

# Implementing an institutional transformation in science and engineering: the University of Nairobi example

Anne Nkoidila

University of Nairobi, Kenya, [annen@uonbi.ac.ke](mailto:annen@uonbi.ac.ke)

Beatrice Ndaisi Kimuyu

University of Nairobi, Kenya, [bndaisi@uonbi.ac.ke](mailto:bndaisi@uonbi.ac.ke)

David K. Kariuki

University of Nairobi, Kenya, [kkariuki@uonbi.ac.ke](mailto:kkariuki@uonbi.ac.ke)

Thomas Ochuku Mbuya

University of Nairobi, Kenya, [tmbuya@uonbi.ac.ke](mailto:tmbuya@uonbi.ac.ke)

Jackson Kivui Maalu

University of Nairobi, Kenya, [jmaalu@uonbi.ac.ke](mailto:jmaalu@uonbi.ac.ke)

Jarrett Onyango Odwallo

University of Nairobi, Kenya, [jodwallo@uonbi.ac.ke](mailto:jodwallo@uonbi.ac.ke)

Marc Zolver

ExpertiseFrance and University of Nairobi, Kenya, [mzolver@uonbi.ac.ke](mailto:mzolver@uonbi.ac.ke)

## Abstract

Ten years ago, the University of Nairobi (UoN) in Kenya entered in a transformative reflexion to reform Engineering and Science Higher Education, Research and Innovation (HERI). Few years later, a concrete project emerged with the construction of a state-of-the-art academic building aiming at facilitating HERI by its own design, the Engineering and Science Complex (ESC), and the development of international cooperation, especially with French institutions and partners from Europe.

Six pillars of activities have been structured and launched in 2023 with six dedicated teams, mostly from the Faculty of Science and Technology (FoST) and the Faculty of Engineering (FoE): Governance, Curricula reform, Research excellence, Innovation culture, Company linkage and Internationalization.

This work-in-progress has been presented at IRSPBL2023 and is now in its implementation stage. New practices, key actions and capacity building per pillar are developed with strategic roadmaps, milestones and deliverables, learning and training programs, student and staff mobility, etc. The authors showcase concrete examples from each pillar and expose the key concept of international multi-disciplinary “Communities of Excellence” of the ESC. They emphasize the importance of international networks and partnerships, such as the AFRETEC network and the EU Global Gateway program, and share challenges and lessons learned.

**Keywords:** institutional transformation, industry Academia linkage, innovation ecosystem, community of excellence, internationalization, higher education infrastructure.

## 1 Introduction

African continent is at a crossroad of its future role and place in the global world. As a main key factor, and repeatedly brandished, its demography will be either a problem or an opportunity. On the one hand, African countries, under the pressure of their debt and international agencies, and seriously impacted by the Climate Change, might not be able to cope and answer the needs and expectations of their young generation “GenZ”. Education won’t tackle the massive demand, decent job market won’t expand, public and private investments won’t happen, and debt and Climate Change will remain dramatic for populations and their standard of living. A vicious loop could take place with massive undereducated and unemployed populations with no future perspective, and often irrelevant governance favoured by global north political drift in Russia, US, Europe, China... On the other hand, African countries can also enter in a virtuous loop in tackling the challenges with education reforms (from primary to higher), decent job creation and Climate Change adaptation, accelerated by dynamic research and innovation ecosystems, allowing Africa to enter in a new era of real prosperity and economic growth, relying on the capacity and creativity of its youth, and giving space to new models of relevant and inclusive public and private governance.

UoN has chosen the virtuous loop by engaging a transformational plan with the construction of the ESC and the reform of its educational programs, research and innovation, in order to support the country development and tackle its challenges. From the ideation in 2015 of the ESC until today, the university achieved some main milestones with feasibility studies in 2019, the French Development Agency (AFD) financial commitment in 2021 and the partnership agreement between UoN and 6 French higher education institutions in 2023. Although the construction of a new state-of-the-art academic building is the main backbone of the project, with a relevant and enabling design to be selected mid-2025 and a construction expected to take less than 2 years, this paper furthers the (Kerubo et al., 2023) paper and focuses on the “software” parts of the systemic transformation with the structure in pillars grouping people in action for the good implementation of the ESC. The Pillar structure is temporary and shall give place smoothly to “Communities of Excellence” that will be hosted in the ESC. Communities are sets of internal and external stakeholders that share the same sector and/or high value service. The ESC will be articulated and animated by these communities, ensuring its sustainable development and relevance.

