

## Case studies of university-industry interaction in Uganda

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## ABSTRACT

Uganda has recently obtained high rates of economic growth, but is still at a low level of economic development - which is reflected in its dualistic economy between the 'modern' sector and the 'traditional/subsistence' sector. This has resulted in a big gap between the incomes of the urban-based economic and political elite and the vast majority of the people in the country-side. Besides this dualism between the urban and the rural, there is also a wide gap between the foreign operated (multinational) companies and the Ugandan owned small enterprises that find it difficult to survive the competition from the big foreign firms.

Uganda has also been characterised by an unstable political environment, especially in the period 1962-1986. The result is that there has been a constant disruption of its educational institutions, including its well-known Makerere University, which has failed to emerge as an institution of higher learning providing high level manpower focused on the development of the country. Government policy in the teaching of science in the country was also affected, and Uganda has moved along a path of development that has relied on its peasant-based agricultural sector.

Although Ugandan universities and public research institutes have recently begun to grapple with the challenges of finding new directions of development in the context of knowledge production and knowledge commercialization, raising the issue of forging links with industry and communities, the nature, scope and outcomes of these interactions have so far received peripheral treatment in the context of developing a national innovation policy.

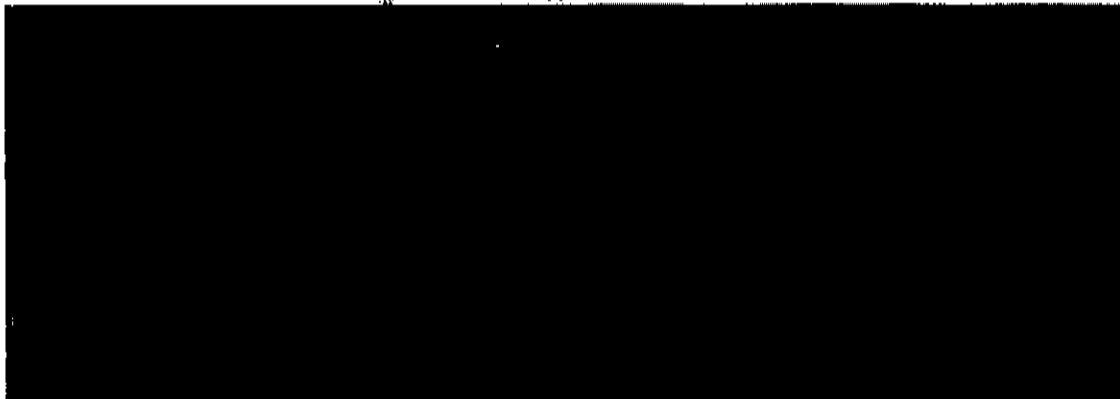
The findings of the case studies reveal that, in general, the nature, scope and outcomes of these interactions have so far received peripheral treatment in the literature, despite the prominence given in the strategic plans of universities and public research institutes. The lack of coordination in government policy, reflected in the incoherent relations between the different faculties and departments in older universities (such as Makerere), has hindered the formation of such linkages and networks. This lack of government policy guidance is also reflected by the lack of funding allocated to research and development activities in universities, which is mainly in the hands of donors or foreign universities that have developed working relationships with Makerere or even with research institutes.

**Keywords:** University-firm interactions, innovation policy, Uganda, universities, firms, developmental university

## INTRODUCTION

Considering their vision and mission statements, Ugandan universities and public research institutes are already grappling with the challenges of finding new direction for achieving developmental relevance in the context of knowledge production and knowledge commercialization. In this regard, the issue of forging and/or strengthening links with industry and communities features prominently in the strategic plans and some research practices of these institutions. However, the nature, scope and outcomes of these interactions have, so far, received peripheral treatment, mostly in the context of advocating for a National Innovations Policy<sup>1</sup>.

The intensifying interactions between academia, firms and communities also challenge our understanding of the underlying epistemological drivers of the process of knowledge production. Theories of university-industry interaction have evolved significantly over the last 20 years<sup>2</sup>: from alternately privileging the state, the firm or the university; to the interlocking "Triple Helix Model" of university-industry-government relations; to the concept of 'Mode 2', emphasizing networking between disciplines, industry, communities and government, and a more integrated and participatory approach to innovative processes.



<sup>1</sup> See, for example, Byarugaba-Bazirake, G.W. and Nyende, D. (June 2005). Baseline survey in scientific and technological innovations in Uganda, Kampala: Uganda National Council for Science and Technology (UNSCT).

<sup>2</sup> Erzkowitz, H. and Leydesdorff, L. (Feb 2000). The dynamics of innovation: From national systems and "Mode 2" to a Triple Helix of university-industry-government relations, *Research Policy*, 29(2): 109-123.

<sup>3</sup> Marcus Garvey Pan-African Institute. (2008). A survey of university-industry interactions among selected bio-sector firms in Uganda.

## METHODOLOGY

The research design and instruments were developed by HSRC. The design suggested the university as the empirical entry point for identifying cases of interaction, and cases of university-firm interaction as the unit of analysis. The research was guided by the following questions:

- What is the main mode or channels of interaction, in terms of knowledge intensity?
- What are the outcomes of this interaction, that is, does the interaction work/succeed or not?
- What are the conditions in the university that facilitate and/or constrain this (un)successful interaction?
- What are the conditions in the firm that facilitated and/or constrain this (un)successful interaction?
- What are the policy conditions and government mechanisms that facilitate or constrain?

At least six case studies had to be identified, covering a mix of cases that have been successful and those that have not; with success being measured in terms of specific outcomes, duration of the relationship and perceptions of benefit. A mix of firm sizes (small, medium and large) was also to be considered. The same was to apply to the universities from which cases were to be selected namely, those with a general orientation and those explicitly dedicated to science and technology.

Uganda has 23 universities most of them private and hardly a decade old. Five of the universities are public, including the oldest, Makerere University, which was established in 1922. The other universities include: Kyambogo University, Mbarara University of Science and Technology, Gulu University and Busitema University. Public universities in Uganda are those established by a statutory instrument or the recommendation of the National Council for Higher Education and by resolution of Parliament.

It was originally envisaged to include all the public universities in the study but Mbarara and Busitema had to be left out. The former because there was no meaningful information on which to proceed as its website had been shut down for renovation; the latter because its management felt that the university was newly formed and had not yet rolled out its research activities to the extent of engaging with firms.

That left Makerere and Kyambogo universities located in Uganda's capital, Kampala, and Gulu University in the war-devastated northern region. Additionally, two public research institutes, the Uganda Industrial Research Institute (UIRI) and the National Agricultural Research Organization (NARO), were included. Resource and time constraints ruled out the inclusion of the Uganda Virus Research Institute, which seemed potentially very promising in terms of exploring interactions involving biopharmaceutical processes and products.

The deadline within which the case studies had to be carried out, constrained the researchers to carry out the exercise when universities were in their vacation season.

This turned out not to have been a good idea, as most staff were either marking students' scripts or supervising those on industrial attachment, or simply doing their private fieldwork. This resulted in a lot of time-consuming and fruitless interview appointments.

Consequently, the response to the questionnaire (schedule 2) on knowledge intensity, channels, outcomes and benefits of interaction, was very slow and poor. The information expected to be generated from the questionnaires was crucial for identifying potential cases of interaction between universities and firms. Eventually, only 13 questionnaires were secured from Makerere and Kyambogo universities, but even then, well after the interim report had been written. On the other hand, the response rate among public research institutes was quick, except for one firm that was reluctant to participate and became hostile about giving its linkage details. Nevertheless, the data from the questionnaires were used qualitatively to complement insights generated from interviews and other research sources.

The respondents from Makerere University ranged from the Deputy Vice Chancellor (Academic Affairs/Research), the Deputy Director (Research), the School of Graduate Studies and the Director of Makerere University Private Sector Forum to the Research Deans of the Faculties of Agriculture and of Technology, various heads of department (Botany, Crop Science, Food Science and Technology, Soil Science, Chemistry, Electrical Engineering, Civil Engineering, and Mechanical Engineering) and various heads of research projects within those units. At Kyambogo University, respondents included the Ag. Vice Chancellor, Academic Registrar, deans of Science and Engineering faculties and the heads of Chemistry, Food Processing Technology and Production Engineering. At Gulu University, the respondents included the acting deans of the Faculties of Medicine and Education, and the Director of Research in the School of Graduate Studies.

## **CASE STUDIES**

### **MAKERERE UNIVERSITY**

#### **Research vision and culture**

Makerere University's vision is to be a centre of academic excellence, providing world-class teaching, research and service relevant to sustainable development needs of society. The mission is "to provide quality teaching, carry out research, and offer professional services to meet the changing needs of society by utilizing world wide and internationally generated human resources, information and technology to enhance the university's leading position in Uganda and beyond".<sup>4</sup> The last strategic plan (2000/01-2006/07) emphasized 'multidisciplinarity' and adopted six themes and five cross-cutting areas as its Research Agenda:

- Education for Development
- Food, Nutrition and Value Addition
- Sustainable Environment
- Good Governance, Equity (including gender), Service Delivery
- Health (infections and lifestyle related diseases)

<sup>4</sup> Planning and Development Department. (January 2004). Strategic Plan 2000/01-2006/07, Kampala, Makerere University Ps.

➤ Natural Resource Utilization and Conservation.

The cross-cutting areas include: Appropriate Technology, Economics, Biotechnology, Methodological Studies and Staff Development.

A new strategic plan is in the process of being finalized. The new plan emphasizes that the new research agenda will be developed bottom-up, that is, with the participation of each unit. Then the information will be captured through the newly instituted Research Management and Coordination System. Virtually all the officials interviewed, however, conceded that donors or "development partners" of the university could and will set their own priorities. This is a reflection of their funding leverage, as illustrated in Table 1 below.

**Table 1. Sources of funding for group or departments' research projects with firms**

Source	Percentage
University	38.9
International funding	33.3
Domestic public funding agencies	22.2
The firm	5.6
<b>Total</b>	<b>100.0</b>

Source: Field Survey

Development partners adopted an enhanced role as the university sought to recover from the "lost years" under the military dictatorship of Iddi Amin Dada (1971-1979). During that period, the university had been forced, by severe funding shortages, insecurity and "brain flight", to concentrate on teaching. The remaining staff also adopted a mode of individual survival and narrow career advancement.

The return of the development partners, coupled with internal reviews in the post-Amin years, has seen the university position itself as a research-led institution. The numbers of both undergraduate and graduate students have shot up, as indicated by the enrolment tables below. All lecturers are required to be PhD holders, but it was difficult to assess the impact of this requirement on research productivity as the university has only recently started to capture the research output, at the institutional level, as papers published in refereed or non-refereed journals. It is important to mention that the university publishes 10 internationally recognized journals notably, *The Makerere University Medical Journal*, *The Makerere University Research Journal*, *The African Journal of Crop Science*, *The African Journal of Animal and Biomedical Sciences* and *The Uganda Journal of Health Sciences*. Foundations, such as Rockefeller, Carnegie and MacArthur as well as NORAD and Sida/SAREC, have been pivotal to the success of initiatives aimed at developing academic capacity. For example, since 2001, Sida/SAREC, alone, has trained 160 PhD staff within Makerere.



**Table 2. Current enrolment (post-graduate) Makerere University**

Category	Male	Female	Total
Science	34	7	41
Technology	32	3	35
Agriculture	85	30	115
Medicine and Public Health	177	85	262
Veterinary Medicine	37	8	45
Forestry and Nature Conservation	7	1	8
Environment	60	10	70
Computing	226	78	304
Statistics and Applied Economics	69	34	103
Education	159	134	293
Social sciences	167	184	351
Arts	198	130	328
Economics and Management	333	154	487
Business Studies	160	115	275
Library and Information Science	6	16	22
Psychology	14	16	30
Laws	34	29	63
Industrial and Fine Art	6	1	7
Adult and Continuing Education	3	2	5
<b>Total</b>	<b>1807</b> <b>(63.5%)</b>	<b>1057</b> <b>(36.5%)</b>	<b>2844</b>

Source: ?

