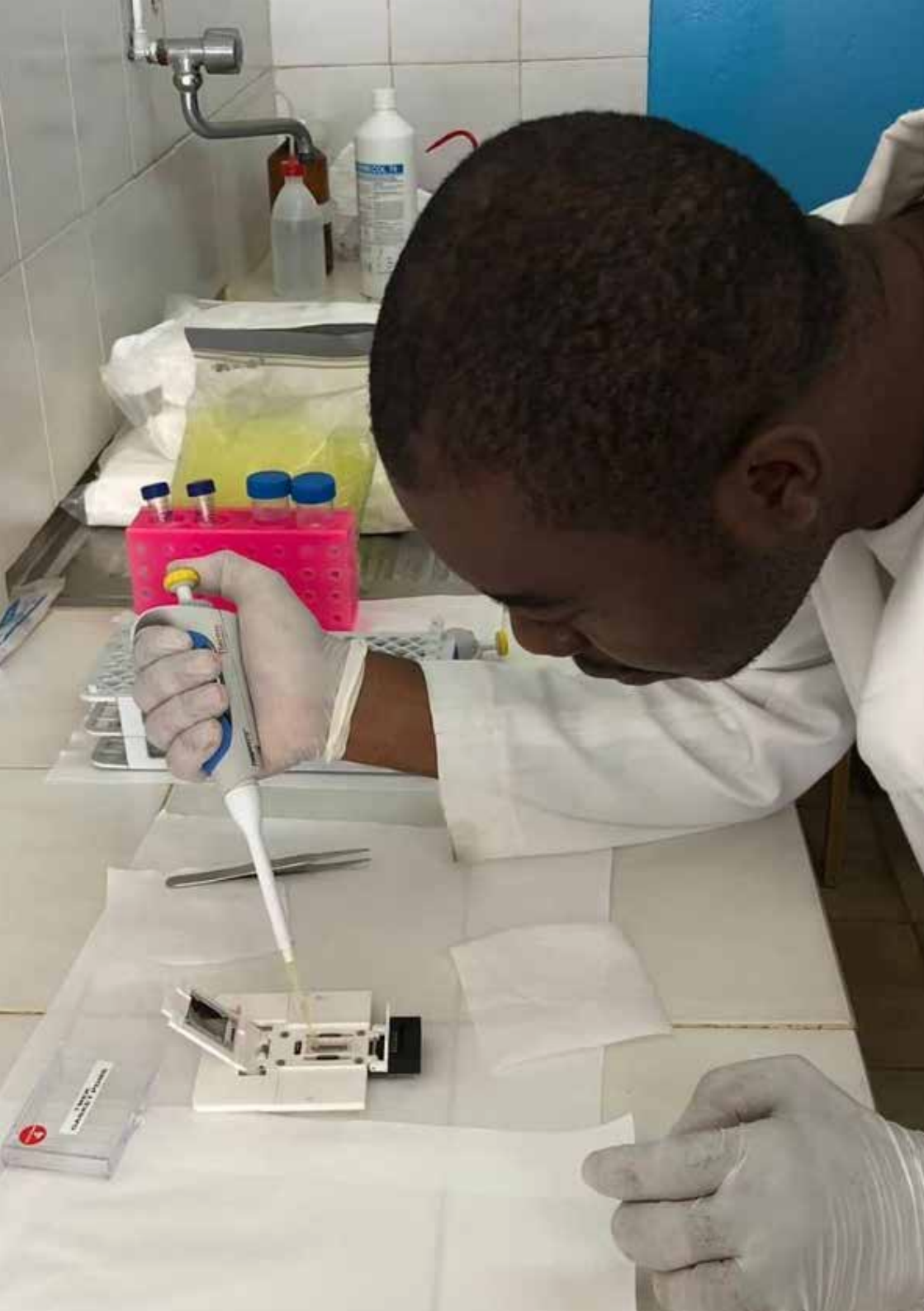


The IDEA League is a strategic alliance between leading European universities of science and technology. Politecnico di Milano joined the network in 2016.

First level Specializing Master

**SUSTAINABLE MANAGEMENT
OF RESOURCES
AND CULTURAL HERITAGE
FOR LOCAL DEVELOPMENT:**
EMPOWERING HIGHER EDUCATION IN AFRICA

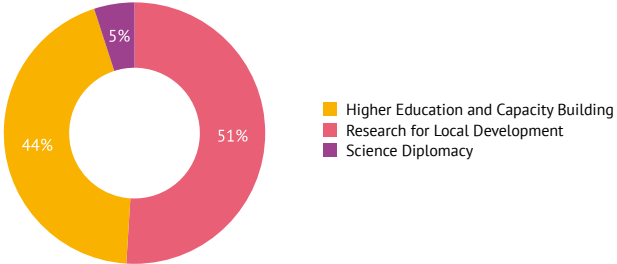
Politecnico di Milano is one of the six founding universities of Fondazione IHEA - Italian Higher Education with Africa.



DETAILED ANALYSIS

More than **100 initiatives** from 2010 to 2021 were collected from the in-depth survey of departments, divided almost equally between the Higher Education and Capacity Building category and Research for local Development. In addition, there are 6 Science Diplomacy initiatives assembled at central level.

BREAKDOWN OF CATEGORIES OF COOPERATION INITIATIVES ACCORDING TO THE PROPOSED TAXONOMY



Initiatives by category



Higher Education and Capacity Building activities are dealing mainly with *capacity building* and strengthening skills in the target countries.

Scholarship initiatives are for the most part linked to AICS funding put in place in recent years, in particular the Partnership for Knowledge (Pfk) project and support to the Somali National University (UNS5). The **Pfk - Partnership for Knowledge** is a three-year initiative financed by AICS with 4 million euros in conjunction with the entire Italian university system that promotes the training of students at MSc and Ph.D. levels in

developing countries, considered crucial for Italy. The Pfk provides 104 scholarships at Italian universities (including Master's degrees and PhDs) distributed over four thematic platforms coordinated by the Università di Firenze, Politecnico di Milano, Sapienza Università di Roma and Università di Pavia.

As part of the initiatives that aim to provide **Support for Universities or local Authorities**, the **UNSS** project contributes to the process of consolidating university education in Somalia. The strategy of the intervention aims to support the UNS (Somali National University) in developing its role as an institution¹⁴.

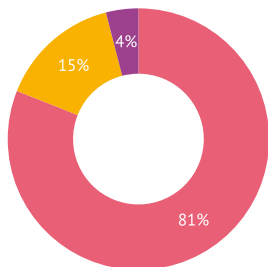
In the last decade, Politecnico di Milano has promoted a vision that goes beyond a simple logic of providing training hours and involves the implementation of an overall process of **institutional strengthening**.

In this regard, the **Transnational education and lifelong learning** category includes **AILs - African Innovation Leaders**, which trained 21 young African professionals on issues related to the Next Production Revolution, who in their turn undertook to train 210 second-generation innovators.

In the strategic framework of the University's three-year plan, the establishment of the **IHEA Foundation - Italian Higher Education with Africa**, should also be noted. The Foundation is the first initiative of transnational education proposed from Italy. It is promoted by six universities, including Politecnico di Milano¹⁵.

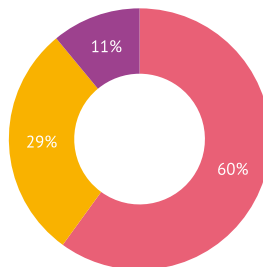
The initiatives already launched include a Master's degree programme entitled *Sustainable Management of Resources and Cultural Heritage for Local Development: Empowering Higher Education in Africa* for "training the trainers" and aimed, in its first edition, at about 35 young Ethiopian academicians.

BREAKDOWN OF THE HIGHER EDUCATION AND CAPACITY BUILDING CATEGORY INTO SUBCATEGORIES



- Scholarships
- Transnational education and lifelong learning
- Support for Universities or Local Authorities

BREAKDOWN RESEARCH FOR LOCAL DEVELOPMENT IN SUBCATEGORIES



- Management of resources and services
- Innovation and Enterprise
- Regional Development and Cultural Heritage

Further *capacity building* actions were promoted in the framework of research projects or projects funded through **Tempus, Edulink** and **Erasmus+** channels.

Other activities at Polimi appear to be relevant to the context of Cooperation, even if they may be codified as **"internationalisation"** initiatives. **Bilateral mobility agreements**, European projects **KA107** and **TEMPUS** fall into this category. Moreover, they have an important function in creating links with universities in developing countries and, in many cases, in facilitating subsequent research projects.

¹⁴ UNSS is developed by the following partners: Politecnico di Milano di Milano, Università di Bari, Università di Bologna, Università di Firenze, Università di Napoli Federico II, Università di Pavia, Sapienza Università di Roma, Università Roma Tre and Università di Trieste.

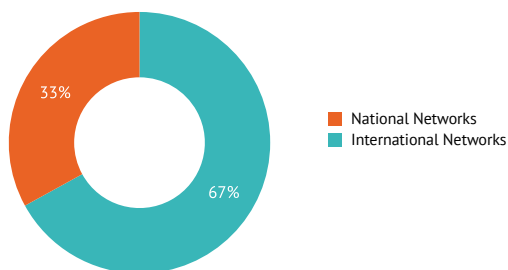
¹⁵ The IHEA Foundation was established in October 2020 and its founding members are: Università di Bologna, Università di Firenze, Politecnico di Milano, Università di Napoli Federico II, Università di Padova, Università di Roma La Sapienza.

Research activities under the sub-category **Regional Development and Cultural Heritage** include the recent VITAE project, a follow-up to the Polisocial Award Emotion project and funded by AICS. The specific objective of this project is to enhance the long-term impact of archaeological research and link it to the promotion of sustainable development at local level by promoting economic growth and cultural development.

Within the sub-category **Management of Resources and Services** special mention should be made of the H2020 DAFNE project associated with the management of water resources in complex transnational basins and the H2020 LEAP-RE project related to the promotion of renewable energy in African countries, boasting a partnership of over 80 institutions from 34 African and European countries.

In the **Innovation and Enterprise** category, it is worth mentioning the ATMOSPHERE project conducted between Europe and Brazil in the field of Cloud Computing, funded by the European Commission to boost business competitiveness.

BREAKDOWN RESEARCH FOR SCIENCE DIPLOMACY IN SUBCATEGORIES



The activities categorised as Science Diplomacy refer to the initiatives (not necessarily project-based and not necessarily funded) that lead to the consolidation of relations networks between universities or with other bodies (national or international) and aim to enhance the role of scientific Cooperation in areas of development.

A total of 7 initiatives are mentioned, mostly related to international networking.

Across the **National Networks**

- CUCS, the University Coordination Network for Cooperation and Development (overseen by the Delegate for Development Cooperation)
- PfK Network: set of 4 platforms (overseen by the Delegate for Development Cooperation)
- IHEA Foundation - Italian Higher Education with Africa (overseen by the Delegate for Development Cooperation)

Across the **International Networks**

- Italo-Somali Scientific Committee (headed by the Delegate for Relations with Africa)
- Sustainable Energy Investment Platform (overseen by the Delegate for Development Cooperation)
- UNESCO Chairs and UNITWIN network (overseen by the Chairholders of each chair)
- Africa IDEA LEAGUE group (chaired by the Delegate for Cooperation and Development and the International Relations Service).

Geographical context

The geographical contexts of interest of initiatives at Polimi encompass all 5 continents, with a significant dominance of **Africa** (especially the Horn of Africa and East Africa); the **Asian continent** is also significantly represented, with interventions concentrated mainly in Middle Eastern countries (Lebanon, Jordan, Iran). Additionally, there are 4 initiatives that include countries from different areas of the Global South, which for the mapping purpose have been grouped under the general heading "Global South".

GEOGRAPHICAL CONTEXTS



Funding

In the last 5 years, Politecnico di Milano has invested its own funds in Cooperation and Development initiatives, amounting to a total of almost 2 million Euros, with externally funded projects totalling over 15 million Euros.

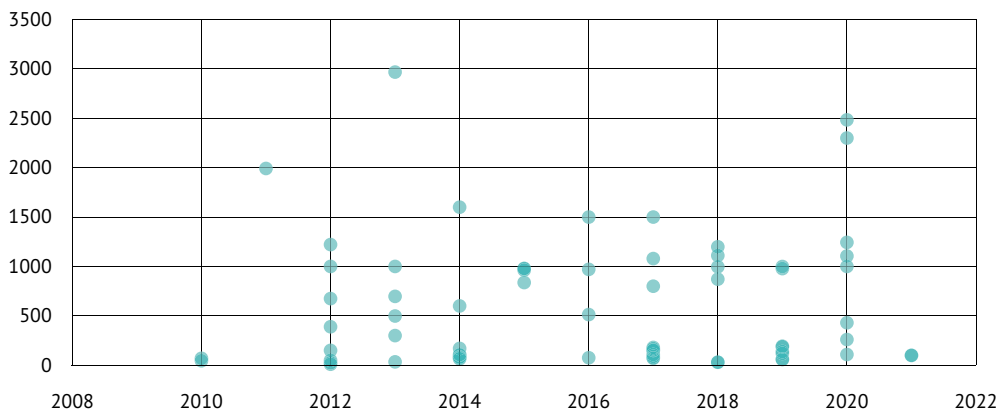
VOLUME OF EXTERNAL AND INTERNAL FUNDING INVESTED IN COOPERATION ACTIVITIES AT POLIMI



AICS is confirmed as the main funder of Politecnico di Milano's Cooperation projects, both through assignment by agreement (art. 24) and participation as partner in calls for NGOs (art. 26). Funding received over the last 5 years amounts to almost 10 million Euros.

Politecnico di Milano has improved its ability to attract funding for Cooperation projects since 2011. Despite the complexities of the 2020-2021 period caused by the COVID-19 emergency, Politecnico di Milano has initiated projects averaging around 2 million Euros per year over the last five years.

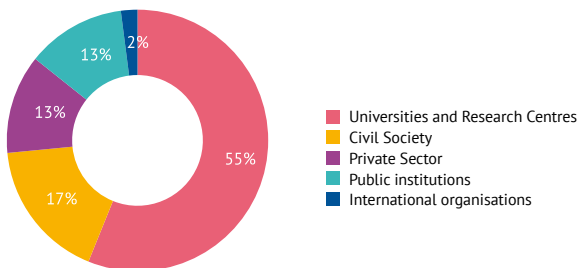
BUDGET RANGE OF PROJECTS (EXPRESSED IN THOUSANDS OF EUROS) PER YEAR



Partnership

Politecnico di Milano operates in a multi-actor context, developing projects in conjunction with the other actors of the Cooperation system. More than 300 collaborations have been launched with partner bodies and institutions for the development of projects. More than 50% of these are implemented with other universities or research centres, followed by almost 20% engaging civil society and about 10% the private sector. Further relationships have been established with international organisations and public institutions.

PARTNERSHIP AND ITS CHARACTERISATION

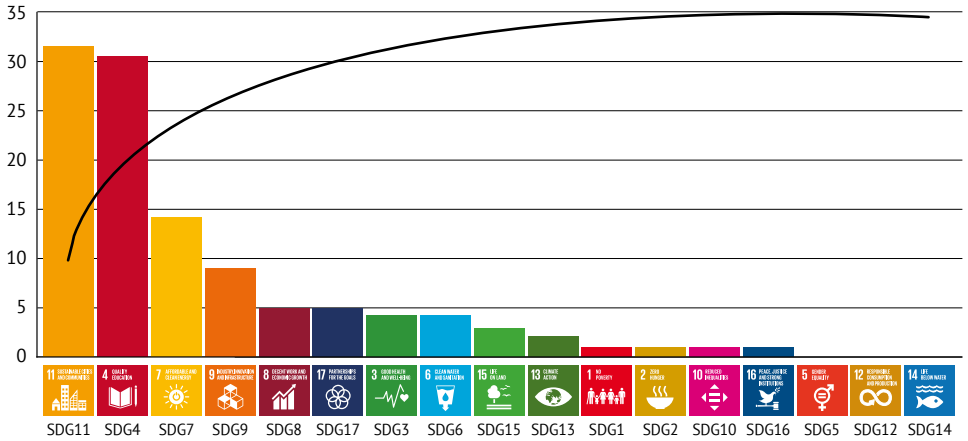


Sustainable Development Goals

It is possible to identify 6 recurrent SDGs that characterise the focus of about 90% of the initiatives undertaken within the framework of Cooperation and Development at Politecnico di Milano.

- SDG11 – Smart cities and communities
- SDG4 – Quality education
- SDG7 – Affordable and clean energy
- SDG9 – Industry, innovation and infrastructure
- SDG8 – Decent work and economic growth
- SDG17 – Partnership for the Goals

SDGs OF PRIMARY INTEREST FOR EACH MAPPED INITIATIVE







FOCUS ON AFRICA

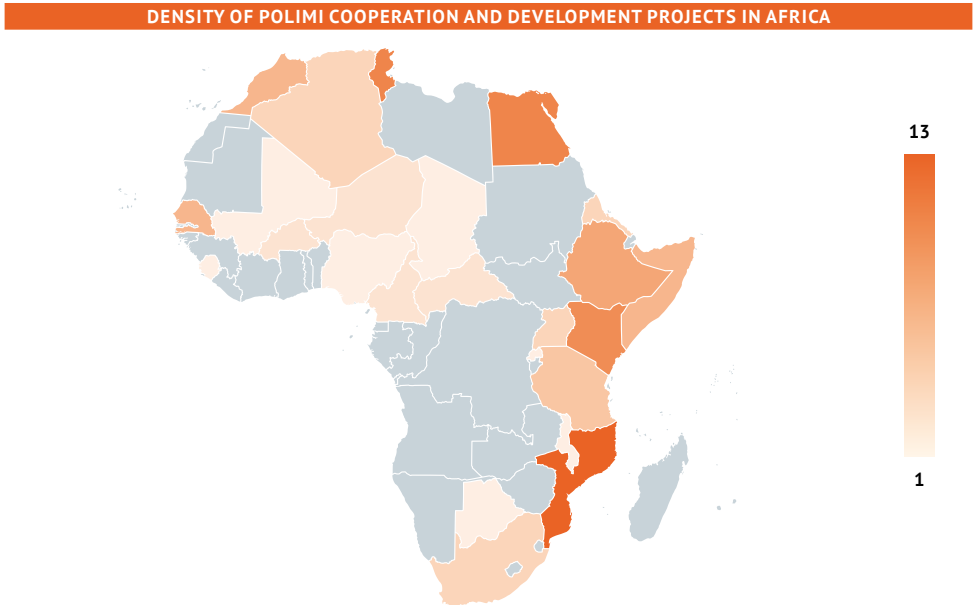
Politecnico di Milano's interest in the African continent is evident: projects involving one or more African countries are around 3 times those involving Asia and 6 times those involving Latin America.

Initiatives by category

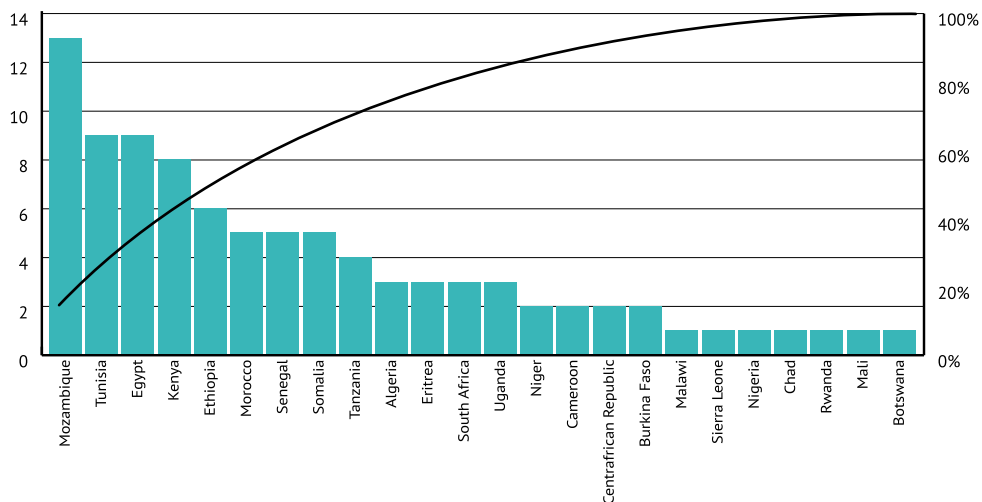
- More than 50% of Higher Education and Capacity Building projects take place in Africa.
- About 65% of Research for local Development projects are carried out in Africa.
- 100% of Science Diplomacy initiatives involve Africa.

Geographical context

Politecnico di Milano's projects involve 25 countries on the African continent, with 70% of the total represented by just 10 countries: Mozambique, Tunisia, Egypt, Kenya, Ethiopia, Morocco, Senegal, Somalia, Tanzania and Algeria.



