Makerere University

Vision:

To be the leading institution for academic excellence and innovations in Africa.

Mission:

To provide innovative teaching, learning, research and services responsive to National and Global needs.

Strategic Framework: 2020-2030

Theme:

Unlocking the Potential of Makerere University as the Regional Knowledge Hub

Physics Department

Mission:

To create and impart knowledge in physics to society through training, research and community extension services for sustainable development.

Background

This document is a culmination of the visit from the Planning Department of the University to CONAS on 2nd July 2018 where they guided the College on how the Departments were to give their input to the University Strategic Plan (SP). Departments were mandated to come up with a Strategic Plan document which would feed into the CONAS SP and subsequently into the University one.

The Physics Department conducted a 3-day workshop to come up with a strategic plan document for the Department on the following days: 7th, 14th and 22nd August 2018, held within the departmental premises. Participants included academic staff members, technicians, other support staff and students. These attended physically and attendance lists for the different days are attached. Other participants included stakeholders from bodies where our students go for training, and hence potential employers of our graduates, and also those who have been having consultancies with staff at the Department. These have been instrumental in giving input relating to their fields of interest. It was not possible for the stakeholders to attend the workshop physically due to financial constraints, but we communicated with them via email. The following stakeholders were invited to participate: Civil Aviation, UNBS, UCC, Uganda Clays Ltd., Ministry of Energy, Radiology Dept., Mulago. However, by the time of submitting this report, the stakeholders had not yet responded.

Review of Past Performance

Teaching, learning, research and knowledge transfer have been the main avenues through which the Physics Department has contributed to the current University Strategic Plan of 2008/09 – 2019/20. The Department offers both undergraduate and graduate programmes, which include: space physics, astronomy and astrophysics, materials science, earth sciences, radiation physics, energy physics, photonics, electronics and optics. In analysing the successes and failures based on the goals and objectives in the outgoing university plan, the Department has carried out a SWOT (strengths, weaknesses, opportunities and threats) analysis.

Strengths

1. Increased research within the Department: new research areas have emerged, such as space physics, astronomy and astrophysics, in addition to the others mentioned above.

2. Increased number of students, particularly at the graduate level-intake, rising from paltry two or three students in 2008 to about fifteen in 2018 at Masters level; while the PhD numbers rose from two to six students.
3. There has been an increase of staff with PhDs within this period, rising from eight to thirteen currently, with four more about to graduate.
4. The undergraduate syllabus was reviewed 2010, having practicals embedded into the theory, which brings in a more participatory approach involving the learner and the instructor.
5. The graduate syllabus was also reviewed in 2012, with options given tracks, which lead to flexibility in specialization.
6. A computer laboratory was set up and furnished with computers.
7. We have a number of collaborations with international universities: Makerere – Bergen; Makerere – TU Delft in the Netherlands (TWIGA); Makerere – NTNU – Mozambique – Makelle in Ethiopia; Makerere – NMU in South Africa; Makerere – Uppsala (ISP program) and the International Centre for Theoretical Physics (ICTP).
8. We also have local collaborations, such as the Radiology Dept., Mulago; Civil Aviation Authority; UNBS; and Uganda Clays Ltd. These have made it possible to find internship training for our students.
9. There has been collaborative research and outreach activities with other colleges and units within the university, e.g. with CEDAT, and this has led to a wider pool of supervisors for our graduate students and to the skilling of the wider community.
10. The MUELE platform, which is at the forefront of promoting e-learning in the university, has been running in a number of courses.
11. There have been weekly seminar series involving both staff and students, which have helped in monitoring research work within the Department. In addition, there have been invited public lectures from international academics.
12. The Department has been carrying out activities which pass on skills to the general public, in particular, the annual training in photovoltaics and biogas, which has been going on the Department since 2012. There have also been monthly moon-viewing activities, which have attracted families with their young ones and this is meant to inspire young ones towards sciences.
13. The Department has played a leading role in offering graduate training to students and staff from our sister universities, hence building capacity for these institutions.

Weaknesses

1. The Department has been unable to mobilize sufficient resources both locally and internationally to carry out research and teaching.
2. Linkages with local industries have been weak.
3. There have been no refresher courses for technical staff by the university.
4. There has been under-utilization of the Workshop and Project Lab.

5. Individual resource mobilization has either led to acquisition of very small grants or failing to get anything altogether.

Opportunities

1. The few projects the Department has had helped attract funding which equipped and renovated the laboratories at the beginning of this decade, e.g. the MSI Project, the NUFU Project and the Solar Energy Project with the Uppsala University.
2. The collaborations have been instrumental in aiding staff in the Department to attain PhDs.
3. The new research areas in the Department were made possible with the collaborations of ICTP together with Boston College, who supplied GPS and VHF receivers.
4. The collaborations we have had enabled staff to obtain research visits to international universities, hence building partnerships.

Threats (or Challenges)

1. Since the operationalization of the Collegiate system it has not been possible for funds to trickle down to departments.
2. The Department cannot repair faulty equipment since there is no maintenance budget allocation.
3. Computers in the computer laboratory are now obsolete.
4. Information on student enrolment does not reach the Department; it is hard to tell those that have absconded.
5. Access to the provisional graduation has not been possible and hence it was difficult to verify students before they graduate.
6. The establishment for professors is not filled and this deprives staff and students of mentorship.
7. Due to increased graduate students, there are challenges, such as:
    - few senior supervisors;
    - a number of students fail to complete on time due lack of equipment and some find problems with funding.
8. The inadequate linkages and collaborations with the private sector affect the research base.
9. Over the past decade, there has been no or minimal recruitment of technicians and this affects the running of the labs. Out of the establishment of twelve (12), we have only five (5).
10. The procurement process takes a long time, so purchased teaching and research materials sometimes arrive late.
11. Taxes on specialized equipment and donations for teaching have been a big problem.

