

## Academic Capitalism in the Responsiveness of Science Academic Units at Makerere University

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Central America is not known for the quality of its higher education. This is reflected in global data with no Central American universities appearing in the international rankings, few of its university professors holding accredited PhDs, and the region accounting for less than 0.10 percent of global research expenditures and Science Citation Index publications (Svenson 2012). In spite of these dismal statistics, there are some exceptional Central American institutions that produce highly qualified graduates and valuable scientific research—particularly in thematic areas important for national and regional development. These exceptions tend to be non-traditional private institutions that combine inputs from both international cooperation and local and regional resources to create unique, practical applications for knowledge transfer and scientific production. They merit attention not only for their impressive academic achievements but also for the lessons they may offer other countries as strategic investment in applied research becomes increasingly vital for small emerging nations in advancing their development agendas (Holm-Nielsen et al. 2005; Svenson 2012).

The purpose of this article is to illuminate the responses to neo-liberal reforms of four science academic units at Makerere University. Although in this case, the university was successful in its earlier responses to neo-liberal reforms, the university still faces an uphill task to harmonize some of the earlier responses amidst new responses that continue to emerge within the science academic units. These new responses were theoretically interpreted using elements of “academic capitalism,” and were empirically based on document data. The emerging responses of the science disciplines show patterns embedded in “academic capitalism” hence justifying its suitability as an interpretive framework. It

is concluded that whereas the science academic units and the university are becoming active actors in the neo-liberal economy, it is important that institutional mechanisms to manage this process are strengthened in the early stages of this engagement.

Increasingly, higher education institutions are engaging in market-like activities referred to as “academic capitalism” (Slaughter and Leslie 1997, 9-11). Indeed, neo-liberal patterns have remained ubiquitous across higher education systems with an emphasis on privatization, commercialization and deregulation of “state functions to promote the new economy in global markets” (Slaughter and Rhoades 2004, 20). Yet, “while universities were not primary players in creating the neo-liberal state, they often endorsed initiatives, directly or indirectly” (Slaughter and Rhoades 2004, 20). Moreover, academic units within institutions, which choose to ignore the market paradigm and stick to the traditional paradigm, find it difficult to attract external funding. In fact, it is equally likely that such academic units would receive less from the internal financial allocations within universities (Slaughter and Rhoades 2004). Indeed, the pervasiveness of neo-liberalism has also been illuminated in the form of organizational transformations within European higher education institutions after the advent of New Public Management (Reed 2002; Salminen 2003; de Boer et al. 2007).

In Africa, and specifically Uganda, have experienced public sector reforms as early as the early 1990s. As in other developing countries, Uganda’s public sector reforms were World Bank sanctions (Pollitt and Bouckaert 2004). The sanctions were seen in the privatization of the public enterprises, decentralization of political governance and administrative duties, and retrenchment of public servants (Brett 1994). As part of the public sector, higher education was equally affected.

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Three events in 1992 explain the accelerated pace of entrepreneurial response at Makerere University. First, the 1992 *White Paper on Education* was an instrument that made the liberalization of university education a government policy (Musisi and Muwanga 2003; Muwagga 2006). Second, the President decided to relinquish the Makerere University chancellorship if the university became entrepreneurial (Eisemon 1994). Third, in the same way, Makerere University began using private sponsorship (Court 2000; Mayanja 2001) after seven decades of state financing (Senteza-Kajubi 1992).

However, even with the anticipated monetary returns accruing from liberalization, most university faculty preferred to continue pursuit of the basic university mission. In addition, they perceived financial matters as an administrative responsibility. In order for university management to convince the academic units, there was drastic decentralization and emphasis on lump sum funding (Mayanja 2001; Mamdani 2007). Nevertheless, studies on the impacts of the market reforms on university behavior at Makerere University articulate loss of cohesion and stratification of the university in terms of revenues (Carrol 2007). However, at the same time, the Visitation Committee to Public Universities (2007, 75) noted that Ugandan public universities were still “ivory towers” typified by limited interaction with the private and public sectors.