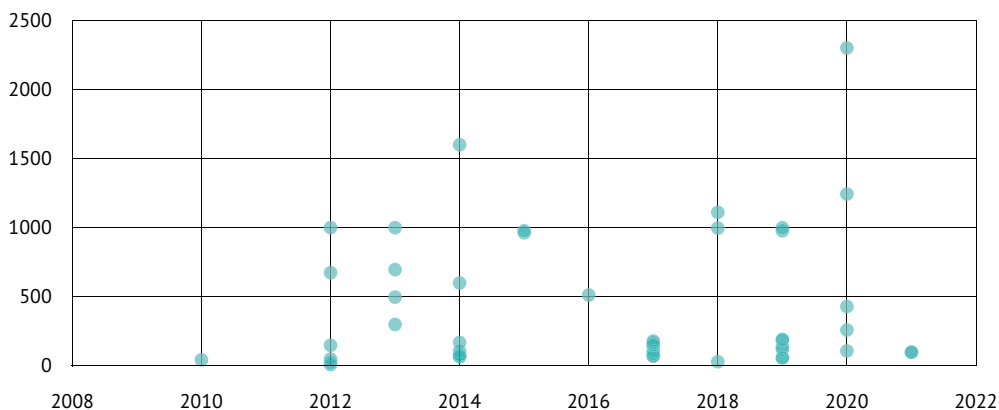
COUNTRIES OF INTERVENTION OF POLIMI COOPERATION AND DEVELOPMENT PROJECTS



Funding

The budget follows the distribution logic in terms of project share between Africa and other regions. However, it should be kept in mind that over the last 4 years, projects financed by AICS have mainly focused on the African continent and have amounted to approximately 8 million Euros. It should also be noted that the number of initiatives tends to increase every year.

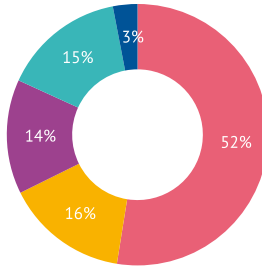
PROJECT DEVELOPMENT IN RECENT YEARS (EXPRESSED IN THOUSANDS OF EUROS)



Partnership

In accordance with Politecnico di Milano's tradition, collaborations developed with African universities or research centres prevail, but a share of partners from the private sector and national institutions is also in constant growth.

MAPPED PARTNERSHIPS WITH STAKEHOLDERS IN AFRICA



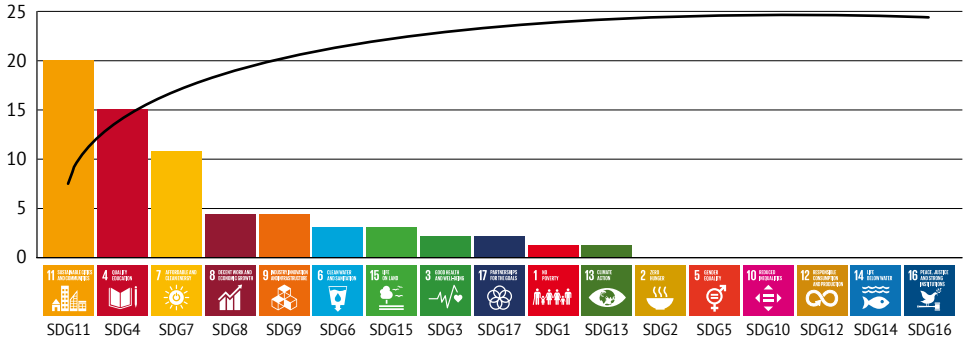
- Universities and Research Centres
- Civil Society
- Private Sector
- Public institutions
- International organisations

Sustainable Development Goals

The projects developed by Politecnico di Milano in African contexts focus mainly on SDGs 11, 4, 7, 8 and 9 (80%), confirming Politecnico di Milano's general trend with respect to Sustainable Development Goals.

The relevance of SDG 17 is emphasised and proved by the 6 Science Diplomacy initiatives involving Africa.

SDGs OF PRIMARY INTEREST IN AFRICA





FOCUS ON ASIA

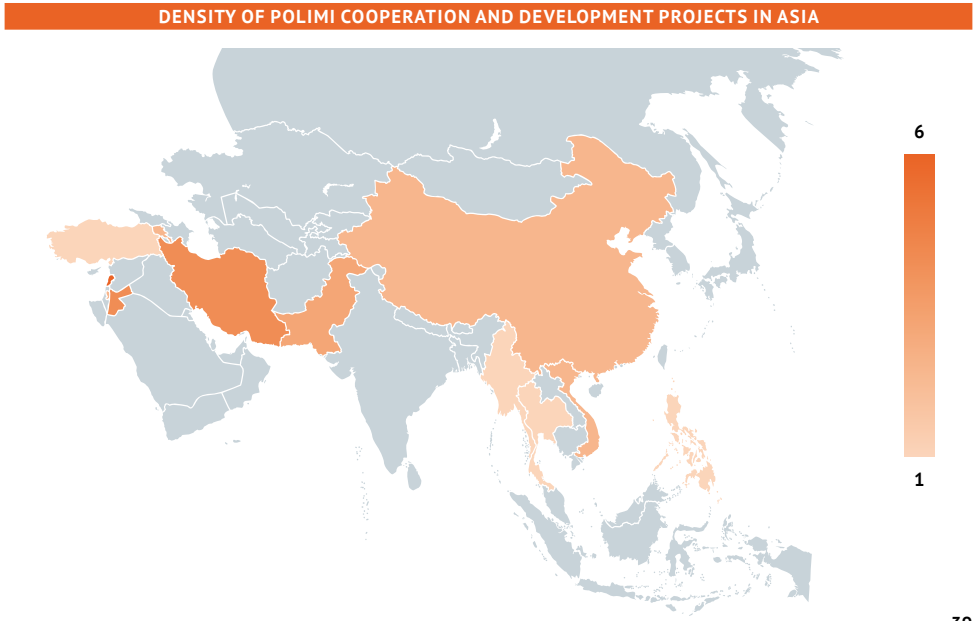
Politecnico di Milano has shown significant interest in the Asian continent, with a particular focus on the Near and Middle East regions, although its involvement is more limited than that in Africa. Over the past 10 years, more than 25 projects have been undertaken conducted in Cooperation with individuals or communities in Asian countries.

Initiatives by category

Unlike the global figure and that for the African continent, in Asia most of the Cooperation projects developed by Politecnico di Milano lie in Higher Education and Capacity Building field, in the form of support for universities and local authorities, while the incidence of Research for local Development projects is lower (around 40%).

Geographical context

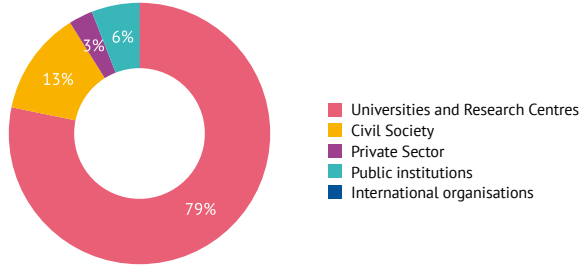
Politecnico di Milano's projects involve 12 countries in Asia, many of which are conducted in the Near and Middle East countries (Turkey, Palestine, Lebanon, Armenia, Jordan, Iran).



Partnership

Compared to the global and African perspective, the partnerships in Asia are characterised by a very strong presence of universities and research centres with a much more limited space occupied by other (private and institutional) actors.

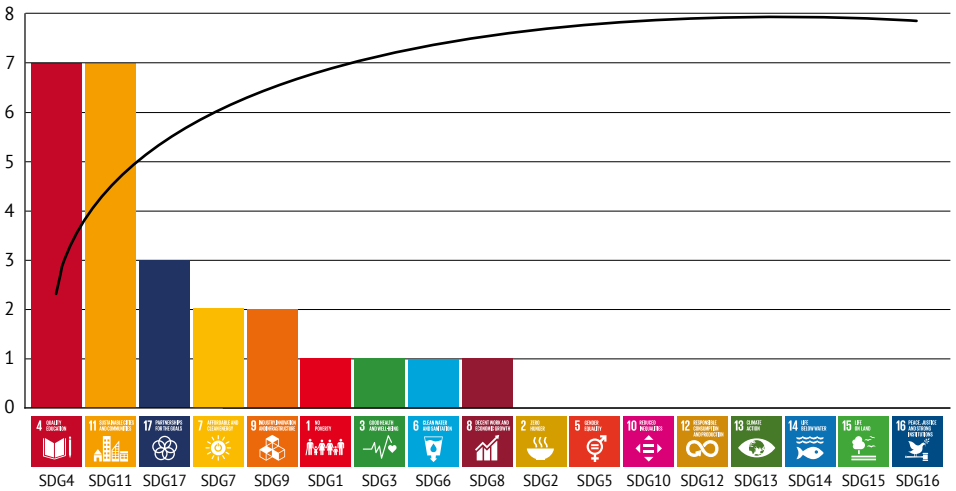
MAPPED PARTNERSHIPS WITH STAKEHOLDERS IN ASIA



Sustainable Development Goals

The Cooperation initiatives activated in Asia focus mainly on SDGs 4, 11, 17, 7, 9 (80%), confirming Politecnico di Milano’s strong technological and innovative orientation with respect to the Sustainable Development Goals, putting a particular emphasis on the issue of quality education, especially at university level, a characteristic element of Politecnico Cooperation.

SDGs OF PRIMARY INTEREST IN ASIA







MOVING TOWARDS AN IMPACTFUL COOPERATION

The taxonomy proposed in this document, in line with national and international Cooperation initiatives, represents an opportunity to assist professors and departments in encoding specific projects and to offer some initial reflections on the results, potential enhancement and impact of Cooperation projects that the latest mapping has highlighted.

Measuring the impact of Higher Education and Capacity Building initiatives

The actions of **Higher Education and Capacity Building** initiatives must aim at the **Empowerment** of individuals and institutions, with a view to the competence sharing more than to the knowledge transfer and horizontal approaches, in order to pay attention to both direct and indirect beneficiaries.

The “**train the trainer**” approach is crucial and it is a common feature across many Politecnico initiatives. The cases collected in this report include, for example, the **training** of 21 professionals on the topics of the Next Production Revolution, who in their turn became “brokers” of innovation in the 6 African countries of origin; the **sharing of techniques and methodologies** related to the conservation of cultural heritage in Eritrea, Armenia and Pakistan; the **institutional strengthening** of universities in Mozambique, Somalia and Tanzania in terms of infrastructure and in the areas of research and human resources. Equally important is the commitment to **educational and training activities** for external, non-academic audiences, with measurable outputs, which in recent years has led to the creation of 5 MOOCs and 4 Sprint MOOCs.

A further dimension of impact measurement is linked to the possibility of **monitoring the employability** or career development of the beneficiaries of *capacity building* and training initiatives, as is already the case for Polimi alumni.

Measuring the impact of Research for local Development

Scientific research becomes a **driver of local and native development and innovation** and can be used both to innovate the practices of the Cooperation improving their effectiveness and to create tools, methodologies, or services to encourage a process of local development, providing opportunities led by the beneficiary countries themselves.

Among the mapped outputs mentioned in this context we may find: one innovative test for the diagnosis of malaria covered by a “social” patent; **infrastructures serving local communities**, including 1 electrification project (Tanzania) and 1 integrated planning project relating to the Water-Food-Energy nexus (Mozambique); **locally-developed tools** (guidelines, master plans, etc.) and a **set of open-data** to support and inform policy makers (on renewable energy, protection of cultural or environmental heritage, urban planning, local development, containment of hydrogeological and health risks, etc.).

For the long-term monitoring purpose, it seems necessary to keep track and consult the beneficiaries of these research projects in the long run.

An internal impact at Polimi is also visible: the **development of new competencies within research teams**. The Cooperation initiatives launched in the last decade have enabled an increasing number of PhD students, temporary research fellowships, researchers, and professors to approach different geographical contexts and explore methodologies for solving complex problems, which results are applicable not only in developing contexts. The experience gained through the field work and the **co-production of knowledge** with stakeholders from multiple geographical areas is then brought back into the classroom. The **birth of new curricular courses, tracks, Masters, MOOCs** associated with Cooperation themes is also an indicator of the increased interest and impact.

Measuring the impact of Science Diplomacy

Strengthening the value of partnerships and networks leads to the development of constructive and continuous dialogue between universities and the outside world. The various forms of academic Cooperation, from research projects to technical support for development, enable Politecnico di Milano to build and consolidate skills networks (horizontal or transversal) between universities, NGOs, international organisations, non-profit organisations, enterprises, local and national institutions. Of particular note are the relationships established with several universities, which are important both in terms of **co-production of knowledge** and as a solid Science Diplomacy network. They represent privileged entry channels to build strategic relationships that help to strengthen local universities and institutions which, as they grow, will consolidate their local network of influence by working with businesses and other institutions and increase opportunities for local development. Therefore, Politecnico di Milano has, therefore, been able to take on the role of **facilitator** between international organisations, municipalities, public bodies and populations in marginal contexts, as in the case of upgrading slums in the favela of Rocinha (Rio de Janeiro), sharing local development proposals with policy makers (on urban mobility and integrated territorial development in Mozambique, social housing in Somalia, healthcare in India and sustainable architecture in tropical regions).

The road ahead

From a strategic long-term point of view, in order to further strengthen the impact of the Cooperation initiatives promoted by our university, further actions would be needed in the coming months:

1. **to structure a co-ordinated process of collecting information** on Cooperation projects
2. **to develop the insights gained from the mapping** of the projects collected into a system of impact indicators validated both from a scientific and organisational points of view
3. **to implement an accompanying course for professors, staff and students** so that the experience of international Cooperation becomes increasingly multidisciplinary and ingrained.

This perspective will help Politecnico di Milano to constantly consolidate its institutional commitment to Higher Education and Capacity Building, Research for local Development and Science Diplomacy by acting in synergy with a variety of stakeholders in order to enhance the technical, scientific and innovation contributions intrinsic to Polimi and to guarantee an effective and efficient impact on Cooperation and Development strategies at both national and international levels.

Good Cooperation to all!



ADDENDUM: FACTSHEETS

COOPERATION AND DEVELOPMENT @POLIMI 2017-2021

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projects led by

DASTU

DEPARTMENT
OF ARCHITECTURE
AND URBAN STUDIES

Boa_Ma_Nhã, Maputo!

Contested Territories

Genius loci of Ghoufi

HANDS

Mo.N.G.U.E.

Vocational Training Centre (Quang Nam Province)

West Nile Regional Profile

BOA_MA_NHÃ, MAPUTO!

A STUDY FOR THE INTEGRATED DEVELOPMENT OF THE REGION BOANE, MOAMBA, NAMAACHA (MOZAMBIQUE)

Scientific Coordinator @Polimi

Laura Montedoro - Department of Architecture and Urban Studies (DASTU)

Duration

2019 - 2020

Funding

Polisocial Award

Budget

190 thousand Euros

Website

www.boamanha.polimi.it/

Geographical Context

Mozambique

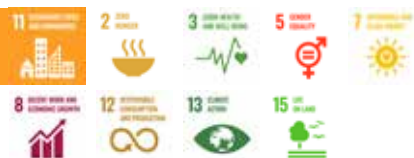


Partners

6 from Africa and Europe



Impact



Beneficiaries

UEM Students (Masters and Ph.D.), Researchers and Teachers; local governments and technical offices; local communities and small entrepreneurs and associations active in the regional food, logistics and tourism sectors.



Boa_Ma_Nhã, Maputo! team meets an agriculture cooperative in Boane, 2019. Courtesy of DASTU.

THEME

The implementation of strategic territorial development guidelines framed in a water-energy-food nexus perspective for the region of Boane, Moamba and Namaacha, and a local development plan for Namaacha.

INVOLVED DEPARTMENTS @POLIMI

Department of Architecture and Urban Studies (DASTU), **Department of Electronics, Information and Bioengineering (DEIB)**, **Department of Energy (DENG)** and **Department of Civil and Environmental Engineering (DICA)**.

ABSTRACT

Boa_Ma_Nhã, Maputo! is a research project based at Politecnico di Milano in partnership with the Eduardo Mondlane University and the Italian Cooperation Agency. The team studied a metropolitan area that is fragmented from the administrative point and lacking statistical and cartographic data. The objective is to contribute to the integrated development of the region and to spread the culture of an effective territorial planning, providing local administrations with a development plan and a methodology. One of the focal points of the research is the creation of a model on the nexus water-energy-food in support of regional strategic planning, with particular reference to the agricultural sector.

RESULTS

- An increase of the land use planning culture by improving the legal framework, policies and public plans in the Mozambican state;
- Improvement of the daily land management and administration practices in the studied area;
- Capacity building at the university level, and training of professionals, institutions, organizations and companies working in the area;
- Framework for development scenarios and production of study area-specific strategic plans, applicable for further analysis in different geographic contexts;
- Set of guidelines for local government;
- Development of a pilot project for Namaacha;
- Development of scientific papers, editorial products, and web tools for project communication.

LIST OF PARTNERS

FAPF Universidade Eduardo Mondlane, Faculdade de Arquitectura e Planeamento Físico (Spain); DESP Dipartimento di Scienze e Politiche Ambientali, Università degli Studi di Milano (Italy); Dipartimento di Scienze Agrarie e Ambientali, Produzione, Territorio, Agroenergia, Università degli Studi di Milano (Italy); AICS Agenzia Italiana per la Cooperazione e lo Sviluppo_Maputo (Mozambique); NGO ProgettoMondo MLAL; ASF_Spagna: Architetti Senza Frontiere Spagna (Spain); ASF_Italia: Architetti Senza Frontiere Italia (Italy).

CONTESTED TERRITORIES

RESEARCH AND INNOVATION STAFF EXCHANGE

Scientific Coordinator at Politecnico di Milano
Antonella Contin - Department of Architecture and Urban Studies (DASTU)

Duration
2020 - 2024

Funding
H2020-MSCA-RISE-2019

Budget
2.0 million Euros

Website
<https://www.contested-territories.net/>

Geographical Context

Ecuador
Colombia
Argentina
Bolivia



Partners

21 from Europe and South America



Impact



Beneficiaries

Indigenous peoples of the Amazon area of Argentina, Bolivia, Colombia, and Ecuador.



Aerial view of the Amazonian. Courtesy of *Contested Territories* project team.

THEME

Creating an international and inter-sectoral network of organizations from Europe and Latin America on a joint research program in order to generate knowledge on innovative and sustainable bottom-up models of territorial development.

POLIMI INVOLVED DEPARTMENTS

Department of Architecture and Urban Studies (DASTU).

ABSTRACT

The research project aims at forming an international and inter-sectoral network of organizations from Europe and Latin America that pursues the generation of knowledge on innovative and sustainable bottom-up models of territorial development. Network participants are expected to exchange and then generate new knowledge to move beyond mainstream conceptions of development and contribute to scientific discoveries by integrating bottom-up strategies to adapt to risk, vulnerability, and exclusion.

Meanwhile, researchers are expected to engage with the UN Sustainable Development Agenda and contribute to it with alternative perspectives, both conceptual and practical. They will nurture new approaches to redefine the humanity-environment relationship that take into account Latin American popular culture conceptions and the indigenous vision of the cosmos.

The project will thus provide an opportunity for (academics and non-academics) participants to actively shape practices and policies for a more inclusive territorial development and a different model of social cohesion.

EXPECTED RESULTS

- Creating the aforementioned international and inter-sectoral network of organizations from Europe and Latin America.
- Collecting alternative knowledge by community-led practices to be used as the basis of a productive framework that supports local-to-global knowledge diffusion. In particular, the "RISE" action will deliver a new understanding of how ordinary people produce innovative models for more sustainable and resilient environments, how they shape, negotiate, imagine and collaboratively manage territories in contested and uneven power relations, and how they advance models of social integration.
- Generating significant benefits for societies in Latin America, with transferable outcomes to Europe.
- Supporting the staff members in developing new skills within inspiring research environments that significantly widen their career perspectives, in and beyond academia.

LIST OF PARTNERS

Torero Film (Germany); Universität Leipzig (Germany); ACUJ (Argentina); Antropología, Ciudad y Naturaleza (Argentina); CEUR-CONICET (Argentina); Ciudades Reveladas (Argentina); Facultad de Agronomía (Argentina); Gemas (Argentina); Instituto de Geografía (Argentina); Ciencias del Desarrollo (Bolivia); Geografía & Instituto de Vivienda (Chile); Universidad de la Frontera (Chile); Pontificia Universidad Javeriana (Colombia); FLACSO (Ecuador); Basurama (Spain); UAM -Universidad Autónoma de Madrid (Spain); Centre National de la Recherche Scientifique CNRS (France); Institut de Recherche pour le Développement (France); University of Leeds (UK); University of Sheffield (UK); Politecnico di Milano (Italy); Habita65 (Portugal).

GENIUS LOCI OF GHOUFI

RECOVERY OF THE 'GENIUS LOCI' OF THE GHOUFI SITE, AURES VALLEY, WILAYA DI BATNA

Scientific Coordinator @Polimi

Susanna Bortolotto - Department of Architecture and Urban Studies (DASTU)

Duration

2016 - ongoing

Funding

MAECI - Ministero degli Affari Esteri e della Cooperazione Internazionale.

Budget

12 thousand Euros

Website

italiana.esteri.it/italiana/sedi/il-recupero-del-genius-loci-del-sito-di-ghoufi-valle-dellaures-wilaya-di-batna/

Geographical Context

Algeria

Partners

2 from Africa

Impact

4 QUALITY EDUCATION



11 SUSTAINABLE CITIES AND COMMUNITIES



17 PARTNERSHIPS FOR THE GOALS



Beneficiaries

Local communities, entrepreneurs, and the civil society.



View of the Ghoufi site.

THEME

The 'Ghoufi Project' has the potential to become an archaeological park that links the cultural and natural heritage of the territory with the safeguarding of the Berber historical memory and identity.

INVOLVED DEPARTMENTS @POLIMI

Department of Architecture and Urban Studies
(DASTU)

ABSTRACT

Ghoufi is located in the Aurès Valley, near the 'Oued El Abiod'. Its location, next to the panoramic road RN31, is referred to as 'Balcon de Ghoufi' because - from above - you can perceive the depth of the canyon (500/1200m) and the beauty of the place, scattered with Berber villages (vernacular, semi-trogoloditic architecture), terracing, water collection systems, palm groves, orchards and gardens.