Strategies for 2020 – 2030

1. Physical Development

Despite the increase in students and staff, there has been no physical expansion of the Department. In this respect therefore the Dept. is planning for an additional building besides the Departmental building to have space to house the following:

(i) Labs for specialized equipment particularly for the new programmes, such as space physics, atmospheric and radiation physics.
(ii) Computer laboratory: with computers for networking and modeling; and at least two high speed computers.
(iii) Office space / Research space.
(iv) A modern auditorium for teaching: with fixed projector and air-conditioner;
(v) Obtain licences for software, e.g. Matlab, Abacus, to mention but a few.

2. Research

Since the university is transiting into a research-based university, we plan to concretize this in the following ways:

(i) Active research groups:

The Department plans to strengthen the following research groups:

- Renewable energy group – with emphasis on solar energy.
- Environmental sciences – space physics, atmospheric physics (to collaborate with the School of Built Environment in CEDAT).
- Optics.
- Radiation physics.
- Materials science.
- Computational physics and modeling (to collaborate with Math Dept.).
- Geophysics (to collaborate with Departments of Geology and Petroleum Studies).

Shortfalls in the Project Lab and Workshop will be rectified in order to service the research groups adequately.

(ii) Solicit for increased research funding from the university:

The university will be requested to allocate a grant annually to the Department for research. This will enable the Department to have innovations, an area we are lagging in.

(iii) Strengthen collaboration with local industries

- This will create more avenues for our students to carry out internship and eventually find employment.
- This enhances skills-development and on-job training for our students.
- It will enable the Department to investigate industry-initiated research leading to consultancy opportunities.

(iv) Solicit for more international collaborations

Currently, international collaborations have helped us a lot, and now we plan to look for more. This also helps to put us on the global map of scientists.

(v) Institute outreach activities

Outreach activities will help us interact with the community around us; thus making us relevant to the community. Activities will include:

- Visiting schools and demystifying physics, by carrying out simple experiments with the pupils;
- Having open days at the Department annually, where school pupils can be invited to exhibit together with our staff and students.
- Opening up our laboratories for carrying out demonstrations/experiments that cannot be afforded by certain schools.
- Continue skills-enhancement to the public in areas relevant to the public, e.g. solar energy and electronics.

(vi) Update the Departmental website

This is another way of marketing the Department in addition to outreach activities:

- The profiles of staff on the website will aid in collaborations.
- The public will get to know of what is done at the Department;
- Our research outputs can be disseminated on the website.
- By disseminating our research findings, the Department can play a part in influencing policy, for the good of the nation.

3. Timely Completion for Graduate Training

Graduate training has had issues of late completion. This has been mainly due to insufficient research equipment. We hope to overcome this by requesting the University to allocate funds annually for research.

4. **Activate the Uganda Physics Society**
   There used to be the Uganda Physics Society, which has now gone dormant. Our aim is to re-activate it and spread membership to other universities and schools. These can engage students and pupils in competitions and quizzes, hence marketing our Department and making ourselves relevant. We also plan to join international societies, such as the American Ceramic Society, the Optical Society, the Physical Society and the Institute of Physics. There is also need for the Department to get an MoU with ICTP.

5. **Centre of Excellence**
   The Department plans to champion in the following two areas during the coming decade:
   - **Nuclear and Radiation Physics:**
     The Dept. plans to champion in this area to train manpower for the ongoing government project of the Nuclear Energy Programme.

   - **Solar Energy:**
     To have a model for solar panels that can harness the sun's energy so that all the lighting will be on solar. This benefits the university and the country at large:
     - the electricity costs will be cut down tremendously;
     - it will be a hub for others to emulate;
     - our students will benefit from the knowledge.

   - **Space Physics:**
     There is already an existing GPS in the Department. With more GNSS equipment, we can become champions in estimating atmospheric water-vapor over the country and this leads to food security. Together with the Meteorological Department, we can make forecasts and hence farmers can know the seasons for planting.

6. **Tracking Physics Alumni**
   The Dept. plans to create a system of locating the alumni and get updates on their current positions. The alumni can be a good resource to market or support our programmes. They can also act as role models to our students, particularly during the Freshers' orientation week.

7. **Other Departmental Requirements**
   There is need for the following:
   - New furniture for offices: the existing furniture is in bad shape.
   - Mode of transport: a mini-bus / double cabin for field trips and outreach activities.

STUDENT PROJECTION 2020 – 2030

The projected graduate and undergraduate intakes are as indicated:

	2018 (current)	**2030**
Undergraduate:		
1st Year	150	200
2nd Year	100	150
3rd Year	70	100
Graduate:		
MSc	40	50
PhD	15	30

PROJECTION OF RESOURCES

1. Since graduate training is purely private, we hope the resources will trickle down to the Dept.
2. We plan to have more collaborations which will bring in more research funds.
3. We hope to get research funding from both the university and also directly from government.
4. We plan to write more fundable proposals to both local and international donors.