This study builds on these previous studies but with a focus on the science academic units as relevant to the neo-liberal reforms. Undoubtedly, these academic units did not quite fully engage with neo-liberal reforms in the earlier wave of responses, but are leading the current wave of responses. Moreover, there has been very little systematic study reporting on these particular academic units regarding their emerging responses to neo-liberal reforms, which is the basis of this article. The remainder of the article is structured as follows. First, an overview of the theory of academic capitalism as an interpretive framework is presented. Second, the methodology used and brief background of the science academic units are outlined. Third, the emerging responses of the science academic units are described, followed by discussion and the conclusion on the applicability of the

academic capitalism theory in understanding these emerging responses.

### **Academic Capitalism as an Interpretive Framework**

As illustrated above, with diminishing government funding, the different disciplines, faculty members, and the institution as a whole have sought alternative sources of funding university research. At the same time, there has been rising demand for scientific knowledge and products from the universities by industry. Indeed, “[t]he shift has occurred because the corporate quest for new products converged with faculty and institutional searches for increased funding” (Slaughter and Leslie 1997, 7). Examples of the new categories of institutional revenue include: university-industry partnerships, investment in spin-off companies, patenting discoveries, research grants, and student tuition fees (Slaughter and Leslie 1997, 11). The competitive spirit that underlies the process of acquiring these financial resources shows the incidence of “academic capitalism” in the science academic units that have been explored.

Additionally, four elements from the theory of academic capitalism are used as an interpretive framework for the recent responses of the science academic units to the neo-liberal changes. The elements include: circuits of knowledge, interstitial organizational emergence, intermediating networks, and extended managerial capacity (Slaughter and Rhoades 2004). Circuits of knowledge are indicators of a reorientation in the exchange of knowledge. Knowledge is the prime material upon which activities of the university are anchored and has been primarily exchanged between individual experts and within professional associations. However, the traditional modes of delivery of knowledge have been steadily altered to embrace modern learning management systems that augment the standardization of skills, which is a key aspect of professional bureaucracies (Mintzberg 2000). Similarly, the partnership between the university, industry, and government is another circuit of knowledge. In fact, this circuit epitomizes the view that “[t]he market for knowledge—the number of places where it is wanted and can be used—is now wider and more differentiated than it has ever been” (Gib-

bons et al. 1994, 49). In addition, scholars and experts from industry work as peer reviewers on national committees that assess the relevance of particular programs or revision of others in line with national funding priorities. Apparently, corporations or agencies patent knowledge and any other products that originate from the university depending on the product's vitality in the market (Slaughter and Rhoades 2004).

Another theoretical building block, the interstitial organizational emergence, refers to the new organizations created from the interface structures within the university and its subunits. The structures are primarily responsible for the generation of third stream income for the university. One of the characteristics of these structures is the link they establish and sustain between the university, the private sector or corporations, and the government. Examples of these structures are technology licensing offices, economic development offices that strengthen the links between university research, and the national development trends. These units have permeated all organizational levels and continue to emerge at basic unit levels. Moreover, specialized training programs not part of the regular curricula for degree programs are delivered to particular clients by specific units established within the university and its subunits (Slaughter and Rhoades 2004, 23-24).

The third element of the academic capitalism theory are intermediating networks. These are synergies that continue to evolve among the different actors and organizations as a consequence of the emergence of the academic capitalist knowledge/learning regime in the neo-liberal economy. Slaughter and Rhoades (2004, 24) note that "these organizations bring together different sectors interested in solving common problems that often stem from opportunities created by the new economy." In addition, they argue that the "[networks] of intermediating organizations allow representatives of public, nonprofit, and private institutions to work on concrete problems, often redrawing (but not erasing) the boundaries between public and private" (24).

Finally, the extended managerial capacity is an element that buttresses the first three elements of the theoretical framework within universities and colleges. Increasingly, trustees (university councils) and presi-

dents (vice chancellors) acknowledge that university engagement with the markets is perpetual and consideration of strategies to deal with this new environment is crucial. The emergence of patents and copyright in universities and colleges typify the extended managerial capacity. Indeed, intellectual property offices and technology transfer units continue to emerge as additional indicators of the extended managerial capacity whose function is to facilitate the processes of commercializing scientific knowledge and products. Still, the institutional policies concerning copyrights are just beginning to be introduced. In summary, the theory of academic capitalism presupposes that any changes in income streams can certainly determine the strategic direction of the academic enterprise and its units (Slaughter and Rhoades 2004).