The Aurès Valley - a thoroughfare since ancient times, a caravan route between the desert and the Mediterranean Sea - has been the subject of archaeological explorations by Pierre Morizot since 1957-1962, which established the chronology of the settlements. This valuable work has been supplemented by ongoing research. This territory still retains the morphological and hydrographic peculiarities that justify the Berber settlement choice despite the fact that unfortunately the places have been abandoned following a recent flood. From 2016 activities of survey and research, directed by the University Badji Mokhtar of Annaba and the Politecnico di Milano (and since 2019 also with the Université Mohamed Khider Biskra, Algeria) resumed at Ghoufi. These activities are aimed in particular at surveying archaeological and architectural artefacts, conservation interventions to address deterioration and instability and valorisation projects. Since 2017 the research has been funded by the MAECI. The project begun with the collection of documentation and knowledge of the Ghoufi site in a GIS environment. It prefigured a preliminary scenario for its conservation and reuse, following an approach of archaeological sustainability respectful of the characteristics of the site, the territory and the Country.

EXPECTED RESULTS

- Collection and analysis of documentation for the knowledge of the Ghoufi site in its quantitative and material values and relative to its state of conservation.
- Analysis of the Ghoufi settlement for the promotion of the procedures for the conservation, protection, enhancement and management of the historical cultural heritage in relation to the dynamics of local development; training of local qualified personnel in conservation and maintenance.

FOLLOW UP

The project led to the activation of an Erasmus+/KA107 and related staff mobility activities (2020-2022) promoted in partnership with Biskra University.

LIST OF PARTNERS

Université Badji Mokhtar Annaba, Faculté des Sciences de la Terre, Département d'Architecture (Algeria); Université Mohamed Khider Biskra (Algeria)

HANDS

HEALTH AND URBAN SPACE IN CHAMANCULO,
MOZAMBIQUE**Scientific Coordinator @Polimi**

Camillo Magni - Department of Architecture and Urban Studies (DASTU)

Duration

2021 - 2022

Funding

Polisocial Award

Budget

100 thousand Euros

Website

<https://www.hands.polimi.it/>

Geographical Context

Mozambique

**Partners**

5 from Africa and Europe

**Impact****Beneficiaries**

NGOs and International Institutions active in the area (including UN-Habitat, WB, UNHCR, RC); local government institutions; local associations and religious bodies; social entrepreneurs.



Kids playing in Chamanculo, courtesy of HANDS project team.

THEME

The research promotes the culture of healthiness through multidisciplinary experimentation of medium and long-term actions aimed at mitigating the health and hygiene vulnerability of the informal neighborhood of Chamanculo, with the help of local production and dissemination of Polichina.

INVOLVED DEPARTMENTS @POLIMI

Dept. of Architecture and Urban Studies (DASIU), Dept. of Architecture, Built environment and Construction engineering (DABC), Dept. of Chemistry, Materials and Chemical Engineering (DCMC), Dept. of Civil and Environmental Engineering (DICA), Dept. of Energy (DENG).

ABSTRACT

The recent pandemic has highlighted, once again, the vulnerability of the most disadvantaged populations living in the informal neighborhoods of the metropolises of the Global South. Chamanculo, the informal neighborhood on which the research applies, is a large shantytown in Maputo, Mozambique, located on the edges of the formal city, home to over 150,000 inhabitants (26,000 in Sector C alone). This is an urban area typically characterized by overcrowding, lack of infrastructure, services, and planning, exposure to associated environmental hazards as well as a dramatic lack of sanitation and a very weak culture of healthiness. In fact, in a population with an average age of 17 years, there are widespread and recurrent cases of tuberculosis, malaria, cholera, gastroenteritis, and several other diseases related to access to unsafe water sources, to which are added in recent months the cases of COVID-19 (WHO 2020).

The research has the priority objective of promoting the culture of healthiness starting from a specific action: the on-site production and dissemination of Polichina, the disinfectant solution recently produced by the Politecnico with the recipe of the World Health Organization to prevent the transmission of Corona Virus. The sale of Polichina, associated with low production costs, would allow the project to be economically independent from external aid in the medium and long term, encouraging replicability in other contexts.

EXPECTED RESULTS

The research has the ambition to contribute to the improvement of the sanitary conditions of Chamanculo through the dissemination of the culture of healthiness, starting with the production of Polichina. The research aims at:

- designing miniaturized and automated modules for the production of Polichina suitable for informal contexts;
- designing a system of hubs for the widespread production of Polichina and waste management in public spaces with the highest social impact;
- the Polychin production and management of medical waste generated by COVID-19;
- designing a social laboratory for the production of Polichina that employs local unskilled female labor;
- disseminating results to local Stakeholders;
- fostering a culture of healthiness through the promotion of the use of Polichina.

LIST OF PARTNERS

Universidade Eduardo Mondlane (Mozambique); Master Design for Development - DASTU and Consorzio Poliedra of Politecnico di Milano (Italy); AICS Mozambico (Mozambique); AVSI; ASF Italia/Spain (Italy, Spain);

Mo.N.G.U.E.

MOZAMBIQUE NATURE GROWTH UNIVERSITY EDUCATION

Scientific Coordinator @Polimi

Michele Ugolini - Department of Architecture and Urban Studies (DASTU)

Duration

2017 - 2019

Funding

Polisocial Award

Budget

93 thousand Euros

Website

www.mongue.polimi.it

Geographical Context

Mozambique

Partners

2 from Africa and Europe

Impact



Beneficiaries

Maxixe Pedagogical University, municipality of Maxixe, and the Mongue community.



A view of Maxixe during an on-site visit, courtesy of DASTU.

THEME

The word Mo.N.G.U.E. identifies a place and it's also the acronym of Mozambique, Nature, Growth, University, Education, the general themes investigated by the project together with the condition of fragility and potential of the territory.

INVOLVED DEPARTMENTS @POLIMI

Department of Architecture and Urban Studies (DASTU), **Department of Architecture, Built environment and Construction engineering (DABC)**, **Department of Energy (DENG)** and **Department of Civil and Environmental Engineering (DICA)**.

ABSTRACT

The project targeted the historic site of Mongue – one of the first mission settlements in the south of Mozambique dated to the end of the XIX century - and the surrounding area, where the Universidade Pedagógica de Moçambique proposes to set up a natural park. Following decades of abandonment, recent interventions have reactivated the historical complex, introducing new functions and regenerating its identity. However, several aspects such as the technical performance of the new buildings, the enhancement of heritage and landscape, and the safeguard of natural assets were generally neglected. Focusing on these last criteria and after a preliminary research phase, Mo.N.G.U.E. aimed at defining a context-aware architectural solution for the site by:

- introducing new functions such as the head office of the park, the research center, and the ecolodge with facility for researchers and visitors;
- redeveloping the local kindergarten;
- reactivating the building heritage to be used by the community.

The general objective was to identify and experiment with an interdisciplinary and reproducible intervention methodology by cooperating with the partners and local communities. Bioclimatic comfort and energy sustainability topics are combined with traditional construction techniques, following a careful and transcalar analysis of the territory. At a larger scale, the goal of the natural park was to protect the Mongue peninsula from the urban growth pressures brought by nearby Maxixe through identifying areas with different levels of protection and development possibilities.

RESULTS

- Graphic elaborations and reports that analytically illustrate the state of affairs of Mongue and its peninsula, a territory in which the actual cartography is outdated;
- Drawings and reports that illustrate the issues related to the wider geographical context, verifying the issues mapped in the local context;
- Preparation, comparison and selection of different settlement and intervention hypotheses, on the basis of the critical issues and potentialities emerged in the previous phases;
- Identification of technical and functional requirements within an architectural reading aware of the Mozambican context;
- A master plan outlining a precise settlement structure that can improve the conditions of the place, the landscape, and the system of open spaces;
- A design of individual buildings capable of improving space quality, bioclimatic comfort conditions and energy sustainability.

LIST OF PARTNERS

Congregazione Sacra Famiglia (Italy); Pedagogical University of Maxixe (Mozambique).

VOCATIONAL TRAINING CENTRE (QUANG NAM PROVINCE)

VOCATIONAL TRAINING CENTRE FOR THE RESTORATION AND CONSERVATION OF CULTURAL HERITAGE (QUANG NAM PROVINCE)

Scientific Coordinator @Polimi

Maria Cristina Giambruno - Department of Architecture and Urban Studies (DASTU)

Duration

2017 - 2020

Funding

AICS - Italian Agency for Development Cooperation

Budget

1.1 million Euros

Website

NA

Geographical Context

Vietnam

Partners

4 from South-East Asia and Europe

Impact

17 PARTNERSHIPS FOR THE GOALS



Beneficiaries

Graduates and staff of institutions responsible for the protection of Vietnamese cultural heritage.



Tam Ky (Vietnam), 2019: kick off meeting, inauguration of the 2nd year and delivery of certificates to the students of the previous year. Courtesy of DASTU.

THEME

The project aims to create a training center in architectural and archaeological heritage conservation through the teaching of technicians, creating a laboratory for the restoration of movable works, and opening and implementing pilot sites for archaeological excavation and conservation of buildings.

INVOLVED DEPARTMENTS @POLIMI

Department of Architecture and Urban Studies
(DASTU)

ABSTRACT

With the support and technical guidance of the Institute for Conservation of Monuments in Hanoi, the project is to set up a training center, within the Quang Nam Vocational Training College, to train human resources on conservation, preservation and management of archaeological and cultural heritage sites (archaeologists, architects, site managers, documentarists, archivists, topographers, AutoCAD designers, restorers of archaeological and architectural objects, specialized workers). These professionals will ensure the proper management of archaeological sites and the protection and enhancement of the Vietnamese historical and architectural heritage.

Over the 30 months of project implementation, several training courses will be conducted. Two six-month training courses for fresh university graduates, young civil servants and young professionals, engaged and interested in the conservation of cultural heritage, will take place. Two four-months courses will train specialized workers on archaeology and architectural restoration. One three-month course, conducted along the other trainings, will prepare the future teachers of the Training Centre. All courses will be based on a "learning by doing" approach – thus, practical training sessions on archaeological sites, especially at My Son, will be carried out. Therefore, also the My Son Management Board will be involved in the project management.

RESULTS

- A training center for managers of archaeological sites, professionals in the sector of heritage conservation, and specialized workers, as well as a laboratory for the restoration of architectural and archaeological items.
- Training 120 people including fresh university graduates, young civil servants, young professionals, workers and teachers, engaged and interested in the conservation of cultural heritage.
- Improving the conservation and protection conditions of My Son archaeological site.
- Promoting the placement on the job market of the human resources trained through the project.

LIST OF PARTNERS

Fondazione Carlo Maurilio Lerici (Italy); ICM - Institute of Monument Preservation of Hanoi (Vietnam); Project Governing Body People's Committee of Quang Nam Province (Vietnam); Tam Ky Vocational Training College (Vietnam),

WEST NILE REGIONAL PROFILE

SUPPORTING MULTI-SCALE INTEGRATED PLANNING IN THE NEBBI – KOBOKO CORRIDOR, UGANDA

Scientific Coordinator @Polimi
 Antonella Contin - Department of Architecture and Urban Studies (DASTU)

Duration
 2018 - 2019

Funding
 Booyoung Group and UN-Habitat

Budget
 100 thousand Euros

Website
<https://unhabitat.org/integrated-and-multi-scalar-planning-in-west-nile-region-uganda>

Geographical Context
 Uganda

Partners
 8 from Africa and Europe

Impact

Beneficiaries
 Municipality of Arua Nebbi Koboko; Ugandan Support for Municipal Development.



West Nile Districts and Town Centres via WestNileweb.com

THEME

The project supports Ugandan government in developing policies, plans and projects, fostering the sustainable economic, social and environmental development of the West Nile Region. It also implements the Habitat Country Program (2016-22).

INVOLVED DEPARTMENTS @POLIMI

Department of Architecture and Urban Studies (DASTU).

ABSTRACT

The aim of the project was to develop an evidence-based integrated territorial development proposal to support decision making for sustainable development in the West Nile Region. The project covered Arua-Nebbi and Koboko as the regional metropolitan axis and included peri-urban and rural areas as the neighboring countries. The project was anchored in projected major infrastructure developments around Arua regions. The project was implemented under the premise that to develop tangible and concrete planning projects, it is crucial to take a territorial and "metropolitan perspective" - scaling down from regional to city level and neighborhood level with participation of stakeholders from both national as well as local authorities, urban and rural key players, academia, civil society and private sector.

The project also worked on domesticating global tools such as the International guidelines for Urban and Territorial Planning (IGUTP) to benchmark against international experiences. Assessing existing plans and policies against the Guidelines providing clear indications of gaps and areas of improvement, for an integrated, cross-scale, cross-sector approach to development. The proposed activities were aimed at developing the strategic plan and projects for Arua-Nebbi-Koboko and the west Nile region with an improved awareness regarding the importance of using an integrated territorial planning approach, alternative to traditional land-use planning, that puts at the center the consideration of the city as it functions within a larger and more complex system of cities, and the match between actions on physical space and sustainable development goals and targets, with a particular focus on public assets.

RESULTS

The main results were a desktop research and field studies, complemented by a fact-finding mission and workshops for the effective interaction with local experts and stakeholders, at both national and local level. Main findings were synthesized with the aim of providing a set of recommendations.

LIST OF PARTNERS

Mekerere University (Uganda); University of Botswana (Botswana); ROAF; National Government of Uganda (Uganda); Municipality of Arua (Uganda); Ugandan Support for Municipal Development (Uganda); GIZ (Germany); FAO.

projects led by

DABC

DEPARTMENT
OF ARCHITECTURE,
BUILT ENVIRONMENT
AND CONSTRUCTION
ENGINEERING

BECOMe

Interactive Building Energy Design Software Tool

Polimi Para Rocinha

UNS3

UNS4

Waste Management Africa

BECOMe

BUSINESS ECOSYSTEM DESIGN FOR SUSTAINABLE SETTLEMENTS IN MOGADISHU

Scientific Coordinator @Polimi

Oscar Eugenio Bellini - Department of Architecture,
Built environment and Construction engineering (DABC)

Duration

2019 - 2021

Funding

Polisocial Award

Budget

164 thousand Euros

Website

NA

Geographical Context

Somalia



Partners

6 from Africa
and Europe



Impact



Beneficiaries

Stakeholders interested in using
this model to start new businesses;
international and national players
(Universities, ONG, etc.), politicians and
institutions (EU, World Bank, etc.).



Mogadishu, 2019. Field picture courtesy of the *BECOMe* project team.

THEME

The research aims to deliver an integrated development plan for a business ecosystem oriented to promote new settlements in Mogadishu, based on affordable and sustainable housing, local entrepreneurship, related social facilities and renewable energies.

INVOLVED DEPARTMENTS @POLIMI

Department of Architecture, Built environment and Construction engineering (DABC), Department of Architecture and Urban Studies (DASTU) and Department of Department of Management, Economics and Industrial Engineering (DIG).

ABSTRACT

The research aimed at proposing a business ecosystem for sustainable settlements, developed through an integrated model that embraces affordable housing, local entrepreneurship and social facilities, also making use of the exploitation of local loops in a circular economy approach. The research goal outlines a set of possible scenarios for stimulating new investments within the building sector, ensuring a balance between all three pillars of sustainability and a methodology for evaluating, for each scenario, feasibility conditions – economic, legislative, social – assessing direct and indirect benefits and risks. In a social perspective, the proposed housing model is designed to target a pre-defined housing price, affordable for the highest percentage of local population, through the optimization of the entire construction process and the use of local renewable energy. The research involved the use of bottom-up actions and aimed to raise awareness on the potential for providing affordable housing solutions to a larger part of the population.

RESULTS

- Clustering. Housing spaces will be integrated with appropriate spaces for local craft/manufacturing activities, ICT development environments (learning by sharing), and social services (school, playground, mosque, etc.).
- On-site renewable energy production. Zero-cost production for housing units, affordable for local entrepreneurs and business/social services.
- Revamping. Supporting the local building sector with the production of building materials/components and the creation of new supply chains and appropriate training strategies.
- Promoting. Creating local forms of circular economy such as the innovative use of local materials and construction resources and using new technologies.

FOLLOW UP

Institutional relations have been opened with the Somali Embassy in Rome, the Somali National University in Mogadishu, and part of the business world that operates in Mogadishu.

LIST OF PARTNERS

SNU - Somali National University (Mogadishu - Somalia); UN-Habitat - United Nations Human Settlements Programme (Kenya); AICS - Agenzia Italiana per la Cooperazione allo Sviluppo (Somalia); ANCE Lombardia (Italy); HCC - Holac Construction Company (Mogadishu - Somalia); Architetti Senza Frontiere Italia (Italy).

INTERACTIVE BUILDING ENERGY DESIGN SOFTWARE TOOL

DEVELOPMENT OF AN INTERACTIVE BUILDING ENERGY DESIGN SOFTWARE TOOL

Scientific Coordinator @Polimi

Niccolò Aste - Department of Architecture,
Built environment and Construction engineering (DABC)

Duration
2017 - 2018

Funding
UN-Habitat

Budget
70 thousand Euros

Website
NA

Geographical Context
Africa

Partner
1 intergovernmental organization

Impact



UN HABITAT
FOR A BETTER URBAN FUTURE

Beneficiaries
NA



Comparison between the architectural model (on the left) and the energy simulation model (on the right), courtesy of DABC.

THEME

Development of a simplified tool for the simulation of building performance, specifically designed for the African context.

INVOLVED DEPARTMENTS @POLIMI

Department of Architecture, Built environment and Construction engineering (DABC)

ABSTRACT

Energy used in commercial and residential buildings accounts for a significant percentage of the total national energy consumption (about 40%).

The majority of modern buildings in Sub-Saharan Africa (mainly tropical climates) are replicas of buildings designed for the western world (cold and temperate climates) and do not take into consideration the differences in climate. As a result, buildings are heavily reliant on artificial means for indoor comfort, i.e. cooling, heating and lighting. Inefficient design solutions and inadequate construction materials, combined with poor understanding of thermal comfort and acritical application of energy-conscious building principles, has led to tremendous energy wastage.

Energy efficiency is one of the most important topics worldwide, nevertheless, each region has its own characteristics which must be considered: this is especially important for online Tools that deliver comprehensive information on energy efficiency and renewable energy for average consumer as well as for municipalities and governments. These Tools are essential for energy retrofit of existing building for energy saving as well as designing of new energy-efficient structures, and designing and sizing renewable energy technologies such as solar thermal and photovoltaic system.

RESULTS

The main project result is a dynamic Interactive Building Energy Design Software Tool, especially tailored to the Sub-Saharan African climatic context.

This open-source, free-redistributable, intuitive, and powerful software can count on:

- a reliable and dynamic building energy simulation that is performed by EnergyPlus simulation engine, which is a state-of-the-art simulation tool. This is the only method to ensure a correct evaluation in cooling-dominated buildings and tropical climates, where dynamic paths heavily affect the buildings thermal behavior and energy performance. Designers need accurate, hourly-based methods, considering the actual building thermal response and its heat absorption and release due to the variation of the outdoor conditions throughout the day;
- an intuitive interface based on Sketchup that avoids the hardness in compiling a building energy model by coupling the easiness in geometric modeling of the modeling tool with the reliability and accuracy of Energy-Plus. Users can build an energy model with SketchUp drawing tools and dedicated interfaces, while the plugin generates the input data file to process with the simulation engine in few easy steps. Also, some macro are developed to generate geometries and to automate modeling process.

Additional features were incorporated within the energy simulation tool:

- Typical meteorological year (TMY) files for Sub-Saharan African locations;
- building envelope material libraries with respect to local materials in Sub-Saharan context;
- integrations of HVAC and renewable energy systems evaluation modules.

POLIMI PARA ROCINHA

ENVIRONMENTAL PERFORMANCES AND SOCIAL INCLUSION: A PROJECT FOR THE ROCINHA FAVELA IN RIO DE JANEIRO, BASED ON IMM METHODOLOGY

Scientific Coordinator @Polimi

Massimo Tadi - Department of Architecture,
Built environment and Construction engineering (DABC)

Duration

2016 - 2018

Funding

Polisocial Award

Budget

75 thousand Euros

Website

<https://it-it.facebook.com/Polimiporrocinha/>

Geographical Context

Brasil



Partners

6 from Europe
and South America



Impact



Beneficiaries

The inhabitants of the Rocinha slums
and the Scientific Community.



Aerial view of the Rocinha slums shared on social by *Polimi Para Rocinha* project team.

THEME

Solutions to improve the living conditions in Rocinha's favela by adopting a methodology developed at the Politecnico di Milano that integrates environmental, urban design and energy efficiency expertise with water and waste treatment strategies according to a systemic approach.

INVOLVED DEPARTMENTS @POLIMI

Department of Architecture, Built environment and Construction engineering (DABC); Department of Architecture and Urban Studies (DASTU); Department of Energy (DENG) and Department of Civil and Environmental Engineering (DICA).

ABSTRACT

Rocinha (Rio de Janeiro) is the largest favela in Brazil and in South America, and an exemplary case study for all sustainability issues in similar contexts. Situations of extreme poverty, social unrest and environmental disarray co-exist with redeeming dynamics, fostered by planned actions focusing on inclusion and legality. The PolimiparaRocinha project aimed to complete these policies by providing them with what has been missing so far: a systemic approach able to improve the economy and life conditions in the entire area, acting first and foremost on the energetic-environmental side as a 'catalyst' for change. An IMM (Integrated Modification Methodology) is applied to this purpose: the method has been developed at Politecnico di Milano and integrates environmental, town planning and energy efficiency skills with water and waste management strategies.