## 2 The ESC Pillars

The academic community is not an easy one to engage in any institutional reform. Among others, (McGowan et al., 2022) have identified many obstacles and proposed key questions to address for maximising the chance of success: sharing the vision, defining the key drivers, proposing incentives and ensuring learning outputs. UoN applied a similar approach by answering these questions clearly and repeatedly under a tree structure maximizing communication, engagement and impact, and making the transformation truly systemic. From a core Project Management Unit (PMU) of 6 key people – one lead director, one project manager, one architect, one procurement officer, one finance manager and one foreign expert - six pillars are implemented: Curricula reform, Research excellence, Innovation culture, Internationalization, Company linkage and Governance. Each pillar is led by a duo of people from FoST and FoE in relation with their pillar's peer from French partner's institutions. Each pillar is then in charge to recruit its local members, 10 to 15, with the constrain to be balanced between FoST and FoE and as much as possible between men and women.

The pillars prepared their roadmap with key objectives, milestones and deliverables. They feedback to the PMU and implement their actions with the financial support of the AFD, controlled by the PMU. Different levels of synchronisations are active, the PMU with the pillar heads, the pillar heads and their teams, the PMU with a specific pillar, and of course all participants altogether, with punctual UoN top management meeting and exchanges within a steering committee. French peers are participating in due time at all levels. Hence, the agility of the project and its appropriation by people are concrete and efficient. PMU and pillar heads receive direct incentives and drivers, including financial compensation, while the pillar members and other stakeholders have indirect incentives and drivers, especially through “quick wins” (participation in international calls, link to international peers, priority access to grants and mobility...) and tangible learning outputs (capacity and network building).

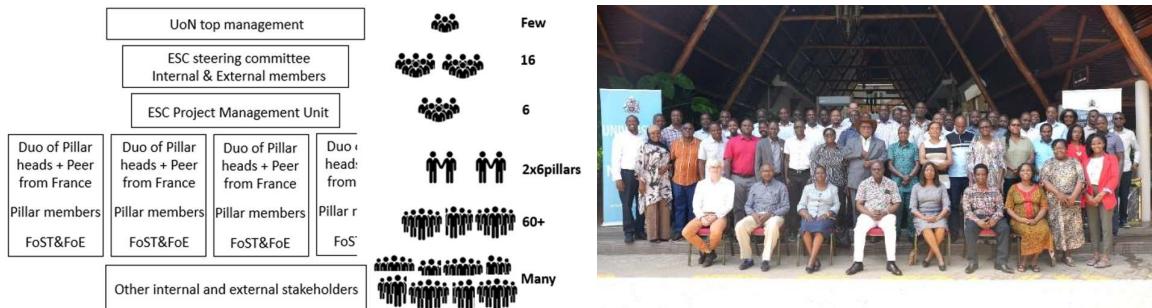


Figure 1: ESC project general organisation; 2024 pillars' global seminar group photo.

## 3 Pillar distribution and example of practices

The six pillars cover the 3 classical perimeters of higher education, research and innovation, crossed with 3 transversal perimeter of internationalization, academia-industry linkages and governance.

### 3.1 Education, Curricula reform

This pillar aims to update and/or create programs to be hosted in the ESC. After sound needs assessments, the pillar team has developed a roadmap to implement 3 main new and/or updated practices:

- **Module development:** competence and skill modules and short schools on professional communication, self-awareness, teamwork, innovation and entrepreneurship, digital and AI literacy, climate change... Implementation started in 2023 in particular with ***the company series***, a set of 5 workshops with industry experts to develop professional skills and self-awareness, to exercise teamwork and creativity, to understand PBL approach, to communicate efficiently, to interact with professionals and to participate in field visits. 150 students have experienced the series and have declared to be “satisfied” or “very

satisfied". **Seasonal schools** are also in development with annual editions in programming/machine learning, climate change, mathematics... with the same rate of success evaluated by students.