### **Background of Four Science Academic Units at Makerere University**

Makerere University is a research-oriented institution with a rich history that began evolving from a technical college, established in 1922. The establishment of Makerere University marked the beginning of higher education in Uganda and the East African region (Ocitti 1991). In 1970, Makerere University became an independent public university funded and directly run by the government of Uganda. In the early 1990s, the university embraced a public-private mix, when students were admitted on a private sponsorship program. In this study, the four science academic units explored are: the College of Health Sciences, the Faculty of Agriculture (now College of Agriculture and Environment Sciences), the Faculty of Computing and Information Technology (now College of Computing and Information Sciences), and the Faculty of Technology (now College of Engineering, Design, Art and Technology). These are hard-applied disciplines based on Biglan's (1973) classification. Further stratification also reveals that the first two academic units belong to the life system while the latter two are part of the non-life system (Biglan 1973). The choice of these units of analysis therefore ensured that any variations in the emerging response patterns could only be partly attributed to the nature of the disci-

plines. Several documents were reviewed and through document analysis, emerging trends were categorized. The documents included the annual report of 2006, the report of Visitation Committee to Public Universities in Uganda, 2007, reports of coordinating units such as the School of Graduate Studies, and speeches by the Vice Chancellor and other senior members of university management. The selection of these documents was the result of extensive review of all documents considered necessary and relevant to the research problem. The selected documents were analyzed in close reference to the elements of the theory of academic capitalism.

### **Emerging Responses across Four Science Academic Units at Makerere University**

In this section, the responses of the four science academic units involved in this study are given. The subsections reflect the components of the academic capitalism theoretical framework. However, the analysis shows that the responses, based on the theoretical elements, are not uniformly evident across all the four academic units. Rather, in the analysis, at least two of the academic units had their responses aligned to a particular element of the theory.

### ***Scientific Discoveries by Individual Academics and Academic Units***

There is substantial evidence that individual science professors and researchers at Makerere University have worked as lead experts in decision processes related to science and technology worldwide. These professors have been engaged as individuals and not as institutional experts, especially in the areas of health and agriculture research (Muhumuza et al. 2005; Bakibinga 2006b; Wafula and Clark 2005). The engagements of the science professors have not all been altruistic. Very little research is done at Ugandan public universities without a thought for its monetary benefits. In other words, there has been “little evidence of disinterested basic research whose primary purpose is to produce knowledge without expecting any monetary or other personal return [at Makerere University]” (Visitation

Committee to Public Universities 2007, 50). Several scientific breakthroughs have generated revenue or attracted funding to the science disciplines as well as for the individual professors. One example of a breakthrough by professors in the health sciences was the discovery of the Nevirapine drug that reduces the risk of mother to child transmission of HIV from 30 to 15 percent. This discovery of Prevention of Mother to Child Transmission (PMTCT) has since been replicated in other African countries (Muhumuza et al. 2005, 56; Bakibinga 2006b, 13).

In the Faculty of Agriculture, two crop varieties were discovered that are reportedly resistant to a crop disease that hit several countries in East and Southern Africa. These cowpea and soybean varieties are also grown in the Eastern and North Eastern parts of Uganda and have been named “Makerere” by the rural farmers (Ekwamu 2006, 12). This is among the aggressive breakthroughs in agricultural science in Uganda since crop disease curtailed soybean production. In addition, some of the outputs of crop and food varieties from the Departments of Crop Science and Food Science and Technology have been commercially patented or produced through partnerships with industry (Luboobi 2005). A food processing and incubation center was recently established at the same department. In a similar vein, at the Faculty of Technology, an individual academician’s invention of cheap sanitary pads made from local materials such as papyrus has been perhaps one of the most significant breakthroughs. These pads branded as “Makapads” (originating from Makerere) have been extensively used in schools and in rural areas at a cost of less than US\$0.27 per pack. Moreover, the same innovative academician has also developed bricks that do not require the use of cement during the construction of small apartments (Bakibinga 2006b, 13).