**Table 3. Current enrolment (under-graduate) Makerere University**

Category	2007/2008	2006/2007
Science	1042	1016
Technology	1876	1679
Agriculture	1091	1120
Medicine and Public Health	1093	1004
Veterinary Medicine	594	550
Forestry and Nature Conservation	215	249
Environment	236	224
Computing and Info Technology	2583	3493
Statistics and Applied Economics	1886	1754
Education	3984	4210
Social Sciences	3132	3432
Arts	4340	5182
Economics and Management	2658	2302
Business Studies	7257	6806
Library and Information Science	593	575
Psychology	1280	1198
Laws	1389	1460
Industrial and Fine Arts	498	501
Adult and Continuing Education	5966	6060
<b>Total</b>	<b>35383</b>	<b>36009</b>

Source:

Although there are many other factors at play - such as, the growth of privately sponsored students and the segmentation of teaching routine - the growth in the number of graduates, over the years, is partly a reflection of the training impact of Makerere's enhanced staff capacity. But, at the same time, it can also be observed that these graduates are not many in the areas inclined towards biotechnological applications, as shown in the tables 4-9 below.

**Table 4. Makerere University graduates, 2008<sup>5</sup>**

Category	Science	Technology	Agric	Medicine	Education	Law	Business/ MGT	Arts/ Soc.Sc.	Total
PhD	2	1	1	1	1	0	0	0	6
Masters	44	8	14	34	33	0	195	115	443
Undergraduate	390	6	69	22	1280	330	313	2549	4959
<b>Total</b>	<b>436</b>	<b>15</b>	<b>84</b>	<b>57</b>	<b>1314</b>	<b>330</b>	<b>508</b>	<b>2664</b>	<b>5408</b>

**Table 5. Makerere University graduates, 2007**

Category	Science	Technology	Agric	Medicine	Education	Law	Business/ MGT	Arts/ Soc.Sc.	Total
PhD	16	3	4	2	3	0	0	1	29
Masters	65	14	36	101	77	1	174	249	717
Undergraduate	1235	171	241	139	1970	4	2019	3033	8812
<b>Total</b>	<b>1316</b>	<b>188</b>	<b>281</b>	<b>242</b>	<b>2050</b>	<b>5</b>	<b>2193</b>	<b>3283</b>	<b>9558</b>

**Table 6. Makerere University graduates, 2006**

Category	Science	Technology	Agric	Medicine	Education	Laws	Business/ MGT	Arts/ Soc.Sc.	Total
PhD	8	1	4	1	4	2	0	4	24
Masters	103	8	25	94	64	3	132	230	659
Undergraduate	758	201	305	284	1512	362	1613	3444	8479
<b>Total</b>	<b>869</b>	<b>210</b>	<b>334</b>	<b>379</b>	<b>1580</b>	<b>367</b>	<b>1745</b>	<b>3678</b>	<b>9162</b>

**Table 7. Makerere University graduates, 2005**

Category	Science	Technology	Agric	Medicine	Education	Laws	Business/ MGT	Arts/ Soc.Sc.	Total
PhD	9	1	3	3	2	1	3	2	24
Masters	67	6	40	122	49	9	116	196	605
Undergraduate	505	186	301	251	845	367	1668	1346	5469
<b>Total</b>	<b>581</b>	<b>193</b>	<b>344</b>	<b>376</b>	<b>896</b>	<b>377</b>	<b>1787</b>	<b>1544</b>	<b>6098</b>

**Table 8. Makerere University graduates, 2004**

Category	Science	Technology	Agric	Medicine	Education	Laws	Business/ MGT	Arts/ Soc.Sc.	Total
PhD	6	0	5	1	8	0	0	1	21
Masters	50	2	20	43	63	6	30	160	374
Undergraduate	416	195	239	244	2208	346	1428	2210	7286
<b>Total</b>	<b>472</b>	<b>197</b>	<b>264</b>	<b>288</b>	<b>2279</b>	<b>352</b>	<b>1458</b>	<b>2371</b>	<b>7681</b>

**Table 9. Makerere University graduates, 2003**

Category	Science	Technology	Agric	Medicine	Education	Laws	Business/ MGT	Arts/ Soc.Sc.	Total
PhD	5	0	5	2	1	0	0	9	22
Masters	64	12	58	111	67	6	34	216	588
Undergraduate	586	257	347	396	850	568	1289	2579	6872
<b>Total</b>	<b>655</b>	<b>269</b>	<b>410</b>	<b>509</b>	<b>918</b>	<b>574</b>	<b>1323</b>	<b>2804</b>	<b>7462</b>

**Table 10. Makerere University graduates, 2002.**

Category	Science	Technology	Agric	Medicine	Education	Laws	Business/ MGT	Arts/ Soc.Sc.	Total
PhD	3	2	0	0	0	0	0	1	6
Masters	26	3	14	9	27	5	11	54	149
Undergraduate	191	36	32	31	722	25	295	2052	3384
<b>Total</b>	<b>220</b>	<b>41</b>	<b>46</b>	<b>40</b>	<b>749</b>	<b>30</b>	<b>306</b>	<b>2107</b>	<b>3539</b>

<sup>5</sup> Figures for only one graduation out of three in a year

## Research structures

Makerere University is well ahead of the rest in having well articulated internal and external structures to coordinate and facilitate research, and facilitate the diffusion and application of its research. Ever since the establishment of the School of Graduate Studies (SGS) in 1994, its mandate has included the management and coordination of research as well as mobilization of research funds. The research infrastructure includes Makerere Institute of Social Research, the Human Rights and Peace Centre of the Faculty of Law and, more crucially for our purposes, the Makerere University Agricultural Research Institute, Kabanyoro (MUARIK). At MUARIK research is undertaken in all areas of soil and crop science, including modern biotechnology. The institute operates a Plant Tissue Culture Laboratory and Screen House Facilities, biosafety laboratory, a gene bank and a molecular biology laboratory at Makerere University's main campus.

University authorities now think they are on the threshold of augmenting the research infrastructure, with the adoption by the University Council of Makerere's own **Research and Innovations Policy** in March 2008. The strategic objectives of the policy are:

- i) to create an enabling, harmonious, transparent and efficient environment for research and innovations;
- ii) to strengthen research management and coordination
- iii) to improve research and publications culture
- iv) to improve funding for research and innovations
- v) to improve gender responsiveness of the university through research and innovations.

### Box 1. Reversing research trends: from individual/unit level to institutional motivation

Established in 1922 as a technical college, Makerere University has evolved into one of the leading universities in sub-Saharan Africa. In the 1950s, 1960s and early 1970s, the university experienced its most productive decades, with a vibrancy of teaching in the region, research and engagement with government and public through public lectures and other fora of academic and political engagement. In subsequent years, the volume of research not only decreased but also increasingly became project-based and dependent on individuals' motivation. The latter created a situation that, even where research continued to flourish, it was not institutionally driven or coordinated and therefore was often not registered as a Makerere University product. This trend was further expounded by the introduction of the private programs that emphasized innovation at the unit level. Teaching/learning and research have therefore been unit-based, presenting increasing challenges for university wide coordination and management, especially on the research enterprise at Makerere University.

The aforementioned trend has had several effects one of which is less visibility of Makerere University on the world-wide web, since the milliard research endeavors have been attributed to individuals within the university rather than the institution. The Research and Innovations Policy seeks to reverse this trend in a two-pronged approach: encouraging and providing more opportunity for team/multidisciplinary research and innovation on the one hand, and rationalizing these efforts in a broader university framework of research and innovations. This policy puts emphasis on provision of research opportunities, quality and ethics in research and innovation, efficiency and effectiveness in coordination and management of research and innovation at Makerere University.

Source: Makerere University Research and Innovations Policy, 2008

According to the new policy, all research activities being undertaken through various academic and research units will now be guided, managed and coordinated by the Makerere University Board of Research and Publications. The Research, Innovation and

Publications Committees are located at the unit level. It will be the responsibility of these units (faculties/institutes/schools/colleges) to formulate research priorities that will feed into the university research agenda.

One of the new staff capacity building initiatives is the mentoring and apprenticeship approach. Thus, as part of the eligibility criteria for research support, senior staff will be required to work with junior members and graduate students on research projects for mentoring and supervision, and to produce joint publications. Academic units are also encouraged to establish Professorial Research Chairs. Staff members are required to spend at least 20% of their time on research and dissemination. Accordingly, staff at the lecturer level and above as well as doctoral students are required to publish at least one paper in a peer reviewed journal, yearly. Provision is also made for recognition and reward of staff for outstanding performance in research and innovation.

In order to improve funding for research and innovation, the university has undertaken to commit at least 3% of the internally generated funds to research and innovation annually. This channel could raise at least USD 600,000 annually.

The **Intellectual Property Management Policy** also approved in March 2008, seeks to: support and promote innovative ideas that can be transformed into useful products for the public good; support the management of the intellectual property of the university; support and promote knowledge transfer mechanisms to students and the wider public; and promote economic activity arising from the products of research and innovation. To achieve the commercialization of intellectual property, the university commits to support the development of small and medium enterprises (SMEs) (e.g. spin-off companies) arising from promising innovations. The IPM policy established an intellectual property management unit, headed by an IPM manager and overseen by a technical committee of the board of Research and Publications

#### **Box 2. University inventions**

Any discovery or invention that satisfies the following circumstances shall belong to the University

- a) results from research carried out by or under the direction of any employee of the university and is supported by university funds or funds controlled or administered by the university; or
- b) results arising from an employee's duties within the university; or
- c) has been developed in whole or in part through the utilization of university resources or facilities not available to the general public.

Source: Makerere University Intellectual Management Policy, 2008

Actually, technology transfer offices and spin-off companies emerged before the IPM and Research and Innovations Policy, and it remains to be seen how they will be impacted by the policy. The Technology Development and Transfer Center (TDTC) of the Faculty of Technology was established in 2002, and is under the office of the Dean of the faculty. It is the linchpin between the community, incubation centers, industries and the faculty. According to its director, Eng. Dr. Adam Sebbit, TDTC's driving concern is to provide support services to third and fourth year students, and fresh graduates in establishing and managing their self-created innovative projects or businesses.

On the face of it, the main aims of the center fit in very well with those set in the Research and Innovations and IPM policies. The TDTC wants to:

- create capacity at Makerere University for development/adoption of intermediate technologies for rural and urban development;
- spearhead applied research in technology and commercialization of research output and development of spin-off companies;
- assess and transfer technologies to stakeholders; and
- develop a human resource base for technology transfer at the national level.

Currently, one of the biotechnological activities underway by technology staff and students at the TDTC is the improvement of the Aloe Vera Gel Extractor. The thrust of the work is to come up with the most suitable type and size of rollers; to enhance the arrangement of rollers to accommodate the different sizes of leaves; to increase the efficiency of gel extraction; and to design better gear arrangements and thus reduce on the weight of the machine.

The TDTC would like to intensify its links with industry, for instance, by interfacing more with SMEs under the umbrella of the Uganda Gatsby Trust, a semi autonomous unit within the faculty. The limiting factors are space and equipment. The center's director favours the more institutional approach implied by the new policies. He hopes this will result in more coherent strategic support of technology transfer centers.

The institutional approach, however, also has its skeptics. One of these is Dr. Musaazi Moses, Head of Technology for Tomorrow (T4T), a spin-off company working in the areas of sanitary health, fuel conservation and sustainable building of bio-technologies. T4T, in the words of Dr. Musaazi, has benefited from the "generous help of the Rockefeller Foundation and the resources of Makerere University", and is also tapping into the Presidential Initiative to support Appropriate Technology, as T4T diversifies its product range.