RESULTS

- State of the art diagnostics, for the identification of the most promising actions for the improvement of the environmental conditions of the favela.
- Implementation of pilot actions in four areas of the favela and their integration into the complex urban system of the favela.
- Measurement of the effects of local modification with IMM methodology; evaluation of the performance of the local system; local optimization of the choices and actions proposed; verification of the project benefits.

AWARDS

The project has been recognized within the *Open Days of Innovation* and has been included in the *International Guidelines on Urban and Territorial Planning* by UN-Habitat, the United Nations Agency that promotes the development of human settlements sustainable from a social and environmental point of view.

LIST OF PARTNERS

Universidade Federal do Rio de Janeiro (Brasil); SMB - Associazione il Sorriso dei miei Bimbi (Italy); AIP - Associazione Piccole e Medie Imprese (Italy); Rotary Club Lecco Manzoni - Distretto 2040 (Italy); Associazione RESilienceLAB (Italy); Politecnico di Milano (Italy).

UNS3

ITALIAN SUPPORT TO UNIVERSITY EDUCATION IN SOMALIA 2017-2018

Scientific Coordinator @Polimi

Niccolò Aste - Department of Architecture,
Built environment and Construction engineering (DABC)

Duration

2017-2018

Funding

AICS - Italian Agency for Development
Cooperation

Budget

260 thousand Euros

Website

NA

Geographical Context

Somalia



Partners

Partnerships in construction

Impact



Beneficiaries

NA



Preliminary render of the project, courtesy of DABC.

THEME

Preliminary activities for the UNS4 project: survey, feasibility study for the reuse of the surviving buildings of the Quaroni project, elaboration of the energy-environmental concept of a typical building, strategic planning, coordination of field activities and capacity building, and revision of the project of the boundary wall.

INVOLVED DEPARTMENTS @POLIMI

**Department of Architecture, Built environment
and Construction engineering (DABC)**

ABSTRACT

The project aimed to strengthen the quality of university education in Somalia, offering opportunities for high-level training aimed at contributing to the institutional, economic and cultural rebirth of the country. The project also intended to contribute to the strengthening of the role of university education in the processes of recovery of the country's cultural identity and the national strengthening of the use of the Somali language for an effective overcoming of tribal differentiations. Lastly, one of the objective of the project was to fully recover the channel of exchange at university level, traditionally present between Italy and Somalia.

RESULTS

Enhancement of the teaching, cultural, scientific research, but also management and institutional capacities of six faculties: Law, Medicine, Veterinary Medicine, Agriculture, Engineering and Economics as well as of UNS as a public institution.

UNS4

INFRASTRUCTURAL AND STRATEGIC STRENGTHENING OF THE SOMALI NATIONAL UNIVERSITY

Scientific Coordinator @Polimi

Niccolò Aste - Department of Architecture,
Built environment and Construction engineering (DABC)

Duration

2020 - 2022

Funding

AICS - Italian Agency for Development
Cooperation

Budget

1 million Euros

Website

NA

Geographical Context

Somalia



Partners

Partnerships in construction

Impact



Beneficiaries

NA



Digital render of the restructuring project, courtesy of DABC.

THEME

The purpose of the UNS4 Project is to technically support the planning and restructuring phase of the Gahayr Campus in Mogadishu of the National University of Somalia (UNS).

INVOLVED DEPARTMENTS @POLIMI

Department of Architecture, Built environment and Construction engineering (DABC); Department of Architecture and Urban Studies (DASTU); Department of Energy (DENG) and Department of Civil and Environmental Engineering (DICA).

ABSTRACT

The purpose of the UNS4 Project is to technically support the planning and restructuring phase of the Gahayr Campus in Mogadishu of the National University of Somalia (UNS), with the aim of giving back to the country a coherent and adequate endowment of university training facilities with respect to the needs identified in previous UNS Projects funded by AICS.

The strategy of the intervention is therefore to provide specific technical assistance and transfer of know-how, aimed at starting the recovery and re-functionalization of the campus with particular reference to its actual needs of use.

EXPECTED RESULTS

NA

WASTE MANAGEMENT AFRICA

COMPREHENSIVE FEASIBILITY STUDY FOR THE CLOSURE OF THE INFORMAL DUMP SITE AND CONSTRUCTION OF AN INTEGRATED SOLID WASTE MANAGEMENT FACILITY IN NGONG TOWN, KENYA

Scientific Coordinator @Polimi

Mario Grosso - Department of Architecture,
Built environment and Construction engineering (DABC)

Duration
2017 - 2018

Funding
AICS - Italian Agency for Development
Cooperation

Budget
150 thousand Euros

Website
NA

Geographical Context
Kenya

Partners
2 from Africa

Impact



Beneficiaries

Local communities, government authorities, landfill workers, and private companies engaged in the waste management industry.



Scheme of the waste management facility, courtesy of DABC.

THEME

The project aims at implementing the comprehensive feasibility study for the closure of the informal dump site and construction of an integrated sustainable waste management facility in Kajiado County, Kenya.

INVOLVED DEPARTMENTS @POLIMI

Department of Architecture, Built environment and Construction engineering (DABC), Department of Civil and Environmental Engineering (DICA).

ABSTRACT

The impact of waste management and disposal should not be underestimated because it affects material and energy savings, shortage of sanitary landfill capacity, ground and water pollution, sanitary conditions, goods production and consumption etc. Urban waste cannot be "simply" considered as a quantity of matter to be disposed. In developing cities, it has to be faced first of all as a sanitary problem. Material and energy recovering from waste should be promoted as most as possible based on the local peculiarities, features and attitudes and properly integrating available technologies. Furthermore, the life-style and economic system can influence directly and indirectly energy needs and waste generation and management with important impacts on the environment. All these considerations could also support waste prevention policies based on the redesign of the production and consumption patterns towards low waste and low carbon settlements. Waste management is multi-sector in nature and encompasses policy making, strategies thinking, the development of legal-institutional-financial-and administrative frameworks as well as the functional design, implementation, operation and management of waste handling facilities. The absence of adequate solid waste management facilities in Kenya leads to the proliferation of illegal dumpsites that present serious health and environmental hazards. In this context, this project is focused on a comprehensive feasibility study for the closure of the current illegal dumping site in Ngong and the design of a new Integrated Sustainable Waste Management (ISWM) facility in Ngong town including a new landfill site.

RESULTS

- Survey on the existing and proposed dumping site;
- Social assessment;
- Strategies for the closure and the rehabilitation of the dumpsite;
- Design and construction of an Integrated Resource Recovery Centre (IRRC);
- Design Proposal for Integrated Sustainable Waste Management (ISWM) Facility;
- Estimation of cost and timings;
- Communication and public awareness campaign program.

FOLLOW UP

- Waste management system analysis (Economic and Management analysis, Involvement of waste pickers within the new facility, Willingness to pay and affordability studies)
- Awareness within public institutions

LIST OF PARTNERS

Technical University of Kenya (Kenya); LDK Consultants Engineers and Planners (Kenya).

projects led by

DCMC

DEPARTMENT
OF CHEMISTRY,
MATERIALS
AND CHEMICAL
ENGINEERING
“GIULIO NATTA”

BAMBI

ExiST

BAMBI

BALLOON AGAINST MATERNAL BLEEDING

Scientific Coordinator @Polimi

Maria Laura Costantino - Dept. of Chemistry, Materials and Chemical Engineering (DCMC)

Duration

2021 - 2022

Funding

Polisocial Award

Budget

100 thousand Euros

Website

NA

Geographical Context

Africa, South America, Southeast Asia

Partners

4 from Italy

Impact

3

SDG 3: GOOD HEALTH AND WELL-BEING



Beneficiaries

Mothers, the population and the health-care systems of the target countries.



THEME

Postpartum hemorrhage is the leading cause of maternal death. The mortality rate is 100 times higher in poor countries. BAMBI aims to develop a low-cost household device that reduces hospital access and COVID risk for mothers.

INVOLVED DEPARTMENTS @POLIMI

Department of Chemistry, Materials and Chemical Engineering (DCMC), **Department of Design (DESIGN)**, **Department of Mechanical Engineering (DMEC)** and **Technology Transfer Office (TTO)**.

ABSTRACT

Globally there are 7 million Post-Partum Hemorrhage (PPH) every year of which 140,000 lead to death. 99% of these deaths occur in developing countries with devastating social costs in communities that are already made fragile by precarious economic conditions. Moreover, the current SARS-CoV-2 global pandemic has increased the risk of fragility in these already tormented areas. The indirect effects of the COVID19 pandemic on maternal health could be devastating in these areas: the significant reduction of hospital services, combined with stay-at-home orders that have led to migration phenomena from cities to rural areas has further reduced the accessibility to medical interventions. It is also worth underlying that pregnant women who have already delivered babies are those more exposed to the PPH risk. The incidence of PPH has increased substantially also in the developed countries over the past decade.

The imbalance between the accessibility and requests for an economic and functional medical device has given rise to the rate of mortality among the mothers giving birth in these regions. The pandemic has made the hospital a life-threatening place for vulnerable individuals especially patients who need to be treated and kept there for other purposes. Therefore, introducing a low-cost and easy-to-use device through the health care market of low-income countries not only saves the lives of PPH patients, but it can provide the opportunity for them to be treated by clinicians out of the hospital environment, a fundamental aspect given the pandemic condition in which we find ourselves nowadays.

EXPECTED RESULTS

- Prototypes: the team will make sure that 3D models and technical drawings of the device are validated and ready for additive manufacturing technology, to be tested on a lab scale.
- Scientific reports and published articles: the prototypes will undergo several in-vitro tests; all the results of the tests will be published as a scientific paper in order to provide support for the diffusion of the device into the worldwide market.
- Clinical results: on the very first clinical trial, the device is expected to stop the bleeding in the case of PPH in the fastest way possible so that the operation won't need a surgical/hospital environment.
- Accessibility of the device: successful clinical results together with the support of scientific materials will lead the project to its final step, i.e. being accessible in the target regions through its distribution. The technology transfer and the IP protection will be two main marketing activities. Our partners will play a significant role in the production and distribution of the device in the area, making it sure it will be accepted by the local clinicians.

LIST OF PARTNERS

ANT - Amici della neonatologia Trentina (Italy); CUAMM - Medici con l'Africa (Italy); Dr. Alberto Zanini (Italy); Soletierre Ontlus (Italy).

ExiST

EXCELLENCE IN SCIENCE & TECHNOLOGY
(KFW PROJECT NO. 51235)

Scientific Coordinators @Polimi

Tiziano Faravelli and Flavio Manenti - Dept. of Chemistry, Materials and Chemical Engineering (DCMC)

Duration

2018 - 2024

Funding

KfW - Kreditanstalt für Wiederaufbau

Budget

100 thousand Euros

Website

NA

Geographical Context

Ethiopia

Partner

Jimma University Institute of Technology (Ethiopia)

Impact

4 QUALITY EDUCATION



10 WOMEN EMPOWERED



Beneficiaries

3 Ph.D. Students



The Jimma Institute of Technology.

THEME

Partnership between Jimma University (JiT) and Politecnico concerning selected visiting Sandwich Ph.D. candidates from JiT, mutually agreed staff exchanges and postdoctoral researchers.

INVOLVED DEPARTMENTS @POLIMI

Department of Chemistry, Materials and Chemical Engineering (DCMC).

ABSTRACT

The project aims at training the Ph.D. students in biomass gasification and combustion modeling. The titles of their research are the following: "Performance Evaluation, Design optimization Using CFD and Testing of Pyrolysis stove for Co-Production of Biochar", "CFD Modeling and Experimental Study of Fluidized Bed Gasification for Selected Agricultural Biomass Wastes", and "Development and Implementation of an Optimized Agriculture Friendly Portable Solar Assisted Bio Digester for Sustainable Economic Development in Ethiopia"

EXPECTED RESULTS

The expected results are a thorough doctoral education on the above subject and the publication of scientific articles.

projects led by

DICA

DEPARTMENT OF CIVIL
AND ENVIRONMENTAL
ENGINEERING

INTERSOS

INTERSOS

INTEGRATED NATURAL RESOURCE MANAGEMENT OF UNION OF TYRE MUNICIPALITIES

Scientific Coordinator @Polimi

Mario Grosso - Department of Civil and Environmental Engineering (DICA)

Duration

2018 - 2020

Funding

AICS - Italian Agency for Development Cooperation

Budget

1,3 million Euros

Website

<http://www.aware.polimi.it/?p=1103>

Geographical Context

Lebanon

Partners

2 from Europe and Middle-East

Impact



Beneficiaries

NA



Garbage truck at work. Photo taken during an on-site visit, courtesy of DICA.

THEME

The project was implemented in the South Governorate of Lebanon and aimed at supporting the Lebanese and Syrian communities through the creation of water and sanitary infrastructures at family, community and institutional level.

INVOLVED DEPARTMENTS @POLIMI

Department of Civil and Environmental Engineering
(DICA)

ABSTRACT

In 2019, the analysis of the state of the art of waste management in the Union of Municipalities of Tyre continued, including through targeted inspections at treatment and disposal sites. In particular, the main critical points were identified and subsequent project actions were planned, in close coordination with the local partnership. In addition, missions were carried out by Lebanese personnel in Italy to waste disposal platforms in order to acquire good practices to apply in Lebanon.

RESULTS

- An amount of 15,000 inhabitants of Tire improve their hygienic-environmental conditions through a separate collection system;
- an amount of 8 Municipalities of the Union adopt an integrated management system of MSW, improving the hygienic-environmental conditions;
- the Ain Baal Sorting and Recycling Unit improves its management system and guarantees a quality service to 36 Municipalities.

LIST OF PARTNERS

ArcenCiel (Lebanon); Intersos (Italy).

projects led by

DESIGN
DEPARTMENT
OF DESIGN

AID_12079_AICS AGREEMENT

AID_12085_AICS AGREEMENT

Tambali Fii

AID_12079_AICS AGREEMENT

TOURISM-TECHNICAL ASSISTANCE AGREEMENT
TO SUPPORT THE IDENTIFICATION OF HUMAN
RESOURCES NEEDED TO FOSTER
THE DEVELOPMENT OF TOURISM IN JORDAN

Scientific Coordinator @Polimi

Giuseppe Amoruso - Department of Design (DESIGN)

Duration

2020 - 2022

Funding

AICS - Italian Agency for Development
Cooperation

Budget

1 million Euros

Website

NA

Geographical Context

Jordan



Partner

Ministry of Tourism and Antiquities
of the Hashemite Kingdom of Jordan



Impact



Beneficiaries

The unemployed youth and women.
The micro and small enterprises operating
in the tourism sector.
The public institutions responsible for
the cultural heritage.



THEME

Definition of a strategic plan for the development of responsible and sustainable tourism in Jordan and the necessary needs in terms of human resources.

INVOLVED DEPARTMENTS @POLIMI

Department of Design (DESIGN)

ABSTRACT

The project supports the Government of the Hashemite Kingdom of Jordan in achieving its goals of sustainable development and inclusive economic growth, innovating and improving competitiveness in the tourism sector to promote employment. The project develops activities aimed at the sector of cultural heritage and tangible and intangible heritage, local traditions and the Jordanian cultural landscape as a characteristic mosaic for the harmonious development of territories and tourism and the economy linked to cultural investment. The specific objectives are:

- identifying the development potential of sustainable and quality tourism and strategic areas of innovation to increase the competitiveness of the tourism industry in Jordan;
- improving the relevance, quality, effectiveness and attractiveness of the Post-secondary Technical and Vocational Education and Training (TVET) in response to the needs of innovation and technological advancement of the tourism sector in Jordan to integrate and increase the tourism offer to starting from the preservation and enhancement of the cultural heritage of landscapes.

EXPECTED RESULTS

- Percentage increase in the tourism sector revenue growth rate;
- percentage reduction in youth unemployment;
- quality and completeness of analytical reports and data on development potential and strategic areas of innovation to increase the competitiveness of the tourism sector;
- relevance, coherence and sustainability of recommendations provided and proposals made in order to innovate and improve post-secondary TVET in relation to tourism development, cultural heritage and landscapes;
- effectiveness and sustainability of proposed actions to support quality human capital development in tourism, cultural heritage and landscapes;
- identification of new technologically advanced professional profiles that could innovate and improve the competitiveness of the tourism industry and the cultural experience of visitors to Jordan;
- number of curricula developed at the post-secondary level of TVET by levels of competency and technical skills to be acquired;
- certification of new competencies, prepared and adopted by the Jordanian National Qualification Framework.

FOLLOW UP

- The creation of a Tourism Center of Excellence to develop excellence in tourism skills and to serve the needs of the Jordanian tourism market and those of neighboring countries.
- Development of the Management Information System and the Jordan Tourism Observatory.
- Product Development in the Tourism sector.

AID_12085_AICS AGREEMENT

MUSEUMS-PROGRAM AGREEMENT TO DEFINE A STRATEGIC PLAN FOR THE IMPROVEMENT AND ENHANCEMENT OF THE MUSEUM OF FOLKLORE, THE MUSEUM OF POPULAR TRADITIONS AND THE ROMAN THEATER OF AMMAN

Scientific Coordinator @Polimi
Giuseppe Amoroso - Department of Design (DESIGN)

Duration
2020 - 2023

Funding
AICS - Italian Agency for Development Cooperation

Budget
€ 1 million Euros

Website
NA

Geographical Context
Jordan

Partner
Department of Antiquities (Ministry of Tourism and Antiquities of the Hashemite Kingdom of Jordan)

Impact



Beneficiaries

Working staff at the Museums and at the Dept. of Antiquities; professors and students of Jordanian Universities; Jordanian citizens and tourists.



THEME

The project promotes the environmental redevelopment and a new functionalization of two Museums and one Roman theater according to the principle of involving the visitor who participates in a cultural experience.

INVOLVED DEPARTMENTS @POLIMI

Department of Design (DESIGN)

ABSTRACT

An inclusive society must favor processes that guarantee maximum access to knowledge according to the practices of design and, more generally, of cultural enhancement. This global scenario requires new skills that integrate design, creative, technological and managerial skills as assets for competitiveness and sustainable and inclusive growth. The agreement aimed at the sector of cultural heritage and tangible and intangible heritage, local traditions and the Jordanian cultural landscape as a characteristic mosaic for the harmonious development of territories and tourism and the economy linked to cultural investment.

More specifically, the projects applies strategic planning and co-design activities to lead to:

- the environmental improvement and functionalization of the Folklore Museum and the Museum of Popular Traditions;
- the application of technological systems and innovative experiential setups, training and transfer of (soft) skills, and improvements to the surfaces of the exhibition itineraries with the insertion of: coverings and information panels for the walls, anti-reflection floors, specific lighting to improve the chromatic perception of the collections, signs and multimedia stations for information and access to the new contents that will be created.
- the development of a communication plan for the archaeological area of the Roman Forum envisaged through the 3D reconstruction of the architectural model and the creation of a universal accessibility system with advanced multimedia systems such as the installation of a digital museum of the Roman Theater at the Odeon.

EXPECTED RESULTS

- Environmental redevelopment and experiential and interactive exhibit of the Jordanian Folklore Museum and the Jordanian Museum of Folk Traditions;
- Living library of Jordanian identity, culture and traditional crafts to create a collection of oral histories through audiovisual production;
- Three-dimensional reconstruction of the site of the Roman Forum (Roman Theatre, Odeon, etc.) through the architectural survey and installation of a multimedia station to offer visitors an interactive tour and the possibility of touching the tactile models.

TAMBALI FII

CREATION OF A TECHNOLOGICAL AND SOCIAL INNOVATION CLUSTER FOR THE GROWTH IN SENEGAL OF THE BOATING AND SEAFOOD CHAIN

Scientific Coordinator @Polimi

Andrea Ratti - Department of Design (DESIGN)

Duration

2017 - 2019

Funding

Polisocial Award

Budget

125 thousand Euros

Website

NA

Geographical Context

Senegal



Partners

7 from Africa and Europe



Impact



Beneficiaries

Partner Universities with their students and researchers; artisans and apprentices; involved associations and enterprises; fishermen and workers of the ichthyic market; local entrepreneurs.



People resting next to some fishing boats in Dakar, courtesy of *Tambali Fii* project team.

THEME

The project aimed at strengthening the Senegalese fishing sector by proposing the definition, creation, and start up of a Pole of Technological and Social Innovation in the Dakar area for the growth of the fishing equipment and boats production chain.

INVOLVED DEPARTMENTS @POLIMI

Department of Design (DESIGN) and **Department of Management, Economics and Industrial Engineering (DIG)**.

ABSTRACT

Tambali Fii stems from the desire to contribute to the growth of the Senegalese nautical and seafood industry. Although this field is still undervalued, it has encouraging development prospects in a country where the fishing market is an important source of livelihood. The idea also represents a strategy to limit the effects of emigration in terms of loss of workforce, entrepreneurial skills and potential for socio-economic development.

The main task of the project was to launch a widespread pole of technological and social innovation in the Senegalese territory, in collaboration with the IPP University of Dakar, the Gianipa shipyard and local fishing associations. An innovation cluster was conceived as a place where to transfer consolidated training models, as well as a basis for field research, co-design workshops and the promotion of synergies between research and entrepreneurship through business incubation mechanisms.