### ***Interface Structures within the Science Academic Units***

Three of the four science academic units studied have established unit-specific interface structures. The Infectious Disease Institute (IDI) is an interface structure at the College of Health Sciences, developed in

partnership with leading research institutions in the area of HIV/AIDS. The IDI was opened in 2004 as a national and regional center of excellence for building capacity (of individuals and of organizations) in Africa for the delivery of sustainable, high quality care and prevention of HIV/AIDS and related infections through training and research. The IDI offers HIV/AIDS support services to over 300 patients per day at the National Referral Hospital where the College of Health Sciences is also located. This research and training effort is part of the Academic Alliance for AIDS Care and Prevention in Africa network (Ssebuwufu 2003; Muhumuza et al. 2005). Similarly, a Department of Software Development and Innovation has been established at the Faculty of Computing and Information Technology to primarily develop commercial software and customize some of the existing software. The students studying at the faculty have manufactured several prototypes, and by working closely with the consultancy firm at the faculty, some spin-offs have been registered (Baryamureeba 2006). The faculty also provides consultancy services through ICT Consults Limited, the faculty's consultancy firm.

Technology Consults Ltd. (TECO) is an interface at the Faculty of Technology set up in 1992 as perhaps the first university-industry interface at Makerere University. The objective of this interface was to create synergies among the different engineering fields within the faculty prior to synergistically interfacing with the external environment. In addition, the Uganda Gatsby Trust (UGT) was set up at the Faculty of Technology in 1994 to interface with and build the capacity of small medium enterprises (SMEs) by offering specialized training courses and field attachment for students (Tibarimbasa and Lugujjo 2000; Musisi and Muwanga 2003). Recently, newer interfaces have been created such as the Centre for Research in Energy and Energy Conservation (CREEC), founded in 2001, a research, consultancy and training organization based at the Faculty of Technology. The goal of CREEC is to develop into a center of excellence in energy for Uganda and the entire East African Region. CREEC focuses on energy management, solar photovoltaic (PV), biomass, and hydropower to develop low cost technologies and sys-

tems that have a direct and positive impact on people's everyday lives. The government of Uganda through the Millennium Science Initiative (MSI)—a new avenue for the government to strengthen the country's scientific and technological capacity—has provided some financial support to CREEC. Another interface is the Innovation Systems and Clusters Program—Uganda (ISCP-U) founded in 2005. ISCP-U has been instrumental in supporting the SMEs and innovation clusters in the different sectors of the economy of Uganda. This interface and the clusters in the program have been funded by the Rockefeller Foundation and Sida/SAREC. The Technology Development and Transfer Centre also creates interfaces between the faculty and the private or public sectors (Luboobi 2007).

### ***Intermediating Networks for Aligning Curricula to National Development***

Aligning the curricula to the evolving social, political, and economic policy frameworks is one of the challenges that Ugandan higher education is facing during this period of reform and innovation (Liang 2004; National Council for Higher Education 2006). After the decentralization of administrative functions to the local governments in line with the Structural Adjustment Program of deregulation, the shortage of skilled human resources conversant with the operations at the local level became more noticeable in Uganda. However, due to the supply-led nature of the Ugandan higher education system, there has been no attempt to realign the academic provisions to the changing human resource demands at the decentralized districts (Eisemon and Salmi 1993; Musisi 2004). Against this backdrop, the Vice Chancellor of Makerere University at the time constituted a committee of 14 members, comprised of seven faculty deans or directors, and seven individuals from the government ministries of finance, education, local government, and the Economic Policy and Research Centre. The seven deans or directors primarily made the decisions (Musisi and Muwanga 2003, 21). This 14 member committee later metamorphosed into the Innovations at Makerere Committee (I@Mak.com) that implemented curricula changes in some of the aca-

demographic units by encompassing aspects relevant to decentralization. The Rockefeller Foundation and the World Bank funded this process until December 2006.