For Dr. Musaazi, the institutional approach per se, is not the missing ingredient that will put Makerere at the hub of a fledgling knowledge driven economy. "The whole philosophy needs to change from abstract to demand-driven research with emphasis put on and success measured by a commercializable end-product. Resources are wasted on a lot of research that goes to the shelves. One end-product is worth a thousand publications. I do not have a single publication out of my work. My view is that the end-product is as good as a publication and this product does not have to be internationally vetted".

It is not only the institutional and intellectual/academic legacy that puts publications above end-products that make Dr. Musaazi 'sort of' cling to the 'institutional embrace'. The projects themselves, right from conception to operationalisation, are driven by individual initiative. Indeed, only two researchers out of those consulted for the study attributed the initiative of establishing a relationship between firms and researchers to the university group or department.

At the Faculty of Agriculture, where they do a lot of biotechnology production and processing activities, a policy on the management of intellectual property seems very much welcome. However, according to the Research Dean, Dr. Margaret Nabasiye, the interpretation of the policy at the unit level is yet to be done. This is perhaps not surprising as Makerere is already one of the 12-members universities of East and

Southern African Regional Forum for Capacity Building in agriculture (RU FORUM), based in Kampala, which has set forth an Intellectual Property Rights Policy.

In the experience of the faculty, UILs occur and will intensify because donors now demand that research projects should involve other stakeholders, such as public research institutes, communities or commercial/industrial firms, rather than the researcher partnering with colleagues. "Some of the research though is generated by firms who conceive an idea and sell it to the faculty", says Dr. Nabasiye. In practice, firms look for somebody they know or have worked with before. "Consequently there is not much balance between the individual and the institution". Some researchers end up with greater project workloads, while others have none. This also affects junior researchers who, unless they are being deliberately mentored, experience a lot of frustration.

The thematic focus of UILs tends to be swayed by the prevailing research priorities, Yet prioritization is dependent on donors. They come to us with very specific areas of intervention such as value addition or food scarcity to which they direct their funds. Once in a while a faculty sets itself some priorities, such as, tissue-culture but these tend to remain on paper because we do not have funds of our own, says Dr Nabasiye.

Sida/SAREC has, over the past few years, supported 24 "capacity building projects" across the faculties of agriculture, technology, human medicine, and social science. The faculty research dean, Dr. Mackay Okure, says the Faculty has its own six-point priority research agenda focusing on: infrastructure development; water quality management and pollution control; architectural planning and urbanization, and engineering materials; renewable energy systems; and geographic information systems and ICT applications. These, however, turn out to be the same areas that Sida/SAREC is funding.

What is very striking is how the TDTC is missing from this list, although every one in the Faculty will tell you how crucial it is for innovation, business incubation, technology development and partnership, and collaboration between industry and university/applied research institutes.

Just a couple of meters away from the Faculty of Technology stands an impressive Department of Food Science and Technology. Supported by another group of donors, the department is rolling out what appears to be a well resourced Food Technology and Business Incubation Program (FTIP). It has assembled a multidisciplinary support staff from the Departments of Food Science and Technology, Agriculture, Economics and Agribusiness; the Faculty of Economics and Management, the Entrepreneurship Development Center of Makerere University Business School, members of the Uganda Manufacturers Association, and entrepreneurship from the private sector.

Judging from the range of services offered, it is puzzling that the Faculty of Technology was not included among the support team. Equally puzzling is why, in the interest of rationalization, the TDTC can not merge or at the very least strongly interface with FTIP, especially where the clientele is from the food industry.

### Box 3. Services offered by FTIP

- Access to food processing equipment for use while testing and developing product market.
- Business concept development.
- Product design.
- Technical support in product development and refinement.
- Nutritional analysis of products for nutritional labeling.
- Support to set up quality assurance procedures.
- Sensory and acceptability analysis of foods.
- Brand development.
- Development of a market strategy.
- Market studies.
- Business plan development.
- Support for sourcing financing.
- Staff recruitment.
- Skills development in production, marketing and management.
- Food safety analysis.
- Support with developing equipment specification.
- Equipment, ingredient and packaging sourcing.
- Intellectual property benefit sharing negotiation.

Source: Department of Food Science and Technology, Makerere University

### University-industry interactions

#### Department of Food Science and Technology (DFST), Makerere University and Maganjo Grain Millers

##### *Background*

The linkage was established at a workshop for millers, oil processors, DFST and Uganda National Bureau of Standards (UNBS), in 2005. The workshop was held by the Ministry of Health (MoH) to launch a food fortification program in concerned industries.

The program emerged from a USAID-funded project, known as Micronutrient Operational Strategies and Technologies (MOST), which, through the MoH, commissioned a baseline study of nutritional programmes and issues in Uganda in 2000. The study was carried out by DFST, and its outcomes included agreement that the MoH mainstreams and takes charge of food fortification in industries.

After the 2005 workshop, DFST visited Maganjo to collect food samples and subsequently trained four staff in the selection and mixture of food fortification. DFST continues to visit Maganjo, at least three times a year, to monitor and evaluate fortification standards.

DFST is the prime institution for training and research in Food and Nutrition Sciences in Uganda. It sees its role as catalyzing the development of Uganda's food sub-sector. Thus Maganjo understood the objective of the linkage to be learning how to implement food fortification in its production processes.

Maganjo Millers was established as a family business in 1979, and registered as a limited liability company in 1984. It is a medium size company, employing 270 workers, with annual sales of between six to nine billion Uganda shillings.

### *Mode of interaction*

The main channels of interaction were: consultancy, technical evaluations and feasibility studies, and training of firms' employees.

### *Outcomes of interaction*

The interaction carried three goals for DFST:

- To increase the vitality of Maganjo's food processing activities, raising the profile of Makerere and DFST in particular.
- To make a contribution to the raising of nutrition standards, research and training.
- To use interaction as a learning experience for students and staff.

With four Maganjo staff trained and their fortified products on the market, the interaction is considered a success. Although Maganjo feels that the food fortification program has not been as rigorously monitored and evaluated by DFST as would have been desired, the overall outcome has resulted in higher standards of food production hygiene on the factory floor.

Finally, Maganjo's reputation as a food fortifier has gained international recognition. It was among the five, of 75 companies worldwide, short listed to be supported under the Global Alliance for Infant Nutrition Programme. However, fortified products have not performed very well on the market, but the blame for this is put on the MoH which retained a (social) marketing role it is ill equipped to fulfill.

The tangible outcomes for DFST include: one masters student, who was able to conduct research on the program, and a publication that will soon follow. Additionally, staff have done research and consultancy work, and published about the program; the Department's standing among donors, who emphasize research beneficial to the well being of society, has improved; and staff have got practical exposure "so that we do not teach merely from text books but real stuff", based on having carried out innovative and demand driven research, and offering professional services. The department in partnership with the private sector has also established a food technology and business incubation program. The aim is to promote entrepreneurship in the food sector by providing access to processing facilities and technical support in food processing, marketing and management.

Notwithstanding the above achievements, the general consensus about the interaction is that it is too early to make a definitive assertion about its success.

### *Limitations and possibilities*

DFST believes that isolated, short term, project like UILs - such as, the one between DFST and Maganjo - lack vigor and sustainability. Without a national drive for UILs and without departmental/faculty institutionalization, the success of the UIL is left to the goodwill and commitment of overstretched individuals. The upshot is delays, inefficiency and lack of accountability because there is no mechanism to follow up. The possibilities lie in nurturing and sustaining innovative research, hands-on solutions, linkages, entrepreneurship development and outreach through the business incubation program.

Maganjo identifies lack of market sensitization as the biggest limitation. In a meaningful linkage, responsibilities and risks should be thoroughly discussed and assigned to those



best placed to shoulder them. MoH monopolized the promotional marketing function, leading to poor turnover of the fortified products. This in turn resulted in expiry of fortificants because they could not be used up fast enough in milling. According to Maganjo, DFST's failure to visit the factory as frequently as required might reflect lack of internal resources committed to the interaction program.

#### *Government policy and funding mechanisms*

Government health, education, social sector, and science and technology policies advocate for close collaboration between academia and industry. There is, however, very little, if any, government funds committed to realize the policy objectives. Makerere is offered basket and not earmarked funding. Without donor funds, there would be no food fortification program. But donor funding comes with donor priorities and targets. Although MoH's five year food fortification funding proposal to the Melinda Gates Foundation and GAIN was approved last year and will take effect this year, the burning need for institutionalization will not be taken on board.

#### Makerere University Faculty of Technology/Uganda Gatsby Trust (UGT) and SESACO Ltd

##### *Background*

The linkage was initiated by SESACO in 1998 after learning from a fellow member in the Uganda Small Scale Industries Association that the Faculty and UGT support SSEs in technology and business development.

SESACO started out in 1979 as an informal home baking business operated by an itinerant construction site worker to supplement his wages. He seized an opportunity to provide convenience meals to his colleagues, who were denied gate passes to leave the site in order to buy a meal. The business was finally registered as a family enterprise in 1987 and specialized in processing cereal foods. It currently has 70 employees and puts its annual turnover at Ushs 100,000,000 (about US \$ 60,000).

UGT is the local chapter of the Gatsby Charitable Foundation (GCF) UK, established by the Sainsbury Family in the 1960s. Gatsby came to Uganda in 1994 and teamed up with the Faculty to form UGT. It enjoys autonomous status within the Faculty, except that both the Vice Chancellor and the Faculty Dean sit on its eight-member board.

The UGT/Faculty mission is to promote university-industry cooperation and develop the technological base of the small-scale sector in Uganda, and to facilitate the growth of such enterprises. To date, UGT has facilitated 1500 SSEs, distributed across 23 districts. UGT has a staff of 12 and an annual turnover worth around US\$ 160,000, derived from its business development, financial and biotechnology (Tree Project) services.

For SESACO, the objective of the linkage was to obtain knowledge and financial credit to expand production and marketing capacity. For UGT, all such linkages are meant to advance four goals: to develop a network of small scale industries linked to the Faculty of Technology; to introduce university students to the opportunities and potential of the small scale industrial sector, assisting them to develop technologies appropriate to it; to assist SSEs to overcome their problems through extension service and mentorship; and to enable SSEs access to credit for growth.

### *Mode of interaction*

The main modes of interaction include: the rendering of engineering and consultancy services by the Faculty/UGT; designing and developing student prototypes for marketing to the firm; developing appropriate technology on demand from the firm; and organizing training courses for managers and workers to boost their managerial and technical skills.

### *Outcomes*

SESACO says they have attained managerial, production and marketing knowledge from attending seminars, workshops and exposure tours of places as far afield as Brazil. This has helped them to diversify their product range and improve on their branding. The promised help on the roaster machine did not materialise. On the other hand, SESACO was introduced to appropriate packaging technology from Brazil; this was acquired through an interest free loan from the African Development Foundation (ADF) introduced to them by Gatsby. Thus SASACO switched from manual to automatic packaging. The Gatsby Revolving Fund enabled SESACO to expand the scale of its operations. However, the insistence by UGT, that its 'loan-enterprises' must grow progressively through its four-tiered structure of US \$ 2,000, \$ 4,000, \$ 7,000 and \$ 10,000 respectively, disappointed SESACO who felt their ambitious expansion plans thwarted.

Over the last three years SESACO has been one of the placement centres for some 50 students from the Faculty, but neither the Faculty staff nor the students contributed any new designs or artefacts. The new products from SESACO, such as the "instant soya cup", were developed internally by the firm. On the whole, the interaction is considered successful from the standpoint of SESACO's human resource development, student development, financial support and marketing expansion.