RESULTS

- Creation of the technological and social innovation hub, a space shared and accessible by the different users involved. After an initial period of observation and research in the field, the hub was equipped and set up according to the needs and demands that have emerged;
- strengthening of local high-level competencies in collaboration with the Senegalese universities that are partners in the project and the SMaRT lab of Politecnico di Milano;
- strengthening of low-level technical competencies to support the Senegalese shipbuilding and fishing industry in collaboration with local companies and associations;
- strengthening of the local social, environmental and economic ecosystem through the activation of a new sustainable fishing industry;
- definition of concrete tools for measuring the social impact of the proposed activities through a system of continuous assessment involving the project partners.

LIST OF PARTNERS

ESP Ecole Supérieur Polytechnique de Dakar (Senegal); IPP Institut Polytechnique Panafricain de Dakar (Senegal); Sunugal (Italy); Gianipa Sarl (Senegal); Senevoile (Senegal); Nautica Italiana (Italy); BCA Demco (Italy).

projects led by

DEIB
DEPARTMENT
OF ELECTRONICS,
INFORMATION
AND BIOENGINEERING

DAFNE
ICT4DEV
ISSES
MASTR-SLS
SAFER

DAFNE

DECISION-ANALYTIC FRAMEWORK

Scientific Coordinator @Polimi

Andrea Castelletti - Department of Electronics, Information and Bioengineering (DEIB)

Duration

2016 - 2020

Funding

European Commission

Budget

510 thousand Euros

Website

dafne-project.eu/results/publications/

Geographical Context

Kenya
Ethiopia
Zambia
Zimbabwe
Mozambique



Partners

14 from Africa and Europe



Impact



Beneficiaries

NA



A trait of the Omo and Zambesi river system, courtesy of DAFNE project team.

THEME

Use of a Decision-Analytic Framework to explore the water-energy-food NEXus in complex and trans-boundary water resources systems of fast growing developing countries.

INVOLVED DEPARTMENTS @POLIMI

Department of Electronics, Information and Bio-engineering (DEIB)

ABSTRACT

DAFNE is an interdisciplinary project which advocates an integrated and adaptive water resources planning and management approach that explicitly addresses the water-energy-food (WEF) nexus from a novel participatory and multidisciplinary perspective. The project aims at quantitatively assessing the social, economic, and environmental impacts of expanding energy and food production in complex physical and political contexts, where natural and social processes are strongly interconnected and the institutional setting involves multiple stakeholders and decision-makers. The focus is on fast growing African countries and the Omo and the Zambezi rivers systems. Here socio-economic and climate change is expected to highly impact water resources systems and the society.

RESULTS

- A decision analytic framework to assist policy making in large transboundary river basins.
- Participatory processes implemented in two study areas (the Omo-Turkana and Zambezi river basins).
- A virtual Negotiation Simulation Lab deployed in the case study areas.

LIST OF PARTNERS

ETH Zürich (Switzerland); Politecnico di Milano (Italy); ICRE8 Research Centre; Ku Leuven (Belgium); University of Aberdeen (Scotland); International Water Management Institute; ACCESS - African Collaborative for Earth System Science; UNZA - University of Zambia (Zambia); IWRM - Integrated Water Resources Management; Centre Eduardo Mondlane University - Faculty of Engineering, Department of Civil Engineering (Mozambique); Addis Abeba University; Water and Land Resource Centre (Eritrea); Vista Remote Sensing in Geosciences GMBH (Germany); ATEC-3D Limited (England); European Institute For Participatory Media E.V.

ICT4DEV

Scientific Coordinator @Polimi

Luciano Baresi - Department of Electronics, Information and Bioengineering (DEIB)

Duration

2021 - 2023

Funding

AICS - Italian Agency for Development Cooperation

Budget

950 thousand Euros

Website

NA

Geographical Context

Mozambique



Partners

Partnerships in construction

Impact



Beneficiaries

Computer Science students and faculty members at University Eduardo Mondlane, Maputo (Mozambique).



THEME

Training of students, professors, and researchers in the ICT sector, research, and implementation of innovative projects.

INVOLVED DEPARTMENTS @POLIMI

Department of Electronics, Information and Bioengineering (DEIB)

ABSTRACT

ICT4DEV, a Politecnico di Milano project coordinated by Prof. Luciano Baresi (Dipartimento di Elettronica, Informazione e Bioingegneria) and funded by the Italian Agency for Development Cooperation (AICS), kicked off on June 1st, 2021.

ICT4DEV addresses some of the issues related to the development of ICT in Mozambique, responding to training and skill building needs in a rapidly evolving sector and supporting the development of ICT applications in the sectors with the greatest impact for the social and economic development of the country. Sustainable development will be pursued through the training of ICT specialists and support for the creation of a cultural environment that enhances the use of ICT.

EXPECTED RESULTS

ICT4DEV aims at:

- improving the knowledge, skills, and abilities of university students, researchers, and professors of Information and Communication Technologies (ICT) of the Eduardo Mondlane University (UEM) in Maputo, through theoretical and practical training initiatives, scientific and technical innovation, and social entrepreneurship. It also aims at contributing to the reduction of the gender gap in Mozambique;
- strengthening the development of IT applications to support and promote the development of projects in the fields like e-Government, e-Health, e-Commerce, e-Agriculture, and e-Learning;
- supporting the birth and development of new entrepreneurship in the ICT sector to meet the needs of the country, with attention to overcome the existing gender gap in accessing, using, and knowing the ICT;
- developing a network for sharing scientific and technological knowledge with Italian, African and other ICT research centers to create useful synergies.

ISSES

INFORMATION SECURITY SERVICES EDUCATION IN SERBIA

Scientific Coordinator @Polimi

Stefano Zanero - Department of Electronics, Information and Bioengineering (DEIB)

Duration

2017 - 2021

Funding

Erasmus + KA2 - Capacity Building

Budget

800 thousand Euros

Website

NA

Geographical Context

Serbia

Partners

10 from Europe

Impact



Beneficiaries

Serbia's Higher Education institutions



THEME

The goal of the ISSES project is to improve the higher education capacities in the field of Information Security in the Republic of Serbia.

INVOLVED DEPARTMENTS @POLIMI

Department of Electronics, Information and Bio-engineering (DEIB)

ABSTRACT

The goal of the ISSES project is to improve the higher education capacities in the field of Information Security in the Republic of Serbia. Entirely new courses will be developed, which will raise the competitiveness of students graduating at the participating HEIs in Serbia. Compared to the current situation in which there are no laboratories supporting education in this field, the project team will develop state-of-the-art laboratories which will allow the students to gain hands-on experience directly transferable to the information security industry. The information security teachers and researchers working at the four Serbian HEIs involved in this project and at other technical HEIs in Serbia do not cooperate. They often invest redundant efforts to prepare teaching materials for the same courses taught at different institutions. This project will strive to standardize information security education in Serbia, by jointly developing and sharing teaching materials between the partners. This will allow them to avoid effort duplication and to focus on their key expertise, e.g. UB on digital forensics, UNS on critical infrastructure security. A subset of the courses built during the project will be novel on a regional and European level, as well, e.g. Security and privacy in the Internet of Things, Cloud Security, Secure Software Development. The hybrid Critical Infrastructure Security + Network Security + Cloud Security laboratory planned to be built at P1 will be more advanced than its role model industrial testbed at P3 because of the inclusion of the cloud computing element. Together with the other two hybrid laboratories built at P5 and P9, it will allow teachers and researchers to carry out cutting-edge teaching and research activities. The Digital Forensics Laboratories (DF Lab) will be also equipped with the latest hardware and software, allowing Serbian HEIs to transfer up-to-date knowledge to students and conduct research activities.

EXPECTED RESULTS

- Course Development Plan: <https://isses.etf.bg.ac.rs/results/courses/>
- Education Programs: <https://isses.etf.bg.ac.rs/education-programs/>
- Labs: <https://isses.etf.bg.ac.rs/labs/>

LIST OF PARTNERS

UNS - University of Novi Sad (Serbia); UZG - University of Zagreb (Croatia); BME - Budapest University of Technology and Economics (Hungary); Polimi - Politecnico di Milano (Italy); UB - University of Belgrade: School of Electrical Engineering (ETF) and Faculty of Organizational Sciences (FON) (Serbia); UNI - University of Nis (Serbia); SEDMS - Schneider Electric DMS NS Ltd (Serbia); UT - Unicom-Telecom Ltd (USA); VTS - Subotica Tech - College of Applied Sciences (Serbia); ICUN - Innovation Center of the University of Nis (Serbia).

MASTR-SLS

MAPPING SCHISTOSOMIASIS TRANSMISSION RISK

Scientific Coordinator @Polimi

Renato Casagrandi - Department of Electronics, Information and Bioengineering (DEIB)

Duration

2017 - 2018

Funding

Polisocial Award

Budget

70 thousand Euros

Website

mastr-sls.polimi.it

Geographical Context

Senegal

Partners

5 from Africa and Europe

Impact



Beneficiaries

Citizens and schools of the Saint-Louis area; policy makers across Senegal.



Sample collection for the MASTR-SLS project, courtesy of DEIB.

THEME

The project aimed at mitigating the spread of schistosomiasis, a disease largely diffused in South-Saharan Africa. The pilot project led to the creation of reliable risk maps: based on data and models, these maps warn people of the maximum exposure zones and provide decision-makers with operational tools.

INVOLVED DEPARTMENTS @POLIMI

Department of Electronics, Information and Bio-engineering (DEIB)

ABSTRACT

Schistosomiasis is the third most common disease in Senegal. It is a parasitic disease with serious chronic effects, liable to infect rural communities and children, and which strongly contributes to reproducing the poverty-illness-poverty vicious circle. Therefore, reducing its transmission is an objective of great social significance. As a necessary support for intervention policies, the MASTR-SLS team produced a quantitative mapping of infection risk in the Saint-Louis region, one of the worst affected by the parasite. This action is combined with information and awareness-raising strategies targeted at local people, who are actively involved in the mapping process, by means of citizen science initiatives. The proposal has met the keen interest of public institutions and charitable entities, as evidenced by the YouthMappers Research Fellowship awarded by MASTR-SLS researchers and by substantial funding received from the Bill and Melinda Gates Foundation.

RESULTS

Among the results of the project, a mapping of infection risk was produced, relying on innovative modeling tools that integrate epidemiological, ecological, hydrological and socioeconomic data with human mobility patterns, deduced from the analysis of telephone big data provided by the national telephone operator Sonatel, via the Opal project (opalproject.org), and by the Senegalese Ministry of Health. The cross-continental YouthMapping initiative organized within the MASTR-SLS project was instrumental to provide a significant increase of freely available maps in OpenStreetMap for both the Saint-Louis Region (+33%) and for the whole Senegal (+8%). The Ministry of Health also received the tools produced thanks to the research.

LIST OF PARTNERS

Groupe Sonatel-Orange (Senegal); African Institute for Mathematical Sciences AIMS (Senegal); EPLS - Centre de Recherche Biomédicale "Espoir Pour La Santé" (Senegal, France); Ministère de la Santé et de l'Action Sociale du Sénégal (Senegal); YouthMappers.

SAFER

NEW TECHNOLOGIES FOR SAFE AND EFFECTIVE RESPIRATORY SUPPORT DURING EMERGENCIES AND IN LOW RESOURCE SETTINGS

Scientific Coordinator @Polimi

Raffaele Dellacà - Department of Electronics, Information and Bioengineering (DEIB)

Duration

2021 - 2022

Funding

Polisocial Award

Budget

99 thousand Euros

Website

NA

Geographical Context

Ethiopia



Partners

6 from Italy



Impact



Beneficiaries

Patients suffering from respiratory failure, health workers, hospitals, healthcare centers and healthcare systems.



THEME

The project aims to develop technologies for the treatment of hypoxemia in emergency situations, particularly in resource-poor settings, involving a scientific society, a social enterprise, and physicians and NGOs already engaged during the Covid-19 pandemic or in low-income settings.

INVOLVED DEPARTMENTS @POLIMI

Department of Electronics, Information and Bioengineering (DEIB), Department of Chemistry, Materials and Chemical Engineering (DCMC), and Department of Mechanical Engineering (DMEC).

ABSTRACT

The Corona Virus disease 2019 (Covid-19) has brought the global shortage of ventilators, and ventilator-related resources to the public attention (Truog, Mitchell and Daley, 2020). The experience of China and Italy prompted the media and public authorities to evaluate countries preparedness for the pandemic in terms of ventilator availability. Experts have worried about countries with weak health care systems and a narrow margin for increasing the availability of critical care resources. In many African countries, the lack of oxygen sources and ventilators cause thousands of deaths not necessarily related to a pandemic, for diseases like child pneumonia, neonatal respiratory distress, postpartum hemorrhage, and traumatic injuries ('WHO-ICRC Basic Emergency Care: approach to the acutely ill and injured', 2018). These deaths are preventable with more widespread and equitable availability of respiratory support resources.

The project aim at developing the technologies for treating hypoxemia during emergencies or in low-resource settings, involving practitioners and NGOs that are currently engaged in the Covid-19 pandemic or are active in low-income countries, medical scientific societies, or collaborating with industrial partners.

EXPECTED RESULTS

The results of the project will be:

- a viable prototype capable of all functions;
- risk analysis, technical documentation, operation manual and laboratory test results, that will represent the core of the technical file to accelerate the regulatory process;
- educational materials and scientific papers to promote the project results;
- through our partnership with MTTs-Asia and our connection with key players in the ventilators market, we will develop an exploitation strategy to implement the results of the project into commercial products across different fields of application.

LIST OF PARTNERS

MTTS Asia; Day One Health (Italy); Essential neonatal care – Italian Society of Neonatology (Italy); CUAMM – Medici con l'Africa (Italy); Pneumology Department, ASST Papa Giovanni XXIII Bergamo (Italy); Emergency NGO.

projects led by

DENG DEPARTMENT OF ENERGY

AILs: EMERGING AFRICAN INNOVATION LEADERS

CEFA / Tanzania (Monitoring)

Global District Energy in Cities Initiative

ILUMINA (Monitoring)

PRE-LEAP-RE

LEAP-RE

SET4FOOD2

VIDES / Albania

VIDES / Lebanon

AILs: EMERGING AFRICAN INNOVATION LEADERS

G7 EXCHANGE & EMPOWERMENT PROGRAM FOR ENABLING INNOVATION WITHIN THE NEXT PRODUCTION REVOLUTION

Scientific Coordinator @Polimi
Emanuela Colombo - Department of Energy (DENG)

Duration
2018 - 2019

Funding
AICS - Italian Agency for Development Cooperation

Budget
1.1 million Euros

Website
<http://community.africanlead.net>

Geographical Context

Ethiopia
Kenya
Mozambique
Niger
Nigeria
Tunisia



Partner
Politecnico di Torino (Italy)



Impact



Beneficiaries

21 First-generation African Innovation Leaders and their organizations.
210 Second-generation African Innovation Leaders trained by the participants to the program.



AILs program reunion at the MIP of Politecnico di Milano, courtesy of DENG.

THEME

Developing stable relationships between Italian companies in the Green and Digital sectors and Innovation Leaders in six African countries, in order to promote innovation and entrepreneurship in those countries.

INVOLVED DEPARTMENTS @POLIMI

Department of Energy (DENG), Department of Management, Economics and Industrial Engineering (DIG).

ABSTRACT

The AILs program is centered on boosting African prosperity by embracing the Next Production Revolution (NPR) and sharing comprehensive understanding of Innovation dynamics with the aim of educating the next generation leaders towards new thinking over sustainable solutions.

The general objective of the project is to promote the embracement of the NPR in Africa while enforcing the EU-AU cooperation on the matter and achieving the mutual benefits and socio-economic innovation that may come when combining this approach with Sustainable Development Goals to promote an equitable and long-lasting prosperity on the continent.

The project represents a legacy of the Italian G7 presidency after the Outreach Session in Taormina with the African Countries. It is a pilot experience and benchmarking case study since it is based on the selection of representative countries to test the approach in different regional frames.

RESULTS

The project can count on two main results:

- a qualified community of Africa Innovation Leaders is created as the seed for the next generation of African Innovation Leaders and is equipped with the right and verified capacity and competences for boosting Africa leap-frogging, so to favor the NPR and the diffusion of its benefits;
- a platform for innovation, the Africa Innovation Community (www.africain-lead.it) is working as a digital tool to enable the participants to replicate and expand their pilot experience toward a larger number of local innovation networks.

CEFA/Tanzania (MONITORING)

THE MATEMBWE-IKONDO MINIGRID: LEARNING FROM THE PAST, PREPARING FOR THE FUTURE

Scientific Coordinator @Polimi
Emanuela Colombo - Department of Energy (DENG)

Duration
2019 - 2020

Funding
Mott Foundation

Budget
57 thousand Euros

Website
NA

Geographical Context
Tanzania

Partners
3 from Europe
and the US

Impact



Beneficiaries
Developers, NGOs, and public institutions.



Field survey in the Matembwe-Ikondo area, courtesy of DENG.

THEME

This project, developed in partnership with the Italian NGO CEFA Onlus was meant to quantitatively and qualitatively analyze the success story of the Matembwe-Ikondo mini-grid (Njombe region, Tanzania).

INVOLVED DEPARTMENTS @POLIMI

Department of Energy (DENG)

ABSTRACT

The project analyzed quantitatively and qualitatively the success story of the Matembwe-Ikondo mini-grid (Njombe region, Tanzania). The identification of the key-variables and driving forces that have determined the success of CEFA's energy program in Tanzania was pursued through: (I) historical data collection on the field about n° of connection to the mini-grid and electricity consumption (II) analysis of the socioeconomic context by means of interviews and focus group discussion aimed at identifying the main dynamics that underline the energy-development nexus in the rural local context with specific attention to the role of complementary action (III) application of an ad hoc calibrated System Dynamics model able to reproduce the behavior of socioeconomic variables along the development pattern driven by the electrification program (IV) Policy testing and sensitivity analysis able to identify the most effective and impacting complementary activities put in place by CEFA and other partners together with the provision of electricity. The project is developed in partnership with CEFA Onlus.

RESULTS

- Field surveys to collect data and information about the socio-economic development and the project/events occurred in Matembwe.
- Conceptualization of the main components of the nexus between electricity use and socio-economic development experienced in Matembwe.
- Formulation of a first mathematical simulation model that reproduce the main dynamics that underline the electricity-development nexus.
- Validation and testing of the abovementioned simulation model.
- Identification of viable strategies for the implementation of small-scale electricity provision projects in rural areas electricity provision projects in rural areas.

LIST OF PARTNERS

Chalmers University (Sweden), Mott Foundation (US), CEFA (Italy)

GLOBAL DISTRICT ENERGY IN CITIES INITIATIVE

PROMOTING THE IMPLEMENTATION OF "DISTRICT ENERGY" SYSTEMS IN DIFFERENT COUNTRIES: A FEASIBILITY STUDY OF A COOLING PLANT IN THE DISTRICT OF HIVERNAGE, MARRAKECH

Scientific Coordinator @Polimi
Mario Motta - Department of Energy (DENG)

Duration
2017 - 2019

Funding
MATTM - Italian Ministry for the Environment, Land and Sea

Budget
165 thousand Euros

Website
www.districtenergyinitiative.org/morocco

Geographical Context
Morocco

Partners
4 from Africa and Europe

Impact



Beneficiaries
NA



THEME

The initiative aims to promote the implementation of district energy systems in different countries and the intervention of Polimi, specifically, concerned the feasibility study of a district cooling plant in the district of Hivernage in Marrakech, Morocco.

INVOLVED DEPARTMENTS @POLIMI

Department of Energy (DENG)

ABSTRACT

The project is part of the Global District Energy in Cities Initiative promoted by the United Nations Environment Agency, UN Environment Programme, and funded by the Italian Ministry for the Environment, Land and Sea (MAT-ITM). The study was carried out in two phases.

Phase 1: Light Touch.

Context analysis, data collection, preliminary feasibility estimate of the plant.

- Activity 1. Data collection and preparation of a simulation model for district cooling projects.
- Activity 2. Light touch assessment. The following were analyzed:
 - The socio-economic framework of Morocco
 - The preliminary feasibility estimate of the plant
 - The preliminary economic and environmental performance of the plant.
- Activity 3. Participation in the multi-stakeholder workshop to present the project and its results to local stakeholders, such as the Municipality, Public Authorities, Companies.

Phase 2: Deep Dive. In-depth analysis of regulatory and legislative aspects, technical and economic analysis.

- Activity 4. An in-depth analysis was carried out of:
 - Morocco's regulatory and legislative framework
 - Economic estimate and return on investment of the plant through contacts with local and Italian companies
 - Sensitivity analysis
- Activity 5- Participation in the final multi-stakeholder workshop, where the results of the study were presented and training addressed to local actors on district cooling in collaboration with AMEE and UN Environment Programme.

RESULTS

- Feasibility study for a renewable district cooling system for Marrakech;
- Analysis of enabling regulatory framework for renewable district energy systems;
- Capacity building activities for local stakeholder.

LIST OF PARTNERS

AMEE - Agence marocaine pour l'efficacité énergétique (Morocco); CLEAN TECH (Morocco); UNEP - UN Environment Programme; Copenhagen Centre of Energy Efficiency (Denmark).

ILUMINA (MONITORING)

MONITORING OF THE ILUMINA INITIATIVE: ACCESS TO ENERGY FOR LOCAL DEVELOPMENT AND WOMEN'S EMPOWERMENT

Scientific Coordinator @Polimi
Emanuela Colombo - Department of Energy (DENG)

Duration
2019 - 2022

Funding
AICS - Italian Agency for Development
Cooperation

Budget
60 thousand Euros

Website
NA

Geographical Context
Mozambique

Partners
2 from Europe

Impact



Beneficiaries
Local communities in the regions of
Zambesia and Cabo Delgado



Electrification in rural and informal settlements in Mozambique, courtesy of DENG.