- **Professional inclusion:** Involving industry in the programs by teaching participation, Problem and Goal Based Learning, employability enhancement, mandatory attachment, field visits, mentorship... In addition to *the Series* and its activities, a **mandatory attachment** policy is under approval by the UoN senate for full deployment.
- **Program update:** Creating industry oriented Master programs possibly leading to international joint or double degrees with partners. A need assessment conducted in 2024 identified first priorities with **AI and Data, HealthTech and biomedical engineering, Agriculture and Food**. In addition, **International mobility** and its recognition is part of program reform. In 2023, UoN has been awarded an EU intra-Africa Academic Mobility Scheme (GREEN-STEM) to sustain student and staff mobility. 90 people from Kenya, Nigeria, Rwanda and South Africa are benefiting from an academic mobility from few months to few years at MSc and PhD level. Coordinating such initiative is also key to understand and build capacities in international recruitment for joint programs or credit exchanges within the ESC initiative.



Figure 2: interactive company series workshops and “spaghetti bridge” challenge.

### 3.2 Research

The research pillar is instrumental to define the sectors of priority that will be operated in the ESC. To be really bottom-up and need-oriented, the pillar has supported international meetings, exchanges, some lab visits and preliminary joint activities. Thus, the pillar identified 6 topical key sectors for Kenya with: **Agriculture and Food science, BioTech and Chemistry, Advanced manufacturing, Energy, HealthTech and Urban development**, and 2 capacitating sectors with **Data/Artificial Intelligence and Innovation**.

The pillar has been able to engage new professional practices for research with **Franco-Kenyan joint PhD programs** and **the development of industrial partnerships**. Joint research projects and micro to macro-chairs are actually proposed by UoN research departments to external companies.



Figure 3: Research seminar 2023 in Kenya and joint research staff with France.

The pillar is also very supportive of capacity building in grant writing and management, to allow more researchers to apply and get international grants. These new capacities are true enablers of professional competences and a window for international network and recognition.

### 3.3 Innovation

Closely intertwined with Research, the Innovation pillar has its own legitimacy. The main objective of the pillar is to **engage and support new practices by a empowering and sustainable ecosystem**. The pillar shall

implement the new ecosystem in the ESC, linked with European ecosystems, especially with France, and other African ecosystems, thanks to UoN membership in the pan-African AFRETEC network, with institutions from Egypt, Kenya, Morocco, Nigeria, Rwanda, Senegal, Angola and South Africa. Meanwhile, the pillar has engaged its team in grant writing, especially under Horizon Europe framework program.

### 3.4 Internationalization

Within the ESC, curriculum, research and innovation new practices are strategically expected to have international outlook and partners. As a roll-out of this strategy, the UoN international office have been strengthened and now counts 6 junior/senior officers and program managers. It actively contributes in the organization of **international mobility**, within different frameworks such as the European E+ program. Under the ESC, around 30 students and more than 65 staff have benefited from a physical mobility between France and Kenya in 3 years, for coursework, research and learning opportunities. Together with the pillar members, the international office also participated in the GREEN-STEM proposal and implementation since 2024, with MSc and PhD mobility. In support of the new practices of the curriculum pillar, it has co-organized seasonal schools such as the **African School on Climate Change Adaptation** and supported **schools in computing/machine learning and in mathematics**. The schools attract 25 to 40 international students, mostly from Africa but also Europe, with a 95% satisfactory and above rating. At last, all the team with faculty members from other pillars are participating in the recent **AFRETEC network**. This network is very active and counts 8 members, including UoN, from different countries in Africa. The AFRETEC pillars are totally convergent with the ESC pillars and act in synergy and a constructive approach as most of their members are shared AFRETEC/ESC.



Figure 4: African School 2024 with the Climate Fresk<sup>©</sup> and field visit to United Nations Nairobi headquarter.