### *University conditions*

UGT's autonomy has allowed it a lot of leeway in making the linkages. It seems that the university bureaucracy and donor dependence are still regarded as a constraining factor, but, exactly in which ways, was not elaborated. One pointer to the problem could be the step UGT took to set up independent companies to run its operations, notably Gatsby (U) Ltd for business development and engineering services, and Gatsby Microfinance Ltd for its financial services.

### *Firm conditions*

The main constraint experienced by SESACO is that when it came to assessment for financial credit, UGT tended to rely more on peer group selection than on the firm's individual performance. Secondly, the distance and location away from UGT's showrooms inhibited the marketing drive. Thirdly, there was a problem failure to harmonize production priorities between the perspectives of UGT and SESACO.

### *Government role*

SESACO describes government policies and funding mechanisms as designed to have a rhetorical rather substantive impact. "If they were serious I would be using mechanical, rather than the tediously manual methods of picking and sorting. I need graders and other machines but no financial assistance is forthcoming from government," says the Managing Director. UGT's view is that government is finally coming round to support them. When UGT completed the construction of two industrial parts (in Kampala and Mbarara), government recognized the value of this model and has commissioned UGT to build 20 new industrial parks over the next five years.

## Faculty of Technology/Uganda Gatsby and Mukisa Fine Millers

### *Background*

Mukisa Fine Millers is an animal feeds processing firm, which was started in 2000. Originally a family business, it was registered as a sole proprietorship in 2003. It has a small workforce of 12, but its annual turnover is US \$ 150,000 – 200,000.

The proprietor had been a coffee processor and poultry farmer for five years prior to coming into contact with Gatsby. Gatsby was introduced to the Mukono area in 1999, through workshops intended to promote enterprise start-up. Thereafter, he opened the feeds factory.

### *Channels of interaction*

The main channels of interaction were: training, courses provided through workshops and study visits, financial services and advice, and attachment of students for industrial and veterinary nutrition training.

### *Outcomes of interaction*

Mukisa had hoped that the linkage would bring his firm financial facilitation to expand the business and improve the feeds processing technology. UGT has extended loans that have enabled the firm to erect its own structures instead of renting them. The feeds technology development program has not yet taken off; instead the manager was introduced to the Faculty of Veterinary medicine at Makerere to learn more about feeds formulas. The interaction was found to be of limited value because the feeds ingredients that the VET school demonstrated and recommended - such as, oats - were not locally/readily available.

There has been no improvement of industrial processing. For example, sifting, mixing, sorting, wetting and packing are still being done manually; only hulling, milling and sewing are done by machines. Equally, disappointing for Mukisa has been the failure by UGT to introduce feeds processing technology, which can effectively utilize locally available raw materials (e.g. cassava).

The interaction, therefore, has been only a partial success with regard to technology development. The real impact has been in expanding the business and gaining new knowledge through exposure visits.

### *Conditions in the university*

These are the same as those already pointed out in case study 3.

### *Conditions in the firm*

Financial constraints and working to different priorities from those perceived by UGT.

### *Government policy, funding and mechanism*

The government policy of allowing the exportation of unprocessed grain is killing local processing firms because the by-products utilized in the feeds factory are lost

Faculty of Technology/Uganda Gatsby and National Tree Seed Centre (NTSC),  
Namanve

*Background*

The NTSC is one of the business centres of the National Forestry Authority (NFA). It was initiated in 1992 under the then Forest Department with funds from the governments of Uganda and Norway, and UNDP, and technical support was provided by the Danish Development Agency (DANIDA).

The mandate for NTSC is to supply, promote and conserve genetically suitable tree seed and other reproductive materials through the following strategies: seed procurement and distribution, tree nursery management, tree seed source development, and training and advisory services.

NTSC has a staff make-up of 80 employees, including four dedicated to research and development (R&D) activities (seed technology and tree improvement). Its annual turnover ranges between US\$ 300,000 – US\$ 350,000, with 8% to 12 % going to R&D activities.

The Gatsby Clubs Tree project linkage was initiated by UGT in 2003 as a biotechnology transfer partnership to improve tree productivity through integration of biotechnology techniques in traditional propagation systems.

*Mode of interaction*

The main strategy is to work with small scale entrepreneurs, through Gatsby Clubs, to plant eight million trees across the country by 2010. The plan envisages commercialisation of clonal tree technology to cater for domestic, wood and timber needs. As such, the main channels of interaction involve imparting, through training courses, improved clonal seed technology from Mondi Business Paper of South Africa. Other channels of cooperation include: short term collaboration on R&D on species site matching, and performance monitoring of seed tree nurseries (a kind of project management service) to ensure quality, better recovery rates and a more controlled calendar for seedlings and planting.

*Outcomes of the interaction*

The main goal of the linkage for UGT was to generate awareness of clonal tree production among enterprises in its SSEs network; and get them involved in mass production and distribution of superior seedlings and species of trees like eucalyptus, pine and cypress. For NTSC the goal was to share experience, support the private wood industry sector, joint promotion of a sustainable wood energy production. The linkage, which started in 2005, is still going strong. Prior to getting training and advice from the NSTC Gatsby Tree Nursery, the recovery rate was as low as 5%. The current recovery rate averages 50% to 60%. This demonstrates that the training was successful in achieving its goal. Gatsby Clubs are now able to establish their own low cost regional clonal propagation nurseries, which they have done in Fort Portal, Mbale and Mbarara beside the original site of Masindi. Furthermore, UGT has embarked on a drive toward sustainability by diversifying away from Eucalyptus for wood fuel to other timber species to meet other needs as well. Farmers are establishing their woodlots and Gatsby has extended its revolving credit system to them.

### *University conditions*

Firstly, Faculty staff members tend to request their research payments upfront and do not keep an adequate record of finances. Secondly, university staff has been lulled into dependency to the point of hampering inter-faculty collaboration on university-industry linkages. The Faculty of Forestry sent three students to be attached to Gatsby Industries, but without a budget for supervision and follow-up. Thirdly, the more "lucrative" the project is perceived to be, the more suspiciously university staff is viewed as a "stealer of knowledge" by potential SSE collaborators. The above points, therefore, raise the issue of institutional integrity and image in the success or otherwise of the interaction.

### *Firm conditions*

NSTC lacks its own extension service to offer advisory and monitoring knowledge as a public good. Currently, such services are rendered intermittently - depending on affordability, which limits productive interaction.

The regulatory framework does not provide for staff attachment to client projects. This hampers rapid information exchange and knowledge sharing. For example, a lot has changed in clonal tree technology, and the marketing has improved since the staff training provided by Gatsby. It is doubtful that the Faculty was aware of these developments and the likely impact on the programme. This could leave them potentially exposed to production spillovers of their nursery products.

### *Government policies and funding mechanisms*

The project had hoped to benefit from the government's much touted Farm Income Grant. But the fund, like many others, has seemingly become a mechanism for dispensing political patronage; it is being spread thin and overlooks deserving projects.

### University-community-enterprises interactions

Three other interface features of the research landscape at Makerere worth noting are: i) the engagement of community organizations, NGOs and local government through commercial relationships, trade shows, continuing education, participatory research and demonstration workshops, etc; ii) spin-off companies, and iii) cross-sectoral partnerships.

The Faculty of Agriculture has been at the forefront of these outreach activities, either directly with community groups or in partnership with others - including, Makerere University Agriculture Research Institute Kabanyolo, NARO, local government, NGOs, and commercial firms. Indeed, these types of collaborative linkages are given significant weighting, as shown in Table 11 below.

**Table 11. Weighted average index for existence and importance of types of collaborative partners**

<b>Types of Collaborative partners</b>	<b>Existence</b>	<b>Importance</b>
Other universities in your country	1.5	3.6
Other universities in sub-Saharan Africa	1.8	3.7
Universities in Europe	2.8	3.6
Universities in USA	2.6	3.4
Universities of U.K	2.1	2.5
University of Asia	2.2	3.1
Universities elsewhere	1.8	3.1
National government departments	2.2	3.7
Local or regional government departments	1.6	3.5
Community organizations	2.2	3.6
NGO in your country	1.6	3.5
NGOs in internationally	2.4	3.5
Public research institutes	1.8	3.8
Private research institutes	1.9	3.4
NEPAD science and technology associations	2.0	3.1
Sub-Saharan African academic or professional associations	1.5	3.3
Agricultural organizations (e.g. Banana Research Network for Eastern and Southern Africa)	1.8	3.3

Source: Field Survey

Some of the important products that have been extended or developed with the community, through these channels, include the products described below.

**The Soil Test Kit (STK):** spearheaded by Prof. Moses Tenywa of the Department of Soil Science, was developed in response to farmers' demand for simple, quick and low cost field diagnostic tools to support their decision making processes in addressing soil fertility problems at the grassroots. The STK consists of chemical reagents that test for five vital soil fertility parameters (PH, soil organic matter, Nitrogen, Phosphorous and Potassium). In the past, soil samples were tested in laboratories, now it can be done in the field by farmers themselves or with the assistance of extension workers. The reagents can test many samples enabling them to benefit big communities, although it can be owned individually. Besides being handy and easy to use, it is affordable. It can be used to test up to 66 samples for only USD 100, whereas the cost of laboratory analysis would be USD 740.

**Biofertilizer technology:** From tests carried out by farmers themselves using the STK, the absence of nitrogen has been widely confirmed as a major constraint in raising crop productivity. Consequently, the production and distribution of bio-fertilizers, such as Rhizobia and compost, has taken on added urgency. The Department has made a contribution to solving this problem by producing biofertilizers containing legume nodule bacteria that fixes nitrogen and make it available to the crops. The bacteria are mixed with a suitable carrier material. The biofertilizer is applied by seed coating and then immediate planting.

**Varietal improvement of the soy bean:** Named Maksoy 1N and Maksoy 4M, these varieties carry a higher protein and oil content that are resistant to the 'soy bean rush disease' and give a higher yield per unit area. According to Dr. Phenehas Tukamuhabwa, "Breeding research has to be relevant to the needs of industry and the farming community. It is them who tell me what they are interested in otherwise the end

product will not be commercialisable". The work has been going on since 1990, and the current varieties are the fifth in the cycle of varietal releases.

## **Integrated Pest Management Technology**

### Makerere University Faculty of Agriculture and P'lkwi Farm Group

#### *Background*

This linkage was initiated by the Department of Crop Science in 1994, as part of an international collaboration in agricultural research - known as the Integrated Pest Management Collaborative Research Support Programme (IPM-CRSP) launched in 1993. The program is supported by the United States Agency for International Development (USAID), which conceptualized it to address health, environment, and economic issues globally, through IPM interventions. It is managed by Virginia Polytechnic Institute and State University (USA) through a consortium approach involving international agricultural research centres, NGOs, and other universities, notably Ohio State University (SA) and Makerere University.

IPM-CRSP has no special institutional status within the Faculty. It is coordinated from the Department of Crop Science and is staffed by 10 researchers - all of them hold PhDs and are well published. Currently, it also has eight post-graduate students.

The objective of the program is to reduce poverty through reducing losses due to pests, and to institutionalize participatory methods in research. Uganda was not initially identified as a major site for the programme - Mali in West Africa was. In order to get Uganda into the programme, a region that marked the agro-ecological conditions, the crops and the pest problem that would provide comparative results had to be found. Bukedea (P'lkwi) was thus selected for the programme.

P'lkwi farm and group were formed in 1993 by a group of 12 households after they had gone through a traumatizing experience of the civil insurrection that occurred in eastern Uganda in the period, 1986 to 1994. Two incidents, involving the rape of women by the insurgents, fuelled the decision to form the group. One incident involved the rape a girl who had just been wedded. The rebels raided the home of the husband and demanded that they remarry her and that he pays them a bride price of seven cows. Even then, one of the rebels held the girl in the presence of her father and raped her. This experience was traumatizing for the bride's father, to the extent that he could not speak for a long time. The two families of the bride and bridegroom, as a result, vacated their homes and moved in with Rev Ebukalin and his family. Rev Ebukalin, the manager of the farm group, and his wife looked after the families to help them heal the trauma.