THEME

ILUMINA is a rural electrification program, funded by the Italian Cooperation Agency in Mozambique. The monitoring phase started in November 2019 with the collection of the preliminary data and their processing. The impact evaluation will be performed at the end of a three years timespan.

INVOLVED DEPARTMENTS @POLIMI

Department of Energy (DENG)

ABSTRACT

ILUMINA is a rural electrification program, funded by AICS Mozambique. It encompasses two parallel projects in charge of two Italian NGOs which operates in Zambezia and Cabo Delgado provinces in the north of the country. The general objective of the program is to improve life standards and resilience of vulnerable population in rural contexts of these two regions by means of access to energy, namely the installation of two mini grids and distribution of solar home systems and improved cooked stoves. The Project undertaken by the research group, in the framework of the Program, aims at monitoring and evaluating the activities of the involved NGOs. The activities have focused on structuring a common logical framework for the two projects along with the definition of appropriate indicators and sources of verifications. The preliminary data have been collected by the implementing NGOs in November 2019 and they have been processed in order to capture a broad overview of the current situation. The final impact evaluation will be performed in a timespan of three years.

EXPECTED RESULTS

- Developing tools and analysis framework for the Monitoring and Evaluation of the impact of projects related to ILUMINA program.
- Providing the implementing partners and AICS with the information needed to use the abovementioned tools and frameworks.
- Ensuring high quality of the Monitoring and Evaluation process and related data gathering.

LIST OF PARTNERS

AVSI (Italy), COSV (Italy)

PRE-LEAP-RE

PREPARING FOR A LONG-TERM JOINT EU-AU RESEARCH AND INNOVATION PARTNERSHIP ON RENEWABLE ENERGY

Scientific Coordinator @Polimi
Emanuela Colombo - Department of Energy (DENG)

Duration
2018 - 2019

Funding
H2020-LC-SC3-2018-Joint-Actions-1

Budget
995 thousand Euros

Website
<http://pre.leap-re.eu>

Geographical Context
Africa

Partners
17 from Africa and Europe

Impact



Beneficiaries
Policymakers, countries of the African Union.



PRE-LEAP-RE partners and stakeholders at the 2nd Strategic Workshop in Stellenbosch, courtesy of DENG.

THEME

The PRE-LEAP-RE consortium gathers 17 African and European partners covering a wide range of sectors: education/research, private sector, policy and funding, in preparation for the wider LEAP-RE project.

INVOLVED DEPARTMENTS @POLIMI

Department of Energy (DENG)

ABSTRACT

PRE-LEAP-RE focused on the definition of a strategic program for renewable energy research and innovation in Africa. It brought together a team of European and African experts: 17 partners from 14 countries, working in academia, research organizations and public institutions involved in the energy sector. The key idea behind the project is that renewable energy alternatives can play a critical role in expanding access to energy as well as economic growth, global development and environmental preservation in the African continent and one of the most effective ways to support the transformative path toward a more sustainable, affordable, and accessible energy in both Africa and Europe is the promotion of joint research and innovation efforts in the frame of the AU-EU High-Level Policy Dialogue process.

The research pathways focused not only on the technology perspective, but also on innovative business models, capacity building, financial schemes and regulatory frameworks, bringing together citizens, researchers, funders and private sector. In 2021 the Horizon 2020 project LEAP-RE was funded by the Directorate-General for Research and Innovation of the European Commission, based on the knowledge base developed in the framework of PRE-LEAP-RE.

RESULTS

- Conduct a review and analysis of relevant past and current collaborative initiatives between Africa and Europe in the field of Renewable Energies;
- Formulate what has to be achieved during the EJP-RE Program;
- Foster a stakeholder community and encourage the engagement of actors in the project;
- Ensure effective communication among all partners.

FOLLOW UP

PRE-LEAP-RE was the preparatory step toward the wider LEAP-RE project. It enabled the formulation of a Research & Innovation and Human and Institutional Capacity Building agenda on Renewable Energy.

It has established the organizational and funding principles for the implementation of an African and European (AU-EU) Joint Program by bringing together national funding agencies and other key EU-AU actors involved in research on renewable energy.

LEAP-RE will be implementing the formulated AU-EU Joint Program.

LIST OF PARTNERS

University of Jyväskylä (Finland); Stratmore University (Kenya); Netherlands Organization for Scientific Research (Netherlands); National Research Foundation (South Africa); Ministry of High Education and Scientific Research (Algeria); LGI Sustainable Innovation (France); KINNO (Greece); InnoEnergy (Netherlands); European Energy Research Alliance; Department of Science and Technology-Republic of South Africa; DLR-PT (Germany); CEA (France); Association of Commonwealth Universities (UK); ANER (Senegal); Africa Energy Services Gropu (Rwanda); Swedish Energy Agency (Sweden); WIP Renewables Energies (Germany); EcoKraft GmbH (Germany); Centre de Development des Energies Renouvelables (Algeria); National Industrial Research and Development Agency (Rwanda); National Commission for Science and Technology (Malawi); Energyzon (France and Cameroun); RES4MED (Italy); Service Public SPW - Region Wallonie (Belgium).

LEAP-RE

EUROPE-AFRICA PARTNERSHIP FOR RENEWABLE ENERGY

Scientific Coordinator @Polimi
Emanuela Colombo - Department of Energy (DENG)

Duration
2020 - 2025

Funding
H2020-LC-SC3-2018-Joint-Actions-2

Budget
30 million Euros

Website
NA

Geographical Context
Africa

Partners
83 from Africa
and Europe

Impact



Beneficiaries
Countries of the African Union



THEME

LEAP-RE is a Long-Term Joint Research and Innovation Partnership on Renewable Energy between the European Union and the African Union.

INVOLVED DEPARTMENTS @POLIMI

Department of Energy (DENG)

ABSTRACT

The LEAP-RE program aligns with and responds to the AU-EU high-level policies and specific objectives of the CCSE Roadmap. It seeks to create a long-term partnership of African and European stakeholders in a quadruple helix approach: government (program owners and funding agencies), research and academia, private sector, and civil society. Impact will be sought by creating a framework, methodology, and cooperation model. The aim is to reduce fragmentation by aligning existing bilateral and multilateral frameworks. LEAP-RE establishes and jointly implements research, innovation, and capacity-building activities that respond to the Multi-Annual Roadmaps (MARS) developed in PRE-LEAP-RE.

The program opted for a large-scale, inclusive consortium of 83 partners from 34 countries and 2 international organizations, to ensure a broad thematic, geographical and stakeholder coverage, and to demonstrate the feasibility of the collaboration and build trust in view of a long-term partnership addressing the post-2025 period. LEAP-RE draws on the experience and partnership developed in PRE-LEAP-RE, which conceptualized and developed a framework for long-term, bi-regional cooperation in research, innovation, and capacity building in renewable energies.

This partnership is further strengthened by previous collaboration between partners in other projects supporting the EU-Africa HLPD on STI, such as LEAP-Agri, ERAfrica, LEAP4FNSSA, RINEA, and CAAST-Net Plus. Furthermore, the proposal includes a number of R&I partners, 8 individual projects (formalized as Work Packages), which were chosen among expressions of interest received in late 2019.

EXPECTED RESULTS

- Planning and modeling future sustainable energy systems;
- Including society as an important stakeholder in scientific research;
- Market, pricing and business models for future sustainable energy systems;
- Strengthening basic research and technology development. The approach encourages the development of scenarios that are appropriate to local contexts and can be further utilized to support policy makers. Moreover, this approach requires the development of capacity-building activities to increase local empowerment and ownership: in line with the SC3-JA-5-2020 call expectations.

LIST OF PARTNERS

Strathmore University (Kenya), University of Nairobi (Kenya), University of Yaoundé (Cameroon), DeKUT Dedan Kimathi University of Technology (Kenya), UEM Eduardo Mondlane University (Mozambique), UDSM University of Dar es Salaam (Tanzania), University of Zambia (Zambia), University of Rwanda (Rwanda), Pan African University (Algeria), Institut International d'Ingénierie de l'Eau et de l'Environnement (Burkina Faso), Addis Ababa Science and Technology University (Ethiopia), Moi University (Kenya), Makerere University (Uganda), Botswana International University of Science and Technology (Botswana), Ecole Supérieure Polytechnique de Dakar (Senegal), Ecole polytechnique d'Abomey Calavi (Benin), Université de Lomé (Togo), Academy of Scientific Research and Technology (Egypt), Netherlands Organization for Scientific Research (NWO), National Research Foundation (NRF) (South Africa), Ministry of High Education and Scientific Research (MHESR) (Algeria), LGI Sustainable Innovation (France), KiNNO (Greece), InnoEnergy (The Netherlands), European Energy Research Alliance (EERA), Department of Science and Technology (Republic of South Africa), DLR-PT (Germany), CEA (France), Association of Commonwealth Universities (UK), ANER (Senegal), Africa Energy Services Group (AESG) (Rwanda), Swedish Energy Agency (Sweden), WIP Renewables Energies (Germany), EcoKraft GmbH (Germany), Centre de Développement des Energies Renouvelables (Algeria), National Industrial Research and Development Agency (NIRDA) (Rwanda), National Commission for Science and Technology (Malawi), Energyzon (France and Cameroun), RES4MED (Italy), Service Public SPW - Région Wallonie (Belgium).

SET4FOOD2

SUSTAINABLE ENERGY TECHNOLOGIES FOR FOOD SECURITY IN HUMANITARIAN CONTEXTS

Scientific Coordinator @Polimi
Emanuela Colombo - Department of Energy (DENG)

Duration
2016-2018

Funding
European Commission - DG ECHO

Budget
1 million Euros

Website
NA

Geographical Context
Global

Partners
1 from Europe
3 intergovernmental organizations

Impact



Beneficiaries
Displaced people and refugees.



THEME

Supporting the link between food and energy availability, efficiency and sustainability in humanitarian contexts.

INVOLVED DEPARTMENTS @POLIMI

Department of Energy (DENG), **Department of Architecture, Built environment and Construction engineering (DABC)** and **Task force - Learning teaching innovation (METID)**.

ABSTRACT

Access to energy plays a key role in ensuring access to basic services, such as food and water, health structures and health assistance, education, environment. Moreover, socio-economic progresses and improvement in the quality of life mainly rely on the access to more modern energy sources, thus putting in evidence the strong correlation between energy and human development. Humanitarian response should therefore take in consideration the paramount role of energy in improving the living conditions and social development of vulnerable groups such as refugees, Internally Displaced Persons (IDPs) and their hosting communities.

The SET4food project was therefore designed to respond to these specific challenges, through several actions focused on knowledge and tools creation and sharing, and training of the main actors involved in the Humanitarian context.

RESULTS

The project reached the following results:

- In-presence intensive training addressing the most active humanitarian organizations
- Promotion of public events for raising the awareness on the topic
- Production of technical tools to support an efficient and effective implementation of energy-related activities:
- Collection of case studies focusing on access to energy in humanitarian or critical development contexts

FOLLOW UP

The ENERGYCoP online platform (www.energycop.safefuelandenergy.org) constitutes the legacy of set4food initiative. It was created with the aim of sharing knowledge and experiences and getting together stakeholders with various expertise related to access to energy.

LIST OF PARTNERS

COOPI - Cooperazione internazionale (Italy), SAFE - Safe Access to Fuel and Energy, FAO - Food and Agriculture Organization of the United Nation, WPF - World Food Programme

VIDES/Albania

PROMOTING SUSTAINABLE SOCIO-ECONOMIC DEVELOPMENT IN THE GREEN ECONOMY IN ALBANIA

Scientific Coordinator @Polimi

Riccardo Mereu - Department of Energy (DENG)

Duration

2017 - 2019

Funding

AICS - Italian Agency for Development Cooperation

Budget

1,5 million Euros

Website

www.videsitalia.it/progetti-di-sviluppo/287-albania-4

Geographical Context

Albania

Partners

7 from Europe

Impact



Beneficiaries

Population of Lezhë and its regional Hospital.



Lezhë regional hospital, for which energy needs assessment and PV panels installation have been performed, courtesy of DENG.

THEME

The VIDES-led project promoted sustainable socio-economic development in the green economy in the Prefecture of Lezhë, Albania. Polimi supervised the scientific content of the training courses and analyzed the energy needs of the Lezhë hospital in order to install a new PV solar power plant.

INVOLVED DEPARTMENTS @POLIMI

Department of Energy (DENG)

ABSTRACT

The project led by VIDES (Volontariato Internazionale Donna Educazione Sviluppo) was dedicated to the promotion of sustainable socio-economic development in the green economy in Albania. The action was carried out in the Prefecture of Lezhë and concerned the green economy sector by aiming to improve the educational offer to promote local development. Politecnico di Milano supervised the scientific content of the training courses offered by VIDES and analyzed the energy needs of the Hospital of Lezhë to drive the installation of a new PV solar power plant.

General objective: contribute to the endogenous, inclusive and sustainable development of Northern Albania through the promotion of youth entrepreneurship in the green economy.

Specific objectives: improve the training offer and raise the level of technical skills in innovative sectors to increase youth employment in the green economy; promote the creation of shared value in the logic of local socio-economic development and environmental protection from the use of renewable energy.

RESULTS

The project led to an improvement of the training offer and a higher-level of technical expertise in local schools, promoting the local socio-economic development and environment protection by the use of renewable energies in the logic of creating shared value:

- improved and updated the educational offer in 2 vocational schools in the Prefecture of Lezhë;
- increased level of technical skills and youth employment in the green economy sectors;
- promoted youth and social entrepreneurship in the green economy sector and increased the transfer of know-how and best practices, also enhancing the role of Albanian migrants returned to the socio-economic development of their country;
- encouraged the penetration of renewable energies, improved energy consumption and the quality of the health service of the Regional Hospital of Lezhë;
- created a favorable environment for the diffusion of renewable energy and increased awareness and sensitivity to environmental issues;
- promoted coordination between public and private actors and the acquisition of tools for investigation and planning in the field of renewable energy in accordance with local opportunities and regulations.

LIST OF PARTNERS

VIDES - Volontariato Internazionale Donna Educazione Sviluppo (Italy); AICS - Agenzia Italiana per la Cooperazione allo Sviluppo (Italy); CEI - Conferenza Episcopale Italiana (Italy); Eterit Rogacionistet Shiptare (Albania); COMI - Cooperazione per il Mondo in via di Sviluppo (Italy); ISF-MI Ingegneria Senza Frontiere (Italy); EWS Earth Wind and Sun S.r.l. (Italy).

VIDES/Lebanon

ENSURING CLEAN, SUSTAINABLE, MODERN AND AFFORDABLE ENERGY FOR THE URBAN AREA OF KAHALE, LEBANON

Scientific Coordinator @Polimi

Riccardo Mereu - Department of Energy (DENG)

Duration

2018 - 2020

Funding

AICS - Italian Agency for Development Cooperation

Budget

1,5 million Euros

Website

videsitalia.it/en/projects/world/51-development-projects/205-lebanon.html

Geographical Context

Lebanon

Partners

4 from Europe and Middle-East

Impact



Beneficiaries

Population of Kahale (7,000 people) and its surroundings (500,000 people); population of Araya (5,000 people); local commercial activities and institutions.



Personnel training in the installation and maintenance of photovoltaic systems, courtesy of DENG.

THEME

The project is aimed at ensuring clean, sustainable, modern and affordable energy for the urban area of Kahale, Lebanon to foster socioeconomic development, to guarantee sustainable pattern of production and consumption and to combat climate change and its consequences.

INVOLVED DEPARTMENTS @POLIMI

Department of Energy (DENG)

ABSTRACT

Lebanon has experienced serious problems in the electricity sector for years. During blackout periods, the population is forced to rely on the use of purchased generators or connect to private generators, with high costs (double bills), and high levels of air and noise pollution. Kahale, a town located about 13 km from Beirut, suffers particularly from electricity cuts. The project aims to contribute to the development of alternative energies in response to the needs of the Lebanese urban population in the electricity sector in line with government programming.

Its specific objective is the creation and maintenance of a system of electricity production (photovoltaic) for the sustainable and equitable development of the urban area of Kahale and its surroundings. The project is replicable in other areas of Lebanon and contributes to sustainable environmental development through the use of renewable energy (-CO₂) and to the better quality of life of citizens. An additional focus is on job creation in the renewable energy sector, through training.

RESULTS

- A new photovoltaic lighting system for public street lighting in Kahale allowing a better movement of people and goods in safety and encouraging businesses.
- Personnel trained in the installation and maintenance of photovoltaic systems.
- People and institutions informed and sensitized to the use of alternative energy sources, on themes including: economic savings generated by alternative energy; quality of life in urban areas; global impact on the environment.
- Renewable energy promoted within the population: a management system will be structured to finance, with the savings generated, access to renewable energy for vulnerable groups in Kahale and promote entrepreneurship in the sector.

LIST OF PARTNERS

COMI (Cooperazione per il Mondo in via di Sviluppo) (Italy); ISF-MI Ingegneria Senza Frontiere (Italy); EWS Earth Wind and Sun S.r.l. (Italy); DonBoscoCulturalCenter Beirut (Lebanon).

projects led by

DIG

DEPARTMENT
OF MANAGEMENT,
ECONOMICS
AND INDUSTRIAL
ENGINEERING

ACTIONAID / Palestine

Innovating School Management (ISM)

NePRev – Next Production Revolution

ACTIONAID/ Palestine

SOCIAL INNOVATION IN PALESTINE TO FIGHT UNEMPLOYMENT AND INCREASE COMMUNITY RESILIENCE IN AREA C

Scientific Coordinator @Polimi

Irene Bengo - Department of Management, Economics and Industrial Engineering (DIG)

Duration

2018-2022

Funding

AICS – Italian Agency for Development Cooperation

Budget

2 million Euros

Website

NA

Geographical Context

Palestine

Partner

4 from Europe and Middle East

Impact



Beneficiaries

Youth (in particular women) and 112.000 inhabitants in 8 communities in Hebron and Bethlehem Governorates.



Bethlehem overlookin view via Wikimedia Commons.

THEME

The project, proposed by ActionAid International Italia Onlus, in partnership with ActionAid Palestine, aims to contribute to the reduction of youth unemployment and enhance the economic resilience in Southern West Bank.

INVOLVED DEPARTMENTS @POLIMI

Department of Management, Economics and Industrial Engineering (DIG)

ABSTRACT

The project aims to influence the economic profitability of the beneficiaries, in particular through improved opportunities to access the job market. The project specific objective is to improve the economic opportunities of young people, especially women, in eight communities within Hebron and Bethlehem Governorates. The majority of the beneficiaries lives in the Area C of the occupied Palestinian territory, where the economic situation is suffocated and the job opportunities very limited.

EXPECTED RESULTS

Project activities are grouped in three components, which are expected to lead to three main results:

- Raising awareness, developing skills and building capacity in youth, to access the job market using also non-traditional and emerging sectors. This component includes orientations activities for high school students, first year university students and students who dropped out of school, the development of training programs and technical training courses and the offer of internship experiences.
- Increasing of youth incomes through self-employment in sectors such as the social and the development business. This component has the objective to create three annual competition (call for ideas) for start-ups and social enterprises and to support 100 youth in the development of their business or social business.
- Creating an environment conducive to youth economic empowerment, with particular emphasis on women's one through multi-channel awareness campaigns against discriminatory practices and for the socio-economic empowerment of young women, collaboration with local authorities, collection and publication of at least 15 success stories and good practices, a campaign supporting unemployed youth.

LIST OF PARTNERS

PPU - Palestine Polytechnic University (Palestine); Agility Management and Financial Consulting (Palestine); CGM - Consorzio Gino Mattarelli (Italy); Comune di Milano (Italy).

INNOVATING SCHOOL MANAGEMENT (ISM)

EMPOWERMENT OF SCHOOLS' MANAGERS AND GOVERNING BOARD MEMBERS, BY BRINGING INNOVATION INTO THE GOVERNANCE OF BISHOP CIPRIANO KIHANGIRE SCHOOLS IN KAMPALA, UGANDA.

Scientific Coordinator @Polimi

Tommaso Agasisti - Department of Management, Economics and Industrial Engineering (DIG)

Duration

6-8 months, 2022

Funding

NA

Budget

40 thousands Euros

Website

NA

Geographical Context

Uganda

Partners

2 from Europe

Impact

9



1



8



17



Beneficiaries

Governing board members and managers of the Bishop Cipriano Kihangire Schools; students attending the BCK Schools.



The Bishop Cipriano Kihangire Schools campus via the school official Facebook page.

THEME

The ISM is conceived to empower the managerial skills of the current and prospect managers, and the governing board members of the Bishop Cipriano Kihangire Schools through high-level training and support activities, oriented towards providing practical tools for bringing innovation.

INVOLVED DEPARTMENTS @POLIMI

Department of Management, Economics and Industrial Engineering (DIG)

ABSTRACT

The main problem being addressed is the lack of effective governance in Ugandan schools, which has a clear direct effect on their chances of becoming learning organisations rather than mere commercial premises.

As mentioned in a World Bank report on education in Sub-Saharan Africa titled Facing Forward: Schooling for Learning in Africa, the lack of clear mandates and related definition of responsibilities, ineffective governance structures and inappropriate skills mix jeopardise the development of learning institutions. Therefore, the ISM is articulated in three main phases: (1) baseline assessment, (2) knowledge seminars, (3) in-field experiences.