An earlier study titled “The Decentralization and Human Resource Demand Assessment from the Perspective of the District Study” by I@Mak.com revealed deficits in certain professional disciplines, which were considered critical to development. These included but were not limited to human medicine, agriculture, computer science, engineering, and physical planning (Musiisi 2004, 128). The overarching recommendation was the need to revise the curricula in the universities so that the graduates become more relevant to the national development trends. Consistent with the Strategic Plan 2000/01-2006/07 (Makerere University 2000), the science academic units revised most of their curricula or designed new academic programs. The restructuring of the curricula was extensive and included the outreach components, and university senate approved the institutional guidelines and policies for field attachment for all undergraduate degree programs. The premise for this field attachment policy was the production of “practically oriented graduates [that] meet the required job-related competences of their future [employers].” The first pilot was done in several disciplines including agriculture, basic health and medicine, and engineering. Between 2002 and 2006, more than 8,000 students from Makerere University had successfully engaged in internships in 59 out of the then 78 local government units (districts) in Uganda (Makerere University 2007, 3-4). More specifically, in the 2003-2004 academic year, the Faculty of Medicine (currently College of Health Sciences) introduced a component of outreach known as Community Based Education and Service (COBES). This outreach or field component has enabled medical students to experience real work environments with limited resources in terms of health facilities. Similar arrangements have been made for technology students who have been placed in the local government departments of water, survey, roads, and physical planning (Katunguka 2005, 15). With this repositioning of socioeconomic development, “the university’s contribution to the nation in this sustained effort could be a major and lasting—and, again, a model

for what could be done in other countries” (Clark 2004, 107).

Another intermediating network is the Makerere University Private Sector Forum (MUPSF), established in 2006 as an institutional interface with the private sector aimed at enhancing the university-private sector partnerships through research and development. The MUPSF is headed by an executive director and has a working committee (also serving as the joint advisory council composed of representatives of key stakeholders) chaired by the Vice Chancellor. The forum envisages initiating sustained interfaces between the departments within the university and the private sector to collaboratively engage in socio-economic development. Already, the MUPSF has signed a Memoranda of Understanding with leading private sector bodies and organizations namely the Uganda Industrial Research Institute (UIRI), the Uganda Manufacturers Association (UMA), the Uganda Investment Authority (UIA), the Private Sector Foundation (PSF), and the National Water and Sewerage Corporation (Bakibinga, 2006b p.10-11; Bakibinga 2008, 11). Similarly, the Vice Chancellor announced in 2006 appointments of four honorary professors including the Governor of the Bank of Uganda (Central Bank), the Executive Director of the Uganda Investment Authority (UIA), and two prominent Ugandan private investors. However, the MUPSF, perhaps because it is so new, has not been institutionalized and has been run by just one individual—the Executive Director (Makerere University 2008b). The MUPSF has been further curtailed by the relatively dysfunctional investment department constituted under the investment policy passed in 2006 (Bakibinga 2008, 6).

### ***Intermediating Networks for Capacity Building in Research and Training***

Despite the significant achievements made so far, the vitality of graduate research in the science and technology fields has been minimal. Fewer than 10 PhDs are annually awarded in the fields of science and technology at Makerere University (Muhumuza et al. 2005, 11). Moreover, the total output at the PhD level has been equally small; for example, in 2005, only 24 of

917 students obtaining postgraduate qualifications were PhDs (Makerere University 2006b, 19). As a response to this unimpressive record, commendable initiatives have been evident through collaborative arrangements with universities in the global North on sandwich programs for research capacity building or through regional networks. In the Agricultural Sciences, through funding support from The Rockefeller Foundation, the Forum on Agricultural Resource Husbandry (FORUM) was founded in 1991 to build research capacity through graduate training. Of the US\$14 million allocated for the period from 1992 to 2003, US\$5 million was invested at Makerere, which has enabled training and completion of 102 Master of Science students of the 250 students assigned to the project. In addition, the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) evolved from the FORUM. The secretariat of the RUFORUM at Makerere University links the Faculty of Agriculture to other similar academic units at 12 universities from Eastern and Southern Africa. In fact, it has enabled the evolution of “Networks of Specialization” in the agricultural sciences rather than establishing “Centers of Excellence” at individual universities in the region. Through this network, Makerere University is partnering with regional universities in the areas of rural development, natural resource management, and crop improvement, biotechnology, and seed systems (Ekwamu 2006, 10). Moreover, through the RUFORUM, and with a grant of US\$700,000, 25 Master of Science students have been trained as they simultaneously engage in some of the research projects at Makerere University (Luboobi 2004, 14; Ekwamu 2006, 9-10).