The second experience produced a positive result. This involved the gang raping of a girl by the rebels, resulting in her impregnation. This traumatizing experience led her to join the other families who had come to live with the reverend. The name of the father of the reverend was Okwi and so the group decided to call themselves P'lkwi, which means 'of Okwi'. The new community formed a church and in order to deal with the needs of feeding, decided to establish a farm on Rev Ebukalin's land. Rev Ebukalin had trained as an agriculturalist at Makerere University, where he obtained a diploma. His wife was a teacher. The farm group eventually grew in number, to twelve members, and out of its farming activities - which involved both traditional and modern farming techniques - won a district prize for its achievements in farming.

As a result, P'lkwi became a learning centre for the near-by community and the Farm Group became a member of the Uganda National Farmers Association-UNAFA. This opened up opportunities for the Farm Group to link up with other groups, including links with farmers in Worcester (England) where Mrs. Ebukalin became a member of a farmer's association as a farming unit. Since then, the P'lkwi family and the P'lkwi Farmers Group became a unit of production and distribution, as well as a learning centre for the near-by communities.

The manager categorises the Farm Group as 'middle-sized', but claims that it has now some 1,300 members from 12 villages. It estimates its economic activities to include: Cassava, generating an income of Ushs 27,000,000 (about \$ 15,000); Vegetable oil, generating an income of Ushs 57,000,000 (about \$ 32,000); and R&D expenditure is estimated at 20%.

The firm is still in the process of evolving into a business enterprise. Currently it is run as a cooperative managed by Rev Ebukalin and Mrs Ebukalin (see appendix). The Group also works closely with the government of Uganda to promote rural industrialisation so that products are marketed domestically and to raise levels of production. The Group has also linked with FAO, which donated an oil mill to improve on oil production and nutrition feeding.

#### *Nature of interaction*

##### *(a) Links with UNAFA, Makerere University and Ohio State University*

The first contact of P'lkwi with the University came through the Uganda National Farmers Association-UNAFA when their farmers' group became a 'special interest group', called the External Link Farmer-ELF, during Mrs. Ebukalin's visit to Worcester State in the United Kingdom to become familiar with farming as a farming unit. At that point, the P'lkwi family and the P'lkwi farmers became one 'Group', and joined UNAFA as members, in 1995, to tap into the farming knowledge provided by the Association. It was through UNAFA that they linked with Makerere University in Kampala-MUK when it introduced a new course, called Integrated Pest Management, into the curriculum. At this point, the Ohio State University-OSU came into the picture when they granted scholarships to students at Makerere to study biological pest control. These students later wanted to carry out their experiments on farms and that is how they came to work with the farmers at P'lkwi. Since then, a partnership was formed between P'lkwi, MUK and OSU; and through this link, one postgraduate student took up the study of pest control by looking at striga which is a pest that feeds on millet and sorghum.

In the process of his studies, the farmers challenged the student's research design protocol, which excluded the existing knowledge that the farmers used to control striga. The community insisted that their knowledge of striga be included in the study. At the end of the student's scientific experiments - based on his design - it was found that the community's knowledge was superior to that found by the student in his experiments. It is at this point that a professor from the OSU allegedly took the findings of the community practices and published them in an academic paper that did not acknowledge that the knowledge was a community common practice, but claimed the findings to be his own 'discovery.'

The peasant producers in many parts of Africa have known for thousands of years that striga is parasitic by nature; compensating for the lack of its own root system by penetrating the roots of other plants, diverting essential nutrients from them and stunting



their growth. Also known as witchweed, Striga infests an estimated two-thirds of the 73 million hectares devoted to cereal crops in Africa, resulting in crop losses of up to 70% among subsistence farmers. In sum, it accounts for an estimated 4.1 million tonnes of cereal in lost cereal yields each year, and is considered by many experts to be the greatest obstacle to food production in Africa.

Feeling aggrieved, P'lkwi summoned the support of the head of the Crop Science Department in the Faculty of Agriculture at MUK to continue giving support to research aimed at validating their indigenous knowledge. At this point, a young lady by the name Rita Laker (an Acholi woman married to an American) of the University of Michigan, working on crop oil, came to P'lkwi with the aim of carrying out research on the processing of ground nuts into cooking oil. She found that the local people crushed the nuts on a stone, which sparked her interest in the issue of appropriate technology. She thought that this form of technology could be improved, and thus advocated the adoption of an appropriate Ewing machine for the purpose of drawing on indigenous inspiration, which proved successful and is now operative in the community.

#### *Outcomes*

According to the coordinator of the program, Prof. Kyamanywa, the farmer's contribution was acknowledged. The official report pointed out that,

"in Uganda farmers noted that Striga had only become a problem with the loss of their cattle due to a regional insurgency in the 80s and subsequent forced displacement into camps. Further questions reveal that with the loss of cattle acreage per farm family had declined, as had the practices of field rotation, fallowing and/or additional of animal manure "weakens" Striga. They were also aware that continuous planting of sorghum in the same fields tended to build up Striga population".

With regard to the Striga management strategy for sorghum, the official report notes that,

"the trial components consisted of using a Striga tolerant variety, fertilizer, and an indigenous plant suggested by the farmers and known locally as Striga chaser (*Celosia argentia*). A laboratory investigation revealed that *C. argentia* induces suicidal germination and illustrated how scientific investigation in the laboratory can document farmer knowledge".

Farmers also indicated that Striga was less of a problem when cotton was used as a rotational group. Longer term rotation trials were introduced to evaluate the effectiveness of rotating sorghum with trap crops – cotton and cowpea - to manage Striga.

The evidence above shows that, through its linkages and interactions with different stakeholders and partners, P'lkwi was able to engage the universities in meaningful research, which led to the development of knowledge for its members in their productive activities.

The P'lkwi group was able to expand its membership based on these developments. It was able to engage in the development of different kinds of technology, which enabled its members to improve their production and gain a share of the market. They witnessed a number of technological innovations that drew heavily from their indigenous base - making it possible to fabricate different types of machines that improved cultivation, planting, harvesting and transportation. Through links and partnerships, the group was

able to obtain relevant machinery, such as brick interlocking machinery for the improvement of housing for its members.

An outcome for the university: The University of Makerere was able to link with the P'ikwi group and through its links with the Ohio State University, was able to engage in meaningful research that led to the discovery of new knowledge in the agricultural economy. The university, however, encountered a negative experience with Ohio State University, which allegedly 'stole' its knowledge on the control of the striga pest.

An outcome for the partners: The IITA was able to form an IT Uganda unit through its links in the collaboration. IT Uganda now operates throughout the country, implementing a program in Northern Uganda using similar approaches gained in P'ikwi, and also by developing a new approach called the "Voucher System".

Was the linkage successful? Yes, it was. As shown above, it has resulted in the improvement of the production, processing and marketing of the community products.

#### *Limitations and possibilities*

The evidence produced also reveals several limitations in the relationships:

*In terms of the research group and the university:* Ohio State University publishing the research results on striga, if true, was unethical. The P'ikwi group was not protected by way of intellectual property rights by Makerere University, which introduced the OSU through bursary schemes.

There is also the tendency for the researchers to adopt a 'top down' attitude to community knowledge by designing their research independently instead of adopting a participatory approach. Dissemination of the findings was inadequate, as only part of the findings was disclosed to the community groups. There is also a lack of recognition of indigenous knowledge systems (IKS) by scholars, and therefore the communities are always 'cheated' out of their knowledge products. There should be a sharing of IPR when registered and exploited for profit.

*In terms of the firm and the industrial sector:* The P'ikwi relations with industry are not organic and there is a tendency towards weakening of the community efforts by over-competition. On the other hand, P'ikwi is challenged to develop its products to be able to cope with demand in particular lines, but the *profit margins* are small compared to those of industry. *The legal forms* of managing the business are limiting. The limited liability company form 'sophisticates' the groups. Partnerships are too loose. For the mill being constructed, the groups intend to adopt the cooperative form of ownership and management. The Banking system is oriented toward supporting big industrial units. Moreover, its interest rates are too high - around 14% - which makes credit unaffordable. There is a need to register and obtain a land title for the mill, but the legal form of the group is still problematic.

#### *Government funding mechanisms*

There is practically no government funding mechanism in support of the kinds of linkages described above. The linkages with Makerere University were a result of an external funding and research initiative. Currently, government is trying to target community groups, such as P'ikwi, to become enterprise developers through a

procurement system called NAADS. There is also the introduction of the Institution Support Fund to groups under NAADS, but these funding possibilities are very much subject to corruption.

*The future of the linkages:* The future of such linkages with the universities are likely to decline as national and international NGOs become increasingly involved in the area of research in communities. Furthermore, the commercialization of the universities is not strategically targeting communities in the research priorities. Only big firms, which are able to provide adequate funding to the universities for their research, will benefit; and hence, the need for a new kind of university whose vision and mission is to promote community and regional development.

#### *Indigenous medicinal technology*

It is important to note that some of the interactions between the university and community groups result in asymmetrical benefits to the university. The university ends up with a stock of potentially beneficial indigenous technical knowledge extracted from the communities using partly participatory methods. University researchers themselves are aware of this practice, which accounts, in no small measure, for the lack of trust between universities and communities/firms. For instance, the Department of Botany - using local administration and a host of NGOs - engaged local communities of poultry keepers and farmers in the Rakai District on the south-western side of Lake Victoria to learn about the medicinal plants they use in the treatment of fowl diseases, including methods for preparing and administering of the medicines. This was done between January and July 2005 under the auspices of Innovation @ Makerere University, a fund set up by the Rockefeller foundation. According to the lead researcher, Prof. Remegius Bukenya-Ziraba, 20 different plant species were found to be used by farmers to treat fowl diseases. One tangible outcome of that study was the publication of a highly rated article in the Norwegian Journal of Botany.<sup>6</sup> Although similar studies have been carried out in the Mbarara and Mbale districts, Prof. Bukenya admitted that the various communities involved had not been brought together to reflect on the significance of that knowledge, the potential commercialization or promotion of fowl herbal medicine, or to account for how the knowledge gathered was used by the researchers.

#### *Spin-off companies*

Spin-off companies started by researchers at Makerere University and directly arising from their research activities are an emerging phenomenon that is likely to take on added significance in light of the new Research and Innovations Policy. Several researchers are already active on the biofertilizer and biofuel fronts, but none have received the same recognition as the Dr. Musaazi's T4T Company. T4T's flagship biotechnology product is the low-cost sanitary pad made from local papyrus and paper. Research at the Makerere Institute of Social Research has demonstrated the positive impact of the pad on the school enrolment and retention rates of rural girls. T4T employs about 50 workers. Papyrus fibers are beaten, dried and softened manually. They are assembled with a moisture barrier and mesh covering. The pads can be purchased with an adhesive backing or without adhesive that slip into knickers with special elastics to hold the pad in place. Dr. Musaazi contends that, "MakaPads" are the only sanitary pads

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<sup>6</sup> See R. Bukenya-Ziraba, Denis Kamoga, and Deogratius Olila. (2007). Medicinal plants used to treat fowl diseases in Rakai District, Uganda, Norwegian Journal of Botany, Vol VII, No 1, pp. 21-32.

manufactured in Africa, are half as costly as the other imported brands, but they have a higher absorption capacity and can be used for 8-10 hours.