Specifically, the activities are realized as follows:

- The baseline assessment requires a 2-days workshop in which the teaching team from MIP will work together with the schools' managers to identify the most important managerial needs. The Workshop will explore the challenges that the Schools will face in the next future, to understand which competences are needed to deal with these challenges effectively (project management, innovation mechanisms, business process reengineering, accounting and finance, etc.).
- The knowledge seminars will be held in a 1-week intensive format. The instructors will deliver knowledge content about the selected needs identified in the first phase. Two major topics will be treated (2 days each) with a final day dedicated to summary and major takeaways. Some time is dedicated to teamwork, for facilitating peer-learning between participants. Also, the participants will select projects of innovation that will be supported by the MIP team in the subsequent phase.
- In the final phase, the selected projects are supported by the MIP team. Three groups of governing board members and managers will be formed (one for each institution, that then will select the innovation project). The managers will be supported in carrying out the projects, and will have access to seminars and dedicated sessions (in presence or online) to receive methodological and theoretical suggestions by the MIP team. Each group of managers will meet the MIP team three times (two online, and a final one in presence with a workshop concluding the project).

EXPECTED RESULTS

- To transfer knowledge about effective managerial practices and methods, to govern and transform the organizations' operations and activities.
- To practice this knowledge in real-life situations. Overall, the ISM initiative has the ambitious purpose of empowering the managerial human capital of the people holding responsibilities in the governance of the BCK Schools, through the local coordination of FIU.

LIST OF PARTNERS

MIP Politecnico di Milano Graduate School of Business (Italy); FIU - Fondazione Italia Uganda Onlus (Italy).

NePRev – Next Production Revolution

SETTING UP A MULTIDISCIPLINARY JOINT MASTER DEGREE DEDICATED TO THE NEXT PRODUCTION REVOLUTION

Scientific Coordinator @Polimi

Sergio Terzi and Elisa Negri – Department of Management, Economics and Industrial Engineering (DIG)

Duration

2019 - 2022

Funding

Erasmus+ KA2

Budget

920 thousand Euros

Website

<https://neprev.com/>

Geographical Context

Tunisia



Partners

3 from Europe



Impact



Beneficiaries

4 Tunisian universities: ENIT, ENIGA, FSJEGJ, and ISGIS.



The 2020 edition of the *International Forum for Next Production Revolution*, courtesy of DIG.

THEME

The project aims to create a new master in the field of engineering with an innovative program that is encompassing three different focal areas, namely "Industry 4.0", "Renewable Energy" and "Management of Innovation & Entrepreneurship".

INVOLVED DEPARTMENTS @POLIMI

Department of Management, Economics and Industrial Engineering (DIG)

ABSTRACT

The NePRev projects aims to develop a closer connection between universities and industries and enforce the role of Tunisian universities to promote the transition toward the Next Production Revolution and adapting to the evolving needs of the labor market in Tunisia. A key major outcome of NePRev is to set up a joint research master degree in Next Production Revolution, focusing on the training and education of researchers and skilled experts prepared to help the Tunisian industry to embrace this revolution. The NePRev project is designed to properly address the following needs of the Tunisian consortium partners:

- current curricula fail to respond effectively to the expectations of the labor market and are not quite ready to respond to the NPR demand from the industry;
- lack of connections between the university and its socio-economic environment, especially in the university-industry relationship;
- lack of high value-added research projects capable to implement innovations in the industry and producing patentable research outputs;
- few digital and pedagogical innovations are introduced in university curricula;
- international student enrollment at Tunisian universities is low despite the country's strategy to attract more foreign students (especially from Africa) and export the Tunisian experience.

EXPECTED RESULTS

- Development of a joint master program open to Tunisian, European, and African participants.
- Reinforcement of the role of Tunisian universities in connecting with their socio-economic environment and contributing to local development, by transferring EU best practices on networking and inter-institutional cooperation.
- Bridging the gap between academic research and industry by assisting Tunisian HEIs in developing proactive strategies to promote knowledge and technology transfer and activate opportunities for mutual learning.
- Improving the knowledge of new technologies and interactive tools as educational means and advise Tunisian partners in developing innovative teaching pedagogy and a technology-based education.

LIST OF PARTNERS

PoliTo - Politecnico di Torino (Italy); OBREAL - Observatory of EU-LA Relations, Barcelona (Spain); Centrale Supélec, Paris (France).

projects led by

DMAT

DEPARTMENT
OF MATHEMATICS
“FRANCESCO BRIOSCHI”

Safari Njema

SAFARI NJEMA

FROM PARATRANSIT MOBILITY TO MOBILITY POLICIES THROUGH BIG DATA ANALYSIS

Scientific Coordinator @Polimi

Simone Vantini - Department of Mathematics (DMAT)

Duration

2019 - 2021

Funding

Polisocial Award

Budget

190 thousand Euros

Website

www.safari-njema.polimi.it/

Geographical Context

Mozambique



Partners

5 from Africa, Europe and America



Impact



Beneficiaries

Local active partners; citizens of urban areas, commuters, and the business world; current informal mobility actors and new entrepreneurs; public administration and agencies; students.



An example of informal mobility.

THEME

80% of everyday mobility in African cities is supported by informal, inefficient, and unsafe mobility systems. The project explores bottom-up place based replicable solutions based on the collection and analysis of big data alternative and complementary to traditional public policies and huge infrastructural investments.

INVOLVED DEPARTMENTS @POLIMI

Department of Mathematics (DMAT) **Department of Architecture and Urban Studies (DASU)**, **Department of Electronics, Information and Bioengineering (DEIB)**, **Department of Design (DESIGN)** and **Department of Management, Economics and Industrial Engineering (DIG)**.

ABSTRACT

The SAFARI project aims at supporting a process of innovation and redesign of the current system of informal mobility providing data and information which could feed a more efficient organization to it. In fact, if the current informal mobility solutions is not able to develop a more structured business and more efficient and safer service model, it is very likely that they will not be able to survive in the face of more formal mobility policies supported by national projects or international funds. At the same time, the possible elimination of informal mobility would come at a high social cost for more fragile sectors of the population, or for spatially marginal areas, with high risks of additional socio-spatial marginalization.

The main hypothesis of the project is that there is space for organizational innovation, able to turn informal mobility to a resource/solution, rather than a problem. This space can be found upon delivering new knowledge about both demand and offer of the informal mobility sector, making use of a new abundant and still underexploited African resource i.e. mobile phone data. In detail, the project will rely on GPS-located data automatically collected, and statistically modeled and analyzed in order to provide strategic hints for restructuring the current offer and providing safer, reliable, economically sustainable solutions to both people demand and business models in a fully replicable and scalable perspective.

RESULTS

SAFARI aimed to achieve four main results:

- supporting easier access to job and facilities for citizens of large urban areas, as a measure to consolidate employment: developing an interpretation of the current "transport poverty", able to feed future socio-economic developmental scenarios;
- consolidating current business models in the informal mobility sector: fostering innovations in the reorganization of the network and services, delivering a network analysis of the current situation able to highlight main priorities of intervention and enabling job creation in the sector.
- new economic opportunities of IT related entrepreneurship: introducing innovation based on IT can be a significant opportunity for new entrepreneurs in the field of smart economy;
- creating expertise at the local level which could generate new economic activities and jobs, new possible fields of education and advanced training; offering students innovative educational offer in the field of mobility solutions, qualifying students in emerging sectors.

LIST OF PARTNERS

AICS - Agenzia Italiana per la Cooperazione allo Sviluppo (Italy), Cueb iq (USA), Universidade Eduardo Mondlane (Mozambique), Vodacom Mozambique (Mozambique), WAZA (Mozambique).

projects led by

DMEC

DEPARTMENT
OF MECHANICAL
ENGINEERING

EMotion
VITAE

EMotion

ERITREA MOBILITY AND CULTURAL HERITAGE: NEW FRONTIERS OF THE HORN OF AFRICA

Scientific Coordinator @Polimi

Federico Cheli - Department of Mechanical Engineering (DMEC)

Duration

2019 - 2020

Funding

Polisocial Award

Budget

120 thousand Euros

Website

NA

Geographical Context

Eritrea

Partners

16 from Africa
and Europe

Impact



Beneficiaries

Local communities, entrepreneurs,
and the civil society.



View of the Asmara-Massawa road, courtesy of the *EMotion* project team.

THEME

The project focuses on the Asmara-Massawa axis, a 117km long single carriageway road that has the potential to become a functional itinerary capable of safeguarding historical memory. The project team took care of inventorying sites of interest and collecting data, in order to formulate a development scenario.

INVOLVED DEPARTMENTS @POLIMI

Department of Mechanical Engineering (DMEC), **Department of Architecture and Urban Studies** (DASTU), **Department of Energy** (DENG) and **Department of Civil and Environmental Engineering** (DICA).

ABSTRACT

The main axis considered in this project is the Asmara - Massawa Road. Besides being a road for trade and transport, this strategic axis represents an extraordinary opportunity to design an original and innovative itinerary system. The challenges of a new mobility in this part of Eritrea could be met and overcome by preserving the preexisting historic infrastructure: an extraordinary and vulnerable cultural heritage, consisting of a unique road and a railway, crossing natural and cultural landscapes and connecting archaeological, historical-artistic and architectural sites; but above all, the road itself is a summation of artifacts and monuments to be preserved, protected and enhanced. In order to face such a complex set of issues, a multidisciplinary team, including archaeologists, architects, geologists, and engineers has contributed to the research. The vision of the project can represent an ideal and real bridge to enhance the transferring of goods, ideas, knowledge and values and promote the connection of people. The upgraded transport system dating from the colonial period might become an instrument of valorization and commercial/cultural/touristic development.

RESULTS

- **Assessment.** Research project development and increase of the number of stakeholders and partners.
- **Knowledge.** Complete collection of the necessary information for the development of the research project.
- **Case study.** Increase connectivity between States in the new functional geography; enhancement of the cultural route and the heritage of the surrounding area; economic and employment growth promotion of all the satellite activities through development of efficient infrastructures; protocols set-up useful for the structural proofs of civil works, for conservation, consolidation and planned maintenance of artifacts, respecting their historical characteristics and minimizing the invasiveness of the interventions, while guaranteeing adequate level of transport safety; configuration of protocols for the creation of a modern approach to mobility, rationalizing traffic, reducing pollution and enhancing connection possibilities; evaluations on the applicability to other communication routes with similar characteristics.
- **Training.** The training aims to obtain a new common, shared and widespread attitude towards mobility and built heritage in general, empowering and strengthening local capacities in fulfilling plans and interventions.
- **Dissemination.**
- **Business plan.** To generate new research and drive investments with the development of local and Italian entrepreneurship in the multidisciplinary field of the project.
- **Sustainability plan.** The possibility to apply the logic of analysis and intervention developed for this project in similar contexts and in other countries; the possibility to create an international partnership working on the topics covered by this proposal, with funding opportunities for the continuation of the research.

LIST OF PARTNERS

EER - Eritrean Embassy of Rome; IEA - Italian Embassy of Asmara; AHP - Asmara Heritage Project Office (Eritrea); AICS Khartoum - Italian Agency for Development Cooperation; CeRDO Research Center on Eastern Desert (Italy); ISMeO - Associazione Internazionale di Studi sul Mediterraneo e l'Oriente (Italy); Università Cattolica di Milano (Italy); Università degli Studi "L'Orientale" di Napoli (Italy); Basco S.r.l. (Italy); E-Co (Italy); Pirelli (Italy); SINA S.p.A. (Italy); STIE S.p.A. (Italy); TomTom International (Italy).

VITAE

SUSTAINABLE VALORISATION OF THE ERITREAN HERITAGE: ADULIS ARCHAEOLOGICAL SITE PROJECT

Scientific Coordinator @Polimi

Marco Bocciolone - Department of Mechanical Engineering (DMEC)

Duration

2020 - 2023

Funding

AICS - Italian Agency for Development Cooperation

Budget

2.3 million Euros

Website

<https://khartoum.aics.gov.it/project/12077-adulis/>

Geographical Context

Eritrea



Partners

Partnerships in construction



Impact



Beneficiaries (yearly)

60 students of local High School and University; 10 people for the Museums' staff; 10 technicians of Local Authorities; 45 local workers.



View of the Archeological site of Adulis, courtesy of *Adulis Project* team.

THEME

Valorization of the Eritrean Heritage – the archaeological site of Adulis. The project was born thanks to the previous joint Eritrean-Italian archaeological work in the ancient area of Adulis, started in 2011.

INVOLVED DEPARTMENTS @POLIMI

Department of Mechanical Engineering (DMEC), **Department of Architecture and Urban Studies** (DASTU), **Department of Energy** (DENG) and **Department of Civil and Environmental Engineering** (DICA).

ABSTRACT

The specific objective of this project is to value the impact of long-term archaeological research and link it to the promotion of sustainable development at local level. The archaeological research relies on two pillars:

- the realization of a sustainable archaeological park, in which the preservation of cultural testimonies is linked to the protection of the environment through the use of renewable energy, water systems, and mobility;
- the interdisciplinary model, with the prevalent use of non-invasive techniques.

By achieving its specific objective, the action will contribute to the overall aim to design new strategies of heritage sustainable development. The action will lead to enhance economic and cultural value. This pattern will come from understanding the potential of past civilization to support problem solving for the present society and suggest viable alternatives for territorial planning, creating better lives for the people, while preserving the planet and its resources.

EXPECTED RESULTS

Considering the priority to enhance the cultural heritage expressed by the Local Authorities and Stakeholders through the valorization of the archaeological area of Adulis; given the extension of the site, the high hydrologic risk threatening its preservation; the need to apply new integrated methodologies and technologies, the expected results are:

- a comprehensive understanding of the territorial context where the archaeological site is located;
- the creation of a sustainable park where the evidence of the discovery can be publicly shared and result pivotal for the development of the local community;
- efficient use of sustainable methodologies for approaching site excavation and preservation;
- the empowerment of workforce in the sector, to manage site, park and artifacts.

LIST OF EXPECTED PARTNERS

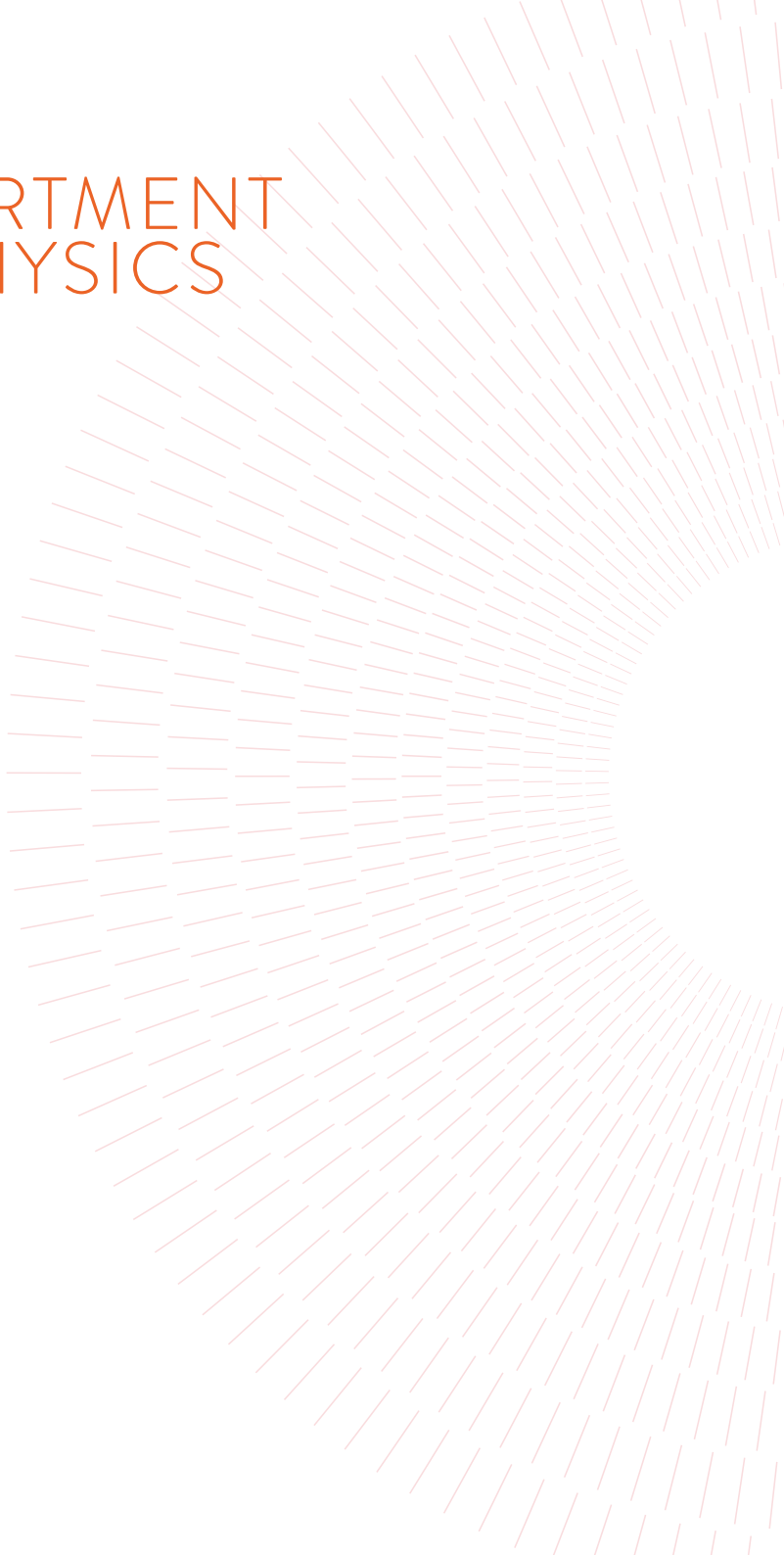
Commission Culture and Sports of Eritrea; museums; Massawa and Foro Authorities; Local communities (Afta and Zula); entrepreneurs and the civil society.

projects led by

DFIS

DEPARTMENT
OF PHYSICS

Tid Mekii



TID MEKII

DIAGNOSTIC TEST LAB-ON-CHIP FOR MALARIA

Scientific Coordinator @Polimi

Riccardo Bertacco - Department of Physics (DFIS)

Duration

2017 - 2019

Funding

Polisocial Award

Budget

90 thousand Euros

Website

www.tmekdiagnostics.com

Geographical Context

Cameroon

Partners

2 from Africa
and Europe

Impact



Beneficiaries

Centre Medical Mgr Jean Zoa (B.P. 185, Yaound, Cameroon); Hospital Saint Luc (B.P. 50, Mbalmayo, Cameroon).



Lab tests, courtesy of DFIS.



THEME

Development of a diagnostic test lab-on-chip, pan-plasmodic, rapid but with the same sensitivity and reliability of the "gold standard" (microscopic examination of blood films), suitable for point-of-care early diagnosis of malaria.

INVOLVED DEPARTMENTS @POLIMI

Department of Physics (DFIS) and **Department of Electronics, Information and Bioengineering** (DEIB).

ABSTRACT

The tests for the diagnosis of malaria available in an African dispensary do not allow effective screening of the population. As a result, hundreds of thousands of people (mostly children) still lose their lives every year on the continent, due to a disease, otherwise easily treatable.

The Tid Mekii project is working on the development of a lab-on-chip diagnostic test based on the exploitation of the magnetic properties of emozoin crystals produced by all the malaria strains. The test does not require specialized personnel nor critical conservation of chemical reagents.

Furthermore, it promises to be rapid (5 minutes), cheap, specific, as well as pan-plasmodic, thus very suitable for application in endemic areas such as Cameroon. None of the current methodologies gathers all these characteristics and is therefore equally reliable.

The device applies original technologies developed by the proponents themselves, a multidisciplinary team of experts in physics, nanotechnologies, electronics and bioengineering, with the support of doctors and biologists of the Sacco hospital and of the health workers of COE (an NGO operating in Cameroon), for field evaluations. Intermediate results are more than promising and suggest a real impact on containment and care policies. In July 2017, the team presented a patent application with the clause to protect the social purpose of the project and ensure maximum accessibility to the test.

RESULTS

A preliminary validation study of TMek has been carried out in Cameroon, in April 2019. Results obtained on 75 patients with clinical suspect of malaria shows on-field operability, without false negative and a few false positive results. The details of this study can be found in the recently published paper: M. Giacometti, et al., "A Lab-on-chip Tool for Rapid, Quantitative, and Selective Diagnosis of Malaria", *Advanced Science*, 5, 2021. (Back cover of the issue).

These findings indicate the potential of TMek as a quantitative, stage-selective, rapid test for malaria. In 2019 TMek has been the winner of the 2018 edition of the Switch 2 product Innovation Challenge for ready-formed start-ups. In 2020 Tmek got a first investment by a venture capital (Poli360) for a feasibility study on the development of TMek as rapid diagnostic test. The project is now in the acceleration phase towards the creation of a start-up for the development and exploitation of the diagnostic test.