Furthermore, the East African Regional Programme and Research Network for Biotechnology, Biosafety and Biotechnology Policy Development (BIO-EARN), another regional network, has partnered with the Department of Crop Science at the Faculty of Agriculture to support PhD studies in collaboration with Swedish universities (Wafula and Clark 2005). Currently, the Faculty of Computing and Information Technology is running another four-year collaborative project called “Strengthening ICT Training and Research Capacity in the Four Public Universities in Uganda.” The project

estimated at over US\$7.5 million (€5.7 million) is funded by the Netherlands Organization for International Cooperation in Higher Education (NUFFIC). The NUFFIC has mainly concentrated on the North-South collaboration through which 30 students have been selected to undertake graduate training and research at a PhD level at Makerere, and at the partnering universities in the Netherlands (Baryamureeba 2008). Similarly, the Faculty of Technology runs a joint Masters in Renewable Energy, as well as other regional universities in Africa (South-South collaboration), and the Norwegian University of Science and Technology (situated in the North) hence the North-South-South Collaboration with funding from NORAD.

### **Enhancing the Management Capacity Concerning Scientific Discoveries**

Generally, although there is substantial evidence of engagement by the science academic units and individual academicians in the markets of scientific knowledge and products, mechanisms within which these synergies are operationalized have been weak at both national and institutional levels. For example, the Ugandan government worked with the Millennium Science Initiative in 2006 to implement a first time US\$33 million earmark in support of the university-targeted Millennium Science Initiative. The goal of MSI is to build a sustainable science and technology human resource and infrastructure in the next five years. Even then, national policies such as the intellectual property rights management policy—through which scientists can own or co-own their inventions and innovations—have been nonexistent (Bakibinga 2006a, 14). Likewise, prior to 2008, intellectual property management policies in most of the East African universities were nonexistent, weak, or inefficient due to lack of institutional mechanisms (Ecuru et al. 2008). Moreover, there has been little or no documented evidence on the patents filed by Makerere University, and individual scholars’ efforts have only been recognized at graduation ceremonies (Visitation Committee to Public Universities 2007). Even then, the Uganda National Council for Science and Technology (UNCST) has noted that 70 percent of the national re-

search and innovations originate from Makerere University (Makerere University 2006b, 20). Consequently, several attempts to harmonize the budding initiatives in scientific discoveries through new institutional policy frameworks and structures have been introduced at Makerere University.

The Makerere University Research and Innovations Policy focuses on “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” (Makerere University 2008c, 4). The policy requires that staff members spend at least 20 percent of their total official working hours on research. One additional highlight of the policy is that 15 percent will be deducted from all research projects as an overhead cost from which the School of Graduate Studies takes five; the central administration takes four percent, and the department and faculty take 3 percent each. In addition, the policy indicates that the annual contribution to the research fund from the internally generated funds will be increased from the current one percent to 3 percent. The Intellectual Property Management Policy has also been passed at Makerere University (Makerere University 2008a). The basis of this policy is “to stimulate and support innovative thinking among students and staff, and to enable ownership and efficient management of intellectual assets and innovations produced at Makerere” (Makerere University 2008a, 8). The Vice Chancellor is responsible for administering the policy and managing university inventions.

An Intellectual Property Management Unit is to be set up that will cooperate with the inventor/scientist in evaluating the intellectual assets’ potential for transfer to the public or private sectors. Furthermore, the Intellectual Property Management unit “shall work closely with the Research and Innovations office to identify intellectual property issues in research proposals and products of research and innovations including those that may be of interest to the private sector” (Makerere University 2008a, 10). The policy specifies that student inventors can enjoy the privileges of an employee inventor as long as they have assigned their intellectual property to the university. On the sharing ratios, the

inventor earns 80 percent for the first US\$5,000, the parent department takes 10 percent, and the School of Graduate Studies and the central administration each take 5 percent. For anything more than US\$5,000, the ratios will respectively be 50 percent and 25 percent for the inventor and department, and an equal share of 12.5 percent each to the School of Graduate Studies and the central administration.