#### *Cross-sectoral partnerships*

One structure that has emerged to address these partnerships is the Makerere University Private Sector Forum (MUPSF), which brings together the public, private sector and Makerere University. The forum is a unit in the Vice Chancellor's office. The rationale behind its formation is that, although Makerere has generated a number of technologies that Ugandan firms have not tapped, the private sector firms in Uganda are constrained by number of factors: limited capital; lack of appropriate technology; poor quality products; limited access to the market; lack of a poorly trained labour force; and very limited investment, if any, in R&D. The forum aims to overcome this deficit by encouraging private sector participation in university activities, promoting the development of demand driven skills at the university, enhancing research technology development and transfer to address private sector needs, strengthening student field attachments and internships, and engaging in robust policy analysis, research and advocacy. Apart from naming many outstanding corporate CEOs as professors and honorary research fellows of the university, the forum has given itself the following concrete tasks:

- a) Introduce private sector-funded Research Chairs named after a private sector enterprise or a person providing the fund. The research would be responding to private sector-identified problems and mentoring students in preparation of employment by the funding enterprise. This is hardly surprising because our survey of the types of relationships between universities and firms showed that firm donations and firm sponsorship were among the least addressed, although among the most desirable, as Table 6 shows.
- b) Establish a National Policy Guidance Project, under which sector think tanks would be established, and existing policies analyzed and a new policy advocated.
- c) Establish a Technology Innovation and Transfer Program, under which technology parks as well as technology and business incubation centres would be established, and small and medium enterprises assisted in start-up and development.
- d) Promote student field attachments and internships.
- e) Strengthen the performing arts through support for the development of the film industry, theatre and sports.

## KYAMBOGO UNIVERSITY (KYU)

### Research, vision and culture

Kyambogo University (KYU) was established by a Statutory Instrument in July 2003. It began with a vision to be a centre of academic and professional excellence; and a mission to advance and promote knowledge and development of skills in science, technology and in other such fields having regard for quality, equity, progress and transformation of society.<sup>7</sup>

KYU prioritizes **teacher education** (which includes basic sciences), **special needs education**, and science and technology. In a sense, this reflects KYU's roots since the university came into being through the merger of three, hitherto independent institutions, previously engaged with those fields: Institute of Teacher Education (ITEK), Uganda National Institute of Special Education (UNISE) and Uganda Polytechnic Kyambogo (UPK).

The university has no strategic policy yet. Neither does it have research and intellectual property policies. But its "strategic intent is to achieve within five years: i) a high level of research and management through advanced application of information and communication technology; ii) optimum human resource capacity to harness natural resources and tap opportunities from international advances to achieve quality in service delivery; iii) high international standards of teaching, learning and research."<sup>8</sup> This is undoubtedly a tall order for this young university whose staff posts (420 in total) are mainly filled by teaching assistants and assistant lecturers.

Not surprisingly, the KYU staff interviewed saw the "strategic intent" more in terms of a declaration than a projection of achievable goals for transformation. This is because the university is still mired in immense problems of lack of sufficient numbers of permanent and well qualified staff; teaching overload which leaves little room for research and publication; old and inadequate laboratory facilities and materials for training and research; inadequate research funding; and an over-centralized management system. Tables 12 and 13 below indicate the paucity of postgraduate programs at the university. This could be partly accounted for by the lack of highly trained academic staff to supervise studies at a high level, especially in the fields of science and technology. There are very few senior academics, for example, the university has only 30 academics holding a PhD. It is asserted however, that as part of the academic and research development program, the university is currently sponsoring a total of 78 staff members; 49 at PhD level, 19 Masters, and 10 bachelors<sup>9</sup>. The university currently produces post graduates only in the fields of history, religious studies and sports science. Plans to produce others in the fields of art and industrial design, educational planning and management, and literature have been mooted. For a university with the stated objective of promoting science and technology, the graduate and enrolment rates for engineering and science are equally worrisome. Enrolment rates have been falling from a high of 27.1% in 2002/3 to 26%, 24%, 23.4%, and 16.3% respectively thereafter. The graduate

<sup>7</sup> Department of Planning and Development. (August, 2007). Kyambogo University Strategic Plan 2007/2008 – 2011/12, p12

<sup>8</sup> Ibid

<sup>9</sup> Finance and Planning Departments. (Jan 2008). Report on Second Consultative Budget Workshop, Kyambogo University

rates have been uneven, from 33.5% in 2004 to 18.1% in 2005; 23% in 2006, 11.2% in 2007 and 21% in 2008.

**Table 12. Graduate and post graduate graduates, Kyambogo University 2004-2008**

Category	2004	2005	2006	2007	2008	Total
Engineering	1067	380	376	420	558	2801
Science	121	137	85	238	311	892
Education	1514	1294	575	2652	649	6684
Special Needs Education and Rehabilitation	155	172	90	1157	1006	2580
Vocational and Development Studies	686	879	580	1012	1023	4180
Arts and Social Sciences	0	0	315	380	587	1282
<b>Total</b>	<b>3543<sup>10</sup></b>	<b>2862<sup>11</sup></b>	<b>2021<sup>12</sup></b>	<b>5859<sup>13</sup></b>	<b>4134<sup>14</sup></b>	<b>18419</b>

Source: Kyambogo University

**Table 13. Undergraduate enrolment rate by disciplines and gender 2002/3 – 2006/7**

Category	2002/2003			2003/2004			2004/2005			2005/2006			2006/2007		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Engineering	873	75	948	1023	111	1134	1145	125	1270	1406	175	1581	1152	185	1337
Science	318	63	381	448	116	564	556	154	710	690	204	894	710	229	939
Education	765	355	1120	1024	416	1440	823	444	1267	1045	758	1803	1307	1088	2395
Special Needs	0	0	0	246	275	522	225	289	514	300	423	723	328	429	757
Vocational	711	704	1415	1198	1093	2291	1356	1123	2479	1602	1458	3060	1575	1413	2988
Arts and Soc.Sc	465	572	1037	576	668	1244	664	714	1378	1190	1315	2505	2611	2944	5555
Total	3132	1769		4515	2680		4769	2649		6233	4333		7583	6288	
Category			4901			7195			7618			10566			13971

Source: Kyambogo University

The Strategic Plan and KYU staff speak strongly about the need for KYU to expand "collaborative linkages" beyond mere placement of students for industrial attachment. Expanding linkages is described as building the capacity of KYU to develop and transfer technology and formalizing partnerships with communities, with a view to transfer and apply learnt/created knowledge/skills to community applications.

### Research structures

The research structure at Kyambogo University is still in its infancy. The School of Graduate Studies was established recently, in 2008, to spearhead and monitor research activities at the university.

<sup>10</sup> 945 Bachelors' Degree; 2598 Diplomas

<sup>11</sup> This includes the three Masters Degrees (1 Sports Science, 1 History, 1 Religious Studies); 1037 Bachelors'; 1765 Ordinary Diplomas; 57 Post Graduate Diplomas

<sup>12</sup> 744 Diplomas; 22 Post-graduate Diplomas; 1245 Bachelors; 10 Masters (7 Religious studies, 2 History, 1 Sports Science)

<sup>13</sup> 3927 Diplomas; 1927 Bachelors; 5 Masters (3 Sports Science, 1 History, 1 Religious)

<sup>14</sup> 1832 Diplomas; 2295 Bachelors; 7 Masters (4 Religious Studies, 2 History, 1 Sports Science)

## University-industry interactions

### Kakira bio-ethanol cluster project

#### *Background*

This project brings together Kyambogo University's Department of Industrial Engineering and Production as facilitators, and a cooperative enterprise group of 60 home based, local gin (waragi) distillers found around the vast sugar plantation of Kakira Sugar Works Ltd (KSWL).

The group was originally known as **Abangi webasonga**. Its formation in 1997 was very much a "survival strategy" by six KSWL workers who had been or were about to be laid off. By 2005, when the group was included in a **Cluster Project**, membership had risen to 200.

Over the years the group faced three serious challenges: improving the quality (fragrance) and stabilizing the alcoholic content of their gin; reducing high levels of molasses spillage (over 20%) and energy (fuel wood) consumption; instituting better waste disposal methods of the highly acidic 'salala' waste liquid that is left after gin distillation. The liquid destroys KSWL's sugar fields and strains a relationship, which is vital for the continued supply of sugar molasses to the distillers.

The group approached their local member of parliament, who also happened to be the Minister of Industry and Trade. He linked them to the United Nations Industrial Organization (UNIDO) office in Uganda, which in turn linked them to Makerere University's Faculty of Technology Outreach Programme in 2005. Through the programme, the faculty looks for key business and academic institutions to promote and manage possible clusters and cluster research under the Sida/SAREC funded "Innovation Systems and Clusters Programme for Eastern Africa (ISCP – EA).

During the second ISCP – EA regional conference held at Jinja in March 2005, Abangi webasonga and Kyambogo's Dr. Ssengonzi Bagenda of Industrial Engineering and Production, came together to form the Kakira Bio-Ethanol Cluster. As a researcher with long standing interest in alternative fuels, Dr. Ssengonzi became the cluster's facilitator through whom new knowledge and research from the university would interface with the group's production and marketing problems and needs. The ISCP-EA is driven by a Triple Helix Model of collaboration between academia, industry and government. Makerere's Faculty of Technology currently oversees 22 such cluster projects in Uganda over diverse fields, while the college of Engineering and Technology of Dar-es-Salaam University oversees those in Tanzania, and Eduardo Mondlane University's Faculty of Engineering oversees those in Mozambique.

#### *Mode of interaction*

The main modes of interaction include: training, design, fabrication and testing of new equipment and technologies, and rendering of engineering services. The thrust of Dr. Ssengonzi's research was the production of a higher quality gin, using more efficient distillation and purification processes that would minimize energy and environmental costs.

The main partners in this interaction were: the Abangi group, which reconfigured its membership to become a cluster thus drawing closer the value chain functions of suppliers and marketers into the production of gin, bio-ethanol and other products. The group sent its officials to be trained in Kyambogo and then embarked on the training of trainers programme among its membership. It also offered sites for the field-testing of new equipment, and received and shared knowledge and experience with engineering undergraduate students from Kyambogo University on industrial attachment.

Makerere University's Faculty of Technology channeled and monitored funds from Sida/SAREC, and organized "exposure" visits for Abangi group officials within and outside the country. Kyambogo University's Department of Industrial Engineering and Production's institutional research contribution was: design and fabrication of a high proof distillation column and a continuous distillation column; fabrication of a fuel saving hearth; and use of activated carbon for ethanol polishing. The department also trained the Abangi group in project leadership, energy efficiency improvements, fabrication of distillation columns, and on new distillation and purification technologies as well as better methods of waste disposal and production of fuel grade ethanol from gin.

#### *Outcomes*

The objectives of the linkage was to make gin production more competitive; to produce automotive fuel grade ethanol; to diversify the production of ethanol away from grown crops (sugar cane); to produce biogas and other products from gin distillation waste (salala) as a way of protecting the environment; and to identify new markets for the cluster project's products.

Both partners were of the view that the interaction has so far worked well because some of the key objectives have been realized. The introduction of new distillation equipment and technologies has improved gin production tremendously. In the past, three distillations were carried out to produce gin concentrated up to 73%. Today, one distillation is enough to raise a 90% concentration. Furthermore, project members have been trained to dilute the gin to a predetermined concentration level of 43%.

With the improvements made on the boiler machines, the consumption of fuel wood has been cut by a third. The construction of a better drainage system has, for the time being, contained the industrial waste disposal problem. However, the lack of adequate funding has curtailed conversion of the distillation waste into other products.

The technical improvements have substantially raised the Cluster Project's annual turnover from US\$ 70,000 to US\$ 100,000; registered membership, which had slipped to 60 people, is rising again as members benefit from the new knowledge and technologies introduced. The university, according to Dr. Ssegonzi, considers the interaction a success because it has contributed to bridging the gap between theory and practice; and resulted in production and dissemination of demand driven technologies that have solved a problem for the local gin industry and, in the process, generated more research in the direction of diversifying alternative fuel sources.