LIST OF PARTNERS

"Malattie Infettive 3" Unit of Università degli Studi di Milano/Ospedale Sacco (Italy); Centre Médical "Mgr. Jean Zoà" (Cameroun)

projects led by

POLIMI INSTITUTIONAL INITIATIVES AND SCIENCE DIPLOMACY

CUCS

Fondazione IHEA

High Level Platform on Sustainable Energy Investments

IDEA League

Joint Italian-Somali Scientific Committee

PFK - Partnership for Knowledge

PFK / Platform 3

UNSS

UNESCO Chairs / UNITWIN Network

CUCS

NETWORK OF ITALIAN UNIVERSITIES FOR DEVELOPMENT COOPERATION

Scientific Coordinator @Polimi

Emanuela Colombo - Rector's Delegate for Cooperation and Development

Duration

2007 - ongoing

Funding

Self-funding by network Universities

Website

<https://cucswebsite.wordpress.com/>

Impact



Geographical Context

Italy



Partners

RUS-Network of Universities for Sustainable Development, RUNIPACE-Network of Italian Universities for Peace, and SAR-Scholars at Risk.

The CUCS is supported by CRUI (Conference of Italian University Rectors).

ABSTRACT

The CUCS is the network of Italian Universities for Development Cooperation. It is promoted by CRUI (Conference of Italian University Rectors) to bring together the reflections and actions of the university world related to sustainable development cooperation. The CUCS was founded in 2007 starting from an experience of coordination among Italian universities promoted by the Ministry of Foreign Affairs, to encourage the exchange among young people, especially university students together with their professors, on the themes of international cooperation for development.

In 2007 the first Memorandum of Understanding was signed among about 30 Italian universities that joined on a voluntary basis. The CUCS network was coordinated by the Politecnico di Milano from its inception until 2019 and is currently co-ordinated by the University of Trento.

EXPECTED RESULTS

- To strengthen the field of Development Cooperation within universities, in a transversal manner with respect to training, research, interaction with society.
- To establish a representative interlocutor of the academic world on issues of cooperation with civil society and the institutional world at national and international level for the development of fruitful relationships and the facilitation of processes.
- To consolidate the sharing of experiences, knowledge and skills.

FONDAZIONE IHEA

ITALIAN HIGHER EDUCATION WITH AFRICA

Scientific Coordinator @Polimi

Emanuela Colombo - Rector's Delegate for Cooperation and Development

Duration

2020 - ongoing

Funding

MIUR - Ministero dell'Università e della Ricerca Scientifica (Ministry of University and Scientific Research)

Website

NA

Impact



Geographical Context

Africa, with a focus on the Horn of Africa (specifically Ethiopia).



Beneficiaries

Partner Universities.

Partners

Virtual Mobility Courses (academic year 20/21) list of partners: Addis Ababa Science and Technology University (Eritrea); Jimma University (Ethiopia); Nelson Mandela African Institution of Science and Technology (South Africa); Somali National University (Somalia); Strathmore University (Kenya); Technical University of Mombasa (Kenya); Catholic University of Cameroon (Cameroon); Universidade Lúrio (Mozambique).

Partnerships for the academic year 21/22 in construction.

ABSTRACT

The Foundation was established in 2020 by six Italian Universities: Università di Bologna, Università di Firenze, Politecnico di Milano, Università di Napoli Federico II, Università di Padova, Università di Roma La Sapienza.

Its goal is to promote the internationalization of Italian universities in Africa and contribute, in terms of cooperation, to local development. It is the first Italian pilot experience in transnational education with the ultimate goal of promoting the awarding of bachelor's and master's degrees on the African continent, with particular attention to the Horn of Africa. The Foundation broadens its mission by including all activities aimed at promoting and developing, with appropriate interdisciplinary scientific methodologies, the teaching, training and continuing education of students residing in African countries and refresher courses for the staff of local universities. In addition to the ongoing virtual mobility programs, the master's degree program "Sustainable management of resources and cultural heritage for local development" will train qualified young faculty members from African universities.

EXPECTED RESULTS

The expected results of the initiative are:

- to offer high quality training, both basic and specialized, to students who aspire to acquire a university education of high technical and scientific level that will enable them to work in various sectors of the production and services in the countries concerned;
- virtual mobility courses;
- a Specialized training (Master "Sustainable Management of Resources and Cultural Heritage for Local Development: Empowering Higher Education in Africa" starting in fall 2021);
- a perspective degree-level training.

HIGH LEVEL PLATFORM ON SUSTAINABLE ENERGY INVESTMENTS

SCALING-UP ENERGY INVESTMENTS IN AFRICA FOR INCLUSIVE AND SUSTAINABLE GROWTH

Scientific Coordinator @Polimi

Emanuela Colombo and Riccardo Mereu,
Department of Energy (DENG)

Duration

2018-2019

Funding

European Commission

Website

[High Level Platform on Sustainable Energy Investments | Energy \(europa.eu\)](https://www.polimi.it/High-Level-Platform-on-Sustainable-Energy-Investments-1-Energy/europa.eu/)

ABSTRACT

The SEI Platform represents the implementation of the request of the African Union - European Union summit to intensify efforts to establish a market and commercial environment capable of attracting responsible and sustainable investments and accelerate the implementation of the Sustainable Development Goals (SDGs). As a thematic task force within the Africa-Europe Alliance for Sustainable Investment and Jobs, the platform aims to bring together African and European actors to examine the challenges and potential towards common strategic interests: accelerate impact, create new jobs and inclusive sustainable growth by private individuals and public investment in the energy sector.

Impact



The platform is focused on three thematic areas through specific working groups (sustainable energy investments and business models, policies and improvements in regulatory, market and business matters and enablers to improve EU-Africa business to business partnership and networking). The composition of the group reflects the geographical, cultural and gender diversity of both continents and has representatives from the public, private and civil society sectors.

Geographical Context

Africa



RESULTS

- As a main result, the SEI Platform provides clear and forward-looking action recommendations to share and support Presidents and Governments on both continents. The platform also includes recommendations to strengthen innovation and empower consumers and small and medium-sized enterprises in Africa.
- The executive summary and report 'Scaling-up energy investments in Africa for inclusive and sustainable growth': [11-2019_sei-platformreport-executivesummary_05.pdf](https://www.polimi.it/11-2019_sei-platformreport-executivesummary_05.pdf) ([europa.eu](https://www.polimi.it/energy/europa.eu/))

Beneficiaries

African companies, institutions, energy utilities, small and medium energy enterprises.

Partners

AfDB (Ivory Coast); AEEP (Italy); Africa GreenCo (Mauritius); African Union Commission, Alliance for Rural Electrification; Bakulu Power (Uganda), Conseil de Coopération Economique; ECOWAS (West Africa); ECRREE (West Africa); EDP Renewables; ENEL SpA (Italy); ENI SpA (Italy); Entsol Tz Ltd; Energy Charter Secretariat; EBRD (EU); EC (EU); EIB (EU); Eurochambers (EU); Florence School of Regulation (Italy); FEEM (Italy); ADEME (France), Giraffe BioEnergy (UK), GOGLA; Global Solar Private Limited (Zimbabwe), GIZ/ Get Invest (Germany), GVE Projects (Nigeria); Iberdrola Renewables (Spain), IEA (France), IRENA (Emirates), KfW (Germany), MEDENER (Spain), MASEN (Morocco), Pan African University; PACCI; POLIMI (Italy); RCREE; Res4Africa Foundation (Italy); REEEP (Austria), Siemens Gamesa (Spain), Solar Power Europe; wPower Hub (Nairobi).

IDEA LEAGUE

EDUCATION PARTNERSHIP FOR RESEARCH THESIS EXCHANGE. AN INVITATION TO CONCEIVE, DEVELOP, IMPLEMENT, AND OPERATE A COMPREHENSIVE PROGRAM AIMING AT FOSTERING FUTURE PROFESSIONALS IN A MULTICULTURAL CONTEXT

Scientific Coordinator @Polimi

Emanuela Colombo - Rector's Delegate for Cooperation and Development

Duration

ongoing

Funding

IDEA League network

Website

<https://idealeague.org/>

ABSTRACT

Although IDEA League universities already have relationships research institutions and most countries, the offer for students to spend time in African countries is limited. Equally, among international students at IDEA League universities, the number of students from Africa is low. As a result, IDEA League aims to strengthen the interaction between future professionals from the two continents in areas deemed crucial to a sustainable future. Sustainability needs to be understood in a global context: lack of mutual understanding between the global South and the global North prevents solutions to societal challenges at local, regional, and global levels. The case of interaction between Africa and Europe is particularly important due to strong and complicated historical links but also due to the potential of rapid development in Africa and the geographic proximity between the continents.

EXPECTED RESULTS

- The program is intended to give students at master level opportunities to take part in exchanges with institutions on the other continent. The outcome is enhanced mutual experience and interaction among higher education institutions.
- Long term, the program is expected to build a body of graduates with first-hand experience from a country and an institution on each continent. These graduates will help strengthen links in engineering and related subject between African and European countries.

Impact



Geographical Context

Africa



Beneficiaries

African and European Students, Teachers, Staff.

Partners

Chalmers University of Technology (Sweden); ETH Zurich (Switzerland); Politecnico di Milano (Italy); RWTH Aachen (Germany); TU Delft (The Netherlands).

JOINT ITALIAN-SOMALI SCIENTIFIC COMMITTEE

SUPPORTING THE SCIENTIFIC DEVELOPMENT AND UNIVERSITY EDUCATION IN SOMALIA

Scientific Coordinator @Polimi

Niccolò Aste - Department of Architecture, Built environment and Construction engineering (DABC)

Duration

2014 - ongoing

Funding

AICS - Italian Agency for Development Cooperation

Website

NA

Impact



Geographical Context

Somalia



Benefici

Public Institutions and Universities.

Partners

University of Bari (Italy); University of Brescia (Italy); University of Firenze (Italy); Politecnico di Milano (Italy); University of Palermo (Italy); University of Pavia (Italy); University of Roma Tor Vergata (Italy); University of Roma Tre (Italy); University of Trieste (Italy); Italian Geographical Society (Italy); Italian Agency for Development Cooperation (Italy); Somali National University (Somalia).

ABSTRACT

The main scope of the Joint Italian-Somali Scientific Committee (ISSC) is to support the interaction among Italian and Somali universities to promote the scientific development and university education in Somalia. The ISSC is currently hosted by the Italian Geographical Society (SGI) and is composed of representatives from several Italian university; it is co-chaired by Prof. Mohammed A. Jimale and Prof. Vittorio Colizzi, director of the Africa Relations Center of the Italian Geographical Society and former director of the UNESCO Chair of Biotechnology and Bioethics at the University of Rome Tor Vergata.

RESULTS

The ISSC gave actively support in several cooperation projects and in particular in:

- "UNS1" project (Somali Web University), aimed at capacity building in health agriculture and vet through web courses between Italian universities and Somali counterparts;
- "UNS2" project, dedicated to the training in Italy of about Somali teachers/managers working in Mogadishu;
- "UNS3" project, which supports the training of teaching staff, the provision of equipment of classrooms and laboratories and the institutionalization of UNS in Somalia;
- "UNS4" project, aimed at the reconstruction of the Gahayr campus in Mogadishu.

PFK: PARTNERSHIP FOR KNOWLEDGE

RURAL DEVELOPMENT AND SPATIAL MANAGEMENT (P1); HEALTH, WATER, SANITATION AND HYGIENE – W.A.S.H. (P2); SUSTAINABLE ENERGY, ENVIRONMENT AND INDUSTRIAL INNOVATION (P3); CULTURAL HERITAGE AND SUSTAINABLE TOURISM (P4).

Scientific Coordinator @Polimi

Emanuela Colombo - Rector's Delegate for Cooperation and Development

Duration

2019 – 2022

Funding

AICS - Italian Agency for Development Cooperation

Website

www.aics.gov.it/home-eng/fields/human-development/pfk/

ABSTRACT

Partnership for Knowledge (Pfk) is a higher education initiative of the Italian Cooperation system aimed at providing life-changing opportunities to researchers, public administration officers, social entrepreneurs and young leaders who are committed to develop their professional and academic skills, strengthen their capacities, widen their networks, make a difference in their home contexts and experience the Italian culture.

Platform 1 promotes research and professional training in the fields of modern and sustainable agriculture, forestry and animal sciences.

Platform 2 focuses on environmental and health problems that influence morbidity and mortality in tropical countries.

Platform 3 aims at providing advanced competencies in the sectors of energy, environment and industrial innovation.

Platform 4 aims at building value around cultural heritage and sustainable tourism as engines for sustainable development.

EXPECTED RESULTS

The program is aimed to produce a batch of graduates from Afghanistan, Albania, Bolivia, Cuba, El Salvador, Egypt, Ethiopia, Eritrea, Kenya, Lebanon, Jordan, Mozambique, Myanmar, Niger, Pakistan, Palestine, Senegal, Sudan, and Tunisia, thanks to the scholarships at Italian universities.

- **Platform 1:** 22 scholarships for Master of Science Programs and 5 scholarships for Ph.D. Programs in the fields of Rural Development and Spatial Management and a network of Alumni in the same fields.
- **Platform 2:** 6 scholarships for Master of Science Programs and 12 scholarships for Ph.D. Programs in the fields of Health, Water, Sanitation and Hygiene – W.A.S.H. and a network of Alumni in the same fields.
- **Platform 3:** 19 scholarships for Master of Science Programs and 6 scholarships for Ph.D. Programs in the fields of Sustainable Energy, Environment and Industrial Innovation and a network of Alumni in the same fields.
- **Platform 4:** 13 scholarships for Master of Science Programs and 8 scholarships for Ph.D. Programs in the fields of Cultural Heritage and Sustainable Tourism and a network of Alumni in the same fields.

Impact



Geographical Context

Afghanistan, Albania, Bolivia, Cuba, El Salvador, Egypt, Ethiopia, Eritrea, Kenya, Lebanon, Jordan, Mozambique, Myanmar, Niger, Pakistan, Palestine, Senegal, Sudan, Tunisia.



Beneficiaries (yearly)

Researchers, public administration officers, social entrepreneurs, and young leaders.

Partners

Politecnico di Torino (Italy); Università Ca' Foscari Venezia (Italy); Università di Bologna (Italy); Università degli Studi di Brescia (Italy); Università degli Studi di Cagliari (Italy); Università degli Studi di Firenze (Italy); Università di Napoli "Federico II" (Italy); Università degli Studi di Napoli "L'Orientale" (Italy); Università degli Studi di Padova (Italy); Università degli Studi di Parma (Italy); Università degli Studi di Pavia (Italy); Università di Pisa (Italy); Università di Roma "La Sapienza" (Italy); Università degli Studi "Roma Tre" (Italy); Università degli Studi di Siena (Italy); Università degli Studi di Torino (Italy); Università degli Studi di Trento (Italy); Università degli Studi di Trieste (Italy).

PFK/ PLATFORM 3

PARTNERSHIP FOR KNOWLEDGE: PLATFORM 3.
SUSTAINABLE ENERGY, ENVIRONMENT AND
INDUSTRIAL INNOVATION.

Scientific Coordinator @Polimi

Emanuela Colombo - Rector's Delegate for Cooperation and Development

Duration

2019 – 2022

Funding

AICS - Italian Agency for Development Cooperation

Budget

970 thousand Euros

Website

www.aics.gov.it/home-eng/fields/human-development/pfk/

Geographical Context

Albania
Ethiopia
Kenya
Mozambique
Tunisia



Partners

6 from Italy



Impact



Beneficiaries (yearly)

Researchers, public administration officers, social entrepreneurs and young leaders.



Online meeting of the PFK/Platform 3 program participants.

THEME

Sustainable energy, environment and industrial innovation.

INVOLVED DEPARTMENTS @POLIMI

Politecnico di Milano (Institutional Project)

ABSTRACT

Partnership for Knowledge - PFK - is a higher education initiative of the Italian Cooperation system aimed at providing life-changing opportunities to researchers, public administration officers, social entrepreneurs and young leaders who are committed to develop their professional and academic skills, strengthen their capacities, widen their networks, make a difference in their home contexts and experience the Italian culture.

The platform aims at providing advanced competencies in the sectors of energy, environment and industrial innovation.

The energy platform trains highly skilled technicians in renewable energy systems, energy efficiency and energy planning. The environment platform focuses on risk protection and prevention, climate change and water management. The industrial innovation platform promotes the new frontiers of innovation such as industry 4.0, Internet of Things/Big Data/Data Analytics, social innovation and circular economy.

RESULTS

- 19 scholarships for Master of Science Programs and 6 scholarships for Ph.D. Programs in the fields of Sustainable Energy, Environment and Industrial Innovation;
- a network of Alumni in the fields of Sustainable Energy, Environment and Industrial Innovation.

LIST OF PARTNERS

Politecnico di Torino (Italy); Università Ca' Foscari Venezia (Italy); Università degli Studi di Trento (Italy); Università degli Studi di Padova (Italy); Università di Bologna (Italy); Università di Napoli Federico II (Italy)

UNS5

INSTITUTIONAL AND ACADEMIC ENFORCEMENT OF THE NATIONAL SOMALI UNIVERSITY

Scientific Coordinator @Polimi

Niccolò Aste - Rector's Delegate for International Relations with Africa

Duration

2021-2024

Funding

AICS - Italian Agency for Development Cooperation

Budget

1.9 million Euros

Website

NA

Geographical Context

Somalia

Partners

8 from Italy

Impact

4 QUALITY EDUCATION



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS



Beneficiaries

Somali Students, Teachers, Staff



Delivery ceremony of the diplomas at the Somali National University via Aics_Somalia.

THEME

Scholarships program for Somali students in several academic fields: Agriculture, Economics, Law, Engineering, Medicine, and Veterinary.

INVOLVED DEPARTMENTS @POLIMI

Politecnico di Milano (Institutional Project)

ABSTRACT

The National Somali University (NSU/UNS) has played, since 2014, the role of State University with the specific aim of offering a quality lay alternative and therefore a different perspective to today's Somali youth. Within the UNS5 project, a group of students from the National Somali University will be given the opportunity to receive training at Italian universities in the following areas: Agriculture, Economics, Law, Engineering, Medicine, and Veterinary.

The initiative intends to give students the opportunity to acquire knowledge, skills and a study approach aimed at problem-solving. The scholarship project addresses the need to continue to train the young teaching staff by providing more tools to develop an increasingly modern and effective teaching methodology, through a dedicated MOOC.

The project also aims to consolidate the collaboration between Italy and Somalia. Fellows, students, and teachers of the Somali National University are offered online tools for learning the Italian language and culture.

EXPECTED RESULTS

The project foresees that the fellows will achieve a Master Degree in the fields of Agriculture, Economics, Law, Engineering, Medicine, and Veterinary, while candidates in Medicine will attend an annual specialization course.

Upon returning to Somalia, the fellows will return the skills acquired, in order to transfer the knowledge acquired in Italy to their colleagues.

They will also have the opportunity to discuss any specific opportunities for further collaboration with the university directly with UNS. The project also provides for the creation of an online Italian language and culture course, and a MOOC for the development of new teaching methodologies.

LIST OF PARTNERS

Università di Bari (Italy); Università di Bologna (Italy); Università di Firenze (Italy); Università di Napoli Federico II (Italy); Università di Pavia (Italy); Università di Roma La Sapienza (Italy); Università Roma 3 (Italy); Università di Trieste (Italy).

UNESCO CHAIRS/ UNITWIN NETWORK

ARCHITECTURAL PRESERVATION AND PLANNING IN WORLD HERITAGE CITIES / ENERGY FOR SUSTAINABLE DEVELOPMENT / GREENOMICs - GREEN CHEMISTRY EXCELLENCE FROM THE BALTIC SEA TO THE MEDITERRANEAN AND BEYOND

Scientific Coordinator @Polimi

Federico Bucci - Vice Rector for Mantova Campus (I); Emanuela Colombo - Rector's Delegate for Cooperation and Development (II); Giuseppe Resnati - Dept. of Chemistry, Materials and Chemical Engineering (DCMC) (III).

Duration

2012 - ongoing

Promoted by

UNESCO - United Nation Educational, Scientific and Cultural Organization

Website

[UNESCO CHAIR in Architectural Preservation... \(I\)](#)
[UNESCO CHAIR in Energy for Sustainable Development \(II\)](#)
[UNITWIN Network on GREENOMICs... \(III\): NA](#)

ABSTRACT

Launched in 1992, the UNITWIN/UNESCO Chairs Programme promotes international interuniversity cooperation and networking to enhance institutional capacities through knowledge sharing and collaborative work. Through this network, higher education and research institutions all over the globe pool their resources, both human and material, to address pressing challenges and contribute to the development of their societies. In many cases, the Networks and Chairs serve as think tanks and as bridge builders between academia, civil society, local communities, research and policy-making. They have proven useful in informing policy decisions, establishing new teaching initiatives, generating innovation through research and contributing to the enrichment of existing university programmes while promoting cultural diversity.

Impact



Geographical Context

Italy



The UNESCO Chair in Architectural Preservation and Planning in World Heritage Cities (I) was established at the Mantua Campus of Politecnico di Milano in 2012. It has been developing innovative activities of education, research and dissemination in the field of architectural design for heritage, supporting the experimentation of new educational practices and facilitating the exchange of knowledge within different areas of the world.

The UNESCO Chair in Energy for Sustainable Development (II) was established at Politecnico di Milano in 2012. It has consolidated its mission to promote an integrated system of education, research, technological cooperation and community service, focusing on energy and sustainable development in line with the 2030 Agenda and international frameworks.

The UNITWIN Network on GREENOMICs - Green Chemistry Excellence from the Baltic Sea to the Mediterranean Sea and Beyond (III) was established at Politecnico di Milano in 2017. It has been promoting an integrated system of research, documentation, training and information activities on Green Chemistry: the main topics are pollution prevention, promotion of green resources and reduction of non-renewable consumption. It also aims to develop new technologies for greater energy efficiency, and new Green Chemistry technologies for Cultural Heritage.

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