### 3.5 Industry linkages

Company partnerships are crucial to develop relevant education and research programs, and to generate impactful innovation. Since 2023, the ESC project has raised 7 partnerships with French and Kenyan companies: **Bureau Veritas, Olvéa Kenya, TotalEnergies, Schneider Electric, Bamburi Cement/Holcim, Elgon Kenya, Camco**, and two national companies, **KenGen and Geothermal Development Company**. UoN is also member of the **French Chamber of Commerce** in Kenya. The content of the partnerships is yet mostly limited in human resources for the ESC activities, such as **the company series, seasonal schools, ad hoc round tables, fairs and events** with students, **field visits**, involvement in various **ESC committees**... A more engaging collaboration by committing additional resources, including financial, and engagements, in Education, Research and Innovation is under development.



Figure 5: Industry experts in workshop, field visit and round table.

### 3.6 Governance

The ESC governance and its business model are strategic to implement these new practices with international partners and professional companies. From a steering committee, the PMU and the pillars (figure 1), the ESC governance shall transition to a proper **board of directors**, with ideally 50% of external stakeholders, which will give direction and objectives to the ESC head office, under the recommendation of 3 advisory committees for studies, research and innovation, and industry. The business model will move from the AFD initial resources to a **sustainable resource mobilization plan** with new grants, fee paying programs, executive education, consulting, IP rights, company chairs or donations, investors, sponsors and donors, etc.

## 4 Communities of Excellence and next steps

The ESC pillars are temporary and shall transition in the next 2 years in “Communities of Excellence” (CoE). Six of the CoE will be topical around the six topics identified by UoN as strategic for Kenya: **Agriculture & Food, Biotech & Chemistry, Manufacturing, Energy, Health and Cities**. Each of them shall develop new higher education programs, enhance research excellence and promote innovation culture with the objectives to generate impact and create jobs. They count internal stakeholders such as students, faculty members and staff, and external stakeholders such as companies, non-governmental and governmental organizations, agencies, community-based organizations and individuals from Society. New practices shall be **multi-disciplinary, international and inclusive**. Two of the CoE will be transversal and service-oriented, with the **ESC innovation ecosystem** where trainings, supervision and exposure to market development will complement facilities, equipment and spaces, and the **ESC Data and Artificial Intelligence platform** where Findable, Accessible, Interoperable, and Reusable data and AI tools and software will be shared, and users from the diverse communities will be trained. Altogether, this is eight CoEs that will take place in the ESC, joining the FoST and FoE capacities with additional faculties such as Agriculture, Health, Built environment and Business. The CoEs will make use of national and international funding tools, such as the ones from the European commission under the Global Gateway, from France with its agencies and National Research Organizations (AFD and French CNRS in particular), and from other countries and their agencies (Germany, Finland, U.K., etc.)

## 5 Challenges and lessons learned

**The academic community** is a very independent, bottom-up and legitimacy-oriented community, that makes a transformational plan a huge challenge. The ESC tree organization is especially adapted to respond to this challenge, when professionally legitimated and recognized people are at the pillar heads. With agility, personal commitment and good leadership quality, they are then able to generate community engagement, especially from their peers and younger generation, and to make sense of the objectives of the project. They are also the ones who share and align the vision and can ensure the relevance of the actions, particularly by being the go-between the teams, the PMU and the steering committee.

**Time frames** must take place in a long term view and shall not be urged. Transformation can be seen as a danger and people need to feel secured and recognized in their participation. The role of the top management, the PMU and pillar heads is important to give the right space and timeline for new practice adoption, with no precipitation. Although, some “**quick wins**”, such as (Kerubo et al., 2023) paper, EU proposal writings (successful or not), short programs development (attractive to good students), the company series (attractive to industry) etc., can fuel the team and generate adhesion to the project.

As projects of such ambition keep uncertainties, teams shall remain **agile and open to new opportunities and new stakeholders**. UoN has many strategical objectives, and a consolidating approach is needed to add synergy whenever possible. Communication and information shall then circulate and be shared in order that everyone can add value. In addition, a real **co-operation and peer-to-peer interaction** shall prevail with international partners in a **win-win spirit**, especially in Africa where South-North sensitivity is high.

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