#### *Limitations and possibilities*

Kyambogo University was established by Act of Parliament in 2003, which provided for the merger of three tertiary institutions that had been operating independently and specializing respectively in teacher education, special needs education and science and



technology. The new institution has not matched staffing levels, teaching requirements and research infrastructure, with the surge in student numbers. Consequently, the university is yet to come up with a research agenda besides the issue of prioritizing biotechnology or agro-processing or simply linking research to industry.

The university interface with industry mostly through the mandatory 90-day student attachment for industrial training. In this connection therefore, the linkage between the Department of Industrial Engineering and Production and the Kakira Bioethanol cluster is for all practical purposes due to the individual initiative of Dr. Ssengonzi. Indeed, Dr. Ssengonzi bemoans the lack of an institutionalized forum for regular consultation and cooperation with industry. Such a forum would ensure interaction in curriculum development that takes on board the lessons and experiences gained in cluster projects, for example.

The second limitation is the lack of earmarked funding for the university to pursue and sustain linkages with industry. Nor is government inclined to compel or persuade industry to link with the university through research activities. Being privately owned, many firms fear that linkage with universities would expose them to unwelcome competition of business rivals.

#### *Government policies and funding mechanisms*

For the group, the biggest drawback has been government's failure to intervene and support the linkage when Sida/SAREC funds for the bio-ethanol cluster ended. Consequently, the possibilities of processing more products from gin or its distillation waste have been put on hold.

#### Vacuum Sealed Matoke Project

This project owes its origin to the presidential initiative on promoting science and technology which saw Dr. Byaruhanga Bazirake of the Food Processing Technology Department winning sponsorship as part of the effort to modernize the banana industry in Uganda. Initially, the President wanted the project to be set up as a factory, but the Ministry of Finance Planning and Economic Development - which manages Presidential initiatives - wanted it incubated through the Uganda Industrial Research Institute. UIRI provides premises and equipment, procured by the Ministry of Finance, for analysis. The main thrust of the incubation is to upgrade the processing technology for extending the shelf life of bananas up to between seven to 10 days. The equipment is worth 700,000,000 Uganda shillings (approx USD 400,000). What is striking about this interaction is the complete marginalization and exclusion of Kyambogo University. Yet, this project could have enabled it to overcome some of its infrastructural weaknesses with regard to laboratory facilities. Failure to harness institutional synergy is generally evident throughout research planning in Uganda. The deliverables of the project will be the following:

- Fresh vacuum sealed bananas projected at 60 tons per week in Kampala and other urban centres. This is supposed to enhance availability of food and food security.
- Animal feeds from banana peels and formulated improved feeds. This is projected to constitute 5% of total banana waste and surplus. Fuel biogas and charcoal will constitute another 5% of banana waste.
- Organic manure peels and stocks will constitute 28% of the waste and surplus

- Dr. Bazirake, who obtained a PhD from the Institute of Wine Technology at Stellenbosch University, also hopes to use starter cultures – *Acetobacter* and *Glucanobacter spp* - for vinegar production projected to be cultured from 2% of banana waste and surplus.
- Formulated and improved banana diet (at least 4 dietetic menus).
- Garbage reduction of over 510 tons from Kampala and its neighborhoods.
- Enhancement of exports of fresh banana through reduced bulk.

## GULU UNIVERSITY

### Research vision and culture

Gulu University is just six years old, being uniquely started and situated in an area that had been bedeviled by prolonged conflict for over two decades. The idea of establishing a university in northern Uganda, specializing mainly in Agricultural Mechanisation, was initiated in 1994. However, the preparatory task force instead proposed that the new university's focus should go beyond agricultural mechanisation and embrace the mission of producing high level human resources effectively participating in solving the social and economic problems of the country. Gulu became the location of choice for the proposed university, at the time named Gulu University of Agriculture and Environmental Science.

With further 'consultations' fed to a large extent by the political barometer of the day, the mandate of the University drastically changed and other disciplines (such as medicine) were introduced with blueprints to bring in engineering as well. Thus Gulu University, as it came to be known, was established in October 2002, with the vision ***"to be a leading academic institution for the promotion of rural transformation and industrialization for sustainable development"***. Given the long running strife in northern Uganda, the University's vision was indicative of playing a leading role in post war reconstruction and rehabilitation of the region - through the provision of human resources in the areas of education, health, agriculture, technology, research and other services.

### Research structure

After six years of maturation, the University has established the following faculties:

- i. Business and Development Studies;
- ii. Agriculture and Environmental Science;
- iii. Science Education; and
- iv. Medicine.

Other specialized institutes that were established include, the Institute for Strategic and Peace Studies and the Institute of Research and Post Graduate Studies mandated to coordinate all research undertakings at the University. Part of the mission of the Faculty of Science Education is to "provide outreach services for sustainable development with special emphasis on industrialization, rural transformation and conservation of biodiversity".

1. Student Enrolment for the last three years.		
Academic year 2004/05	Females	273
	Males	875
	Total	1,128

Academic year 2005/06	Females	512
	Males	1,013
	Total	1,525
Academic year 2006/07	Total	2,192

Projected student enrolment 2004/5 - 2009/10

2004/5	1,439
2005/6	2,109
2006/7	2,535
2007/8	2,915
2008/9	3,225
2009/10	3,355

2. Staffing

Projected academic staff requirement 2004/5 – 2009/10

2004/5	108
2005/6	165
2006/7	214
2007/8	269
2008/9	306
2009/10	349

As at June 2006:	Approved positions	424
	Filled posts	133
	Vacant	291

Category	Establishment	Recruited
Professor	42	7
Associate Professors	48	2
Senior Lecturer	71	4
Lecturers	159	59
Assistant Lecturer	72	-
Teaching Assistants	66	61

3. Graduation

1<sup>st</sup> Graduation, 20 January 2006

Females	67
Males	52
Total	219

4. Research outputs – proportion of staff publications in international and local journals.  
NO RECORDS

5. Number of staff with a PhD is 7

6. Number of lecturers who have received National or International Journal Awards.  
NOT KNOWN or NOT VERY CLEAR

However, the following were alluded to:

Dr. Andama	from AICAD
Prof. Okwakol	from Unesco
Prof. Onen	from EU & Unesco
Prof. Balidawa	from EU & World Bank

## **University-industry interactions**

### **Faculty of Agriculture and Negri Farm**

The University sponsored an innovation developed by one of the staff members, in the Faculty of Agriculture, who has since left for PhD study in the USA. The Solar Food Drying Panel was designed with the aim of minimizing post-harvest loss, especially of perishable products and fruits of seasonal nature. Three of these solar panel units were produced; two were installed within the campus and one at an outside farm called Negri Farm (St. Isidoro Arch Diocesan Farm).

According to the farm manager, Bro Alex Koko, the farm was started in the 1950s by the Comboni Missionaries who established such farms in the then four northern districts of Arua (at Kasoka), Gulu (Negri), Karamoja (Amaler) and Lira (Aler). Gulu happened to have been the only Diocese serving the entire north at the time. In responding to the social and development needs of the people, the farms, which were attached to school institutions, were intended for:

- o intensifying crop production;
- o training farmers; and
- o keeping animals.

In the 1960s, when changes in the education policies were brought in by government and direct control and administration of schools were hived-off from the missionaries, the farm activities started declining in Arua, Lira and Karamoja. The Gulu Farm, which covers an area of two square miles, continued operating at very low levels of production (of some crops). In the 1970s, however, Fr. John Kalabrini intervened and rebuilt the farm, and installed an oil mill, rice hurler and a grinding mill. The farm became very productive up to the early 1980s. During the trying period of economic war under Iddi Amin Dada's rule, people would come from as far as Kampala to buy rice and cooking oil from the farm. This boosted lots of production of sunflower and rice amongst the local farmers, who benefited from the training attained and the ready market provided by the farm mills and hurler.

When Fr. Kalabrini left, the production dropped substantially, the machines deteriorated, were not regularly serviced and did not function very well. The management of the farm kept on changing and the state of the farm deteriorated.

### ***Mode of interaction***

Essentially the panel functions by harnessing solar energy to naturally dry selected food products, preserving and packaging them for future consumption without use of other additives. The panels installed at campus were being used for:

- o academic purposes, learning and further research;
- o drying, packaging and selling the dried products; and
- o testing the market for acceptability of the products.

While the panel at Negri farm was meant to demonstrate the facility on the actual farm setting, this demonstration phase was further intended to explore the economics of the innovation in terms of production costs, markets and income generated. The initial phases targeted perishable fruits, like pineapples and mangoes.

The farm was used as a model for university-farmer linkage where small appropriate technologies were demonstrated to farmers, including the student attachment programme.

In 2005, Bro Alex Koko took over as Manager of the farm, and with the help of the Diocese, repaired the mills and started producing sunflower and a variety of other crops - including maize for local consumption targeting the schools around.

Interactions between Gulu University and the farm were initiated at the end of 2005. In March 2006, an informal request for collaboration by the University was made, but not followed through by formal documentation. Nonetheless, the farm offered large pieces of land which the University used to test plants, including various cassava stocks for teaching and experimental purposes.

It was at this time that the University gave the farm a Solar Drier unit. University students were attached to the farm and worked together with farmers to produce lots of simsim and groundnuts. But the process of collaboration did not last due mainly to reported financial constraints, and the drier being rendered redundant. The critical situation at the farm led to staff lay-off, originally about 20 to 30 workers. The activities of the university waned down, and this year 2008 students have not come to the farm at all.

#### *Outcomes of interaction*

The solar panel was used for just a few months for pineapple fruits. The panel was located deep in the field instead of installing it nearer the farm houses for proper management and maintenance. By the time of this survey, the panel was already ruined. Worst still, the technical person, who designed it, left for further studies and no one else took interest in studying it.

Erratic rainfall patterns had drastic effects on planned seasonal planting, wasting several acres of planted crops (especially sunflower plants).

With all these drawbacks notwithstanding, potential areas of collaboration with the University can still be tapped in the areas identified by the farm manager, which include:

- farm survey;
- soil mapping in order to re-plan the farm;
- training of local farmers;
- establishment of animal units like zero grazing;
- getting the irrigation system going; and
- the processing of various seed crops.

However, certain limitations were cited, including the dilapidation of the farm buildings, lack of tractors and its accessory components - like trailers, harrows and plough - which require injection of more money, and the attachment of more technical people engaged in farm activities.

The Catholic Archdiocese was indicated to take seriously the responsibility of reorganizing the farm which has wide potential catchments areas, including the districts of Gulu, Kitgum and Amuru. The farm should first 'put its house in order' and then reactivate the linkage with Gulu University.

#### *Limitations and possibilities*

The idea of the university-firm/public interaction is dogged by a number of constraints that reflect the nascent nature of the University as well as the general conditions in northern Uganda, which have been a theater of conflict for over two decades.

- 1) Research funding that is lacking, limited and difficult to access, de-motivates potential researchers from pursuing their initiatives. Research funds sourced and approved are bundled in the University's central account, and subsequently funds released for research is limited to no more than 3 million shillings, irrespective of the nature of the research.
- 2) Staffing position and structure poses a problem in two aspects:
  - i. There are few academic staff members who inevitably have to handle a high work load of 40 to 60 hours a week. This constrains their capacity to engage in any meaningful outreach or research activities. One of the lecturers was quoted to have said that they do not even have time to read or carry out research on their own.
  - ii. The University lacks senior people/staff, who encourage, support, guide and supervise research. More than 50% of the academic staff are teaching assistants whereas ideally, this should be 10%. There are about five full professors and a few associate professors, two senior lecturers and 20 lecturers. It was noted that teaching assistants can not engage in serious research.
- 3) There is the underlying problem of entry point into the public domain. By the time the University was established, a unique system/network had been formed and public space was cocooned by the numerous NGOs operating in the region, the local government, and the government Ministries in some cases, which rendered it very difficult for the University to penetrate. This is particularly evident where benefits are involved, for example, an Education Renaissance Event was organized by the local government but the University being in the lead, was not involved nor invited.