## **Discussion and Conclusion**

Certainly, the notion of academic capitalism has been evidently entrenched in the science academic units explored in this study, as demonstrated by mobilization of external financial resources and the elements of the theory. Indeed, the four elements of the theory of academic capitalism have been illuminated in the emerging responses to neo-liberal reforms by the science academic units. These units have successfully engaged in attracting external funding for research even during the first responses to the neo-liberal reforms when they were quite constrained, as increased enrolments were registered in the humanities and social sciences disciplines. The external funding is largely from the development partners or donor agencies in the global North. The other avenues such as patenting are in their nascent stages and if properly managed and attuned to the national development agenda, are potentially strong sources of external funding. Because of the differences in the acquisition of external funding, there are some variations across the units with respect to the components of the theoretical framework. In other words, not all the elements of the framework have exact empirical examples within all four units.

Regarding the circuits of knowledge, the academic activities within the science units show an increasing inclination to partnerships between the university, industry, and government. Several patents have been registered by the academic units and scientific discoveries have been instrumental in attracting additional funding from the development partners. The discoveries at the College of Medicine and the Faculty of Agriculture have been further extended to other countries in the region through networks with additional funding from



the development partners. In essence, the responses of the academic units at Makerere University radiate some correspondence with earlier developments in the United States, in which research in agriculture, medicine, and other fields were emphasized (Geiger 2006). It could also be argued that with discoveries such as PMTCT in HIV/AIDS, Makerere University has repositioned for the emerging trends in which funding for basic research is increasingly juxtaposed to the practical relevance it can engender (Pavitt 2001). In Uganda, national competitive funding arrangements are starting to emerge through the MSI initiative and it is also likely that the involvement of experts from industry in the vetting of programs for funding will become more apparent (Slaughter and Rhoades 2004).

The component of the interstitial organizational emergence is empirically evident in the College of Health Sciences, Faculty of Computing and Information Technology, and the Faculty of Technology. Whereas the IDI, an interface structure at the College of Health Sciences is service-oriented, it is possible that through delivery of such services, the College attracts external funding to conduct additional academic research. Besides, the interface was partly conceived as a support unit to the continued scientific discoveries at the College. At the Faculty of Computing and Information Technology, the interface structure has facilitated the development of software for commercial purposes. Perhaps the Faculty of Technology has the highest number of interface structures that are not only intended to generate revenue through consultancy, but also offer specialized training to the SMEs, in addition to steering the activities of the innovation clusters (Hearn and Holdsworth 2002). Obviously, the largest portion of external funding to support these engagements is from the development partners. For example, if science academic units embark on expanding their financial resource bases through industry-funded research, the commercial value of discoveries and growth of spin-offs will increase (Shane 2004). Nevertheless, the participation of universities in intellectual property markets has been hesitant and slow (Dill 2006; Geiger 2006) despite mandates to issue licenses for the discoveries through their technology transfer and licensing offices.

In other words, technology transfer offices have been criticized for delaying processes involved in bringing the discoveries to full commercial production in certain instances (Geiger 2007).

Apparently, the findings illuminate intermediating networks, which are reflected in the form of synergies between the various actors and organizations. In this study, the networks associated with the neo-liberal economy have been divided into two categories: (1) those for aligning curricula and research to national development; and (2) those related to capacity building in research and training. Human resource development was the most significant prerequisite in the realization of the objectives of restructuring the public sector and the decentralization of service delivery. As the leading university, Makerere University engaged different actors from the public and private sectors in the Innovations at Makerere project to build the needed capacity for the decentralized districts of Uganda (Musisi 2004). The science academic units explored in this study were key actors that have also created several sustainable programs by embedding the practices related to the national economy into the academic programs (Katunguka 2005; Makerere University