Because of these constraints, there have been no serious outreach or research interventions that bring the University in the public arena interface.

- 4) The Director of Research singled out a unique problem that relates to attitudes concerning research undertakings. Most of the academic staff appear to be complacent, and see no need to pursue research projects. This negative attitude is contrary to what a university should portray with regard to research work.
- 5) Research proposals developed are not easily funded, and research funds are often diverted to other uses. On paper, for the last three years, research budgets have been oscillating from 60 to 45 to 90 million shillings respectively. This represents only 6% of the 2 billion annual budget.

## **PUBLIC RESEARCH INSTITUTES**

Two public funded research institutions were surveyed, Uganda Industrial Research Institute (UIRI), and the National Agricultural Research Organization (NARO). From the institutes, two firms were identified - Uganda Cleaner Production Centre, stemming from UIRI interactions, and Innscor (U) Ltd, the company operating the Nandos multinational fast food Franchise in Uganda.

### **National Agricultural Research Organization and Nandos Franchise**

The National Agricultural Research Organization (NARO) is the apex body for guidance and coordination of all agricultural research activities in the national agricultural research system in Uganda. NARO is a public institution established by an Act of Parliament, which was enacted on 21<sup>st</sup> November 2006.

NARO comprises of the council as its governing body, committees of the council as its specialised organs, a secretariat for its day-to-day operations, with the semi autonomous public agricultural research institutes under its policy guidance.

The **vision, mission and goals** that guide the National Agricultural Research Organization are derived from the Plan for the Modernisation of Agriculture (PMA).

#### Vision

*"A farmer responsive research system that generates and disseminates problem-solving, profitable and environmentally sound technologies, knowledge and information on a sustainable basis."*

#### Mission

*"The generation, adoption and dissemination of appropriate and demand-driven technologies, knowledge and information through an effective, efficient, sustainable, decentralized and well coordinated agricultural research system."*

#### The goal

*"To enhance the contribution of agricultural research to sustainable agricultural productivity, economic growth, food security and poverty eradication through generation and dissemination of appropriate technologies, knowledge and information"*

#### Objective

The objective of NARO is the coordination and oversight of all aspects of agricultural research in Uganda.

#### Nandos Franchise

Operated by Innscor (U) Ltd since 1998, the firm imported all of its ingredients from the Republic of South Africa. It employs 235 people, making a large scale operation by Ugandan standards. The firm's CEO indicated that 10% of its revenues go into research - in this case, research was used in its generic sense to include market surveys - and it is outsourced. In collaboration with NARO, they developed a suitable Irish potato variety, the Victoria variety, a requisite for their unique chips. To this end Kachwenkano Zonal Agricultural Research Development Institute, one of the numerous institutes created

under NARO, for specific ecological zones, produced the variety in south western Uganda - an area known for Irish potato farming.

NARO did the incubation and eventual development of the variety, upon request by Nandos, which is sold to a number of farmers organized in associations who in turn find a ready market in Nandos. The arrangement has continued for nine years. The linkage was described as very successful, and that it has improved the incomes of the rural farmers whom they provide with soft loans through advances made to facilitate on-farm operations.

The firm expressed disappointment in government failing to provide incentives, and other mechanisms to support UILs. The other limitation is that the interaction is a 'one-man show', in the words of the firm's CEO, who wondered if it would be abandoned if the person changed his mind, and what this portends for the livelihoods of the peasant farmers benefiting from the linkage. The farmers have experienced management challenges, as the associations into which they are organized are loosely managed. The management was supposed to follow the structure of a cooperative union, but this was never implemented. Furthermore, since the country continues to rely on rain fed agriculture, any extended dry spells of weather conditions cause loss since, in most cases, farmers will have been advanced some monies for the purchase of the seedling and other farm operations.

#### Uganda Industrial Research Institute and Uganda Cleaner Production Centre

Uganda Industrial Research Institute is Uganda's lead agency for industrialisation established by an Act of Parliament under the Ministry of Trade Tourism and Industry. It is the country's main vehicle for the implementation of strategies and measures aimed at transforming industry in Uganda. Its vision is to be a model institution and centre of excellence for incubation of industry, to be a pioneer of self financing R&D, and to elevate the level of technology in Uganda and the region. Its mission is to improve capacity and competence of the private sector undertaking viable industrial production processes and increasing the sector's ability to produce high quality marketable products through enhanced research, training and technical know-how. Its mandate is to undertake R&D and/or acquire appropriate technology in order to create a strong, effective and competitive industrial sector in Uganda.

#### Uganda Cleaner Production Centre

Established in October 2001, it is a multinational firm operating in some 38 countries. For Uganda's operations, it falls under the category of medium scale firms as it employs less than 50 persons with an annual turn over of USD \$ 200,000, with 60% of its turn over going directly to R&D and innovation. The firm is anchored with some 200 other firms, which fall under UCPC as a one stop centre for technology transfers and management for cleaner production (environmentally friendly technologies).

The firm is linked with the Uganda Industrial Research Institute and housed on its premises. The Board of UCPC is drawn from the universities as well as staff of UIRI as required by UNIDO, the funding agency. Furthermore, UIRI provides laboratories and other technology incubation facilities.

The firm is facing competition in the sector - although not highly pronounced - from Environmental Consultants; the Uganda National of Standards Bureau, which is the



national agency responsible for quality certification; and a private sector driven agency, Enterprise Uganda. The technologies developed are demand driven, and the firm is aligned with the United Nations Environment Programme through the African Roundtable on Sustainable Consumption and Production, Delft University (Netherlands) and Designers Without Borders (Eco-designs). Its insertion in the value chain is in mitigating environmental baggage associated with a product, through green supply chain management and life cycle assessment. Furthermore, in relation to the competitiveness of the technology, the firm views the linkage as a journey and not a destination, engaged in continuous improvement to achieve state of the art technology - as opposed to obsolete technology - and disseminate it through stakeholder workshops and publications. Annual certificates for environmental audits and evaluations are issued to firms.

The firm's research function is achieved through consultancies and studies that resulted in the following innovative activities:

1. water saving in the brewery industry;
2. energy efficiency in tea factories, cutting energy costs up to 50% thereby making funds available for other sector activities; and
3. occupational health and safety.

The most significant impact of the linkage has been ISO certification for enzyme export for a product of an agro-based firm, Reco Industries.

Knowledge and technology support comes through Foreign Direct Investment (FDIs), donor support from Austria and Norway, UNIDO and UNEP. The major impact of the innovation on the community has been environmental compliance; reduced energy wastage and costs; occupation safety; and most importantly, Kayonza Tea Growers in Rukungiri District of South West Uganda was saved 50% of its energy costs with savings invested in extending the national power grid to this otherwise remote area. The company is farmer owned and ISO certified, thus contributing to fair trade commodities.

Major limitations/constraints to the linkage is that universities, which should be a key stakeholder in the arrangement, have been resistant to the concept of cleaner production. The academics argue that they have always done things their way; besides, firm managers suffer from inertia and resistance to change with an end-of-pipe approach to environmental management that wastes will always exist and be dumped. Yet, the same can be significantly reduced and the remainder be used as raw materials for other products. Furthermore, there is a lack of incentives in the tax regime and an absence of eco-financing (in general) and cleaner production (in particular), as finance institutions attach much risk to the concept (with which they are not familiar).

## CONCLUSION

The case studies revealed that, according to their vision and mission statements, Ugandan universities and public research institutes are grappling with the challenges of finding new directions of developmental relevance in the context of knowledge production and knowledge commercialization. Initially, it was intended to carry out research on two newly established public universities, such as Mbarara and Busitema, but these universities were excluded from the analysis when it was discovered that no meaningful information could be obtained either on the website or from the university

records. In the case of Mbarara University, the website was shut down for renovation and no organized system for information collection was available. In the case of Busitema University, the university management could not provide any information because the university had only recently been established and thus had not yet rolled out its research activities to the extent of engaging with firms. The website that was shown to us had very scanty information, dealing only with the university's vision and mission.

Hence, only the three older public universities were included in the analysis: Makerere and Kyambogo universities near Kampala, and Gulu University in the war-devastated northern region of the country. In view of this, we decided to also include two public research institutes because of their central role in linking to firms and community activities. The newer private universities that have sprouted out in the last ten years were not researched because there was very little indication that they were engaged in any form of interactions with firms and communities in promoting new product knowledge to enhance economic competitiveness. Our focus then was on how the institutions included in the analysis were able to forge and/or strengthen links with industry and communities. It was found that forming linkages with industry featured prominently in the strategic plans and research practices of these institutions.

The research has revealed the similarities in these linkages as well as differences, which need not be repeated here. In general, the nature, scope and outcomes of these interactions have, so far, received peripheral treatment in the literature. A constraining factor is government innovation policy that has remained scattered and uncoordinated. This lack of coordination in government policy is also reflected in the incoherent relations between the different faculties and departments in older universities such as Makerere University. This lack of government policy guidance can also be judged from the lack of funding to R&D activities in the universities, which our paper on policy showed, is mainly in the hands of donors or foreign universities that have developed working relationships with Makerere or even with research institutes.

The intensifying interactions between academia, firms and communities also remain a challenge to our understanding of the underlying epistemological drivers of the process of knowledge creation and knowledge. Universities still continue to adopt reductionist paradigms which do not take into account of indigenous knowledge - which is widely used by peasant farmers. On the other hand, theories of university-industry interaction have evolved significantly over the last 20 years: from the Mode 1 university, which privileged the State in the universities role as a 'pure researcher'; to the interlocking 'Triple Helix Model' Mode 2 role in which university-industry-government relations, which emphasizes networking between disciplines, industry, communities and government as well as the more integrated and participatory approach to innovative processes.

The P'ikwi Farm case study showed a very interesting relationship and linkage between communities, the university and the State. The evidence showed that, through its linkages and interactions with different stakeholders and partners, P'ikwi Farm was able to engage the universities in meaningful research, which led to the development of knowledge for its members in their productive activities. The P'ikwi group was as a result of these interactions able to expand its membership based on these developments. It was able to engage in the development of different kinds of technology, which enabled its members to improve their production and gain a share of the market. They witnessed a number of technological innovations based on their indigenous knowledge, which

made possible the creation of different types of machines that improved cultivation, planting, harvesting and transportation. Through links and partnerships, P'lkwi was able to obtain adequate machinery, such as brick interlocking machinery for the improvement of housing for its members.

Thus, despite the absence of a clear government policy on innovation, the universities and institutes, with the prodding of external donors, have forged a role for themselves in trying to assist economic actors with their projects. But this is still at the level of informal linkages between the individual academic and firms. The general conclusion we draw from the research experience is that the Ugandan government is no longer the sole actor in determining the R&D activities of the universities and research institutes. The findings show that other stakeholders such as industry, peasant farmers and non-state researchers (e.g. NGOs) have shown the capacity to initiate linkages and research activities that are beneficial to society. However, there is no clear indication that the universities in Uganda have, in any general way, played the role that can enable us to refer to them as 'developmental universities'.

Makerere University has continued to pursue research activities that do not relate to the development needs of the country, but such a weakness cannot be attributed to this university alone. The problem also lies with the Ugandan State, which has been politically unstable and as such, it has been unable to develop a long-term developmental strategy that could have given direction to the universities. The research has therefore revealed a series of positive activities that are *ad hoc* and uncoordinated in terms of policy for scientific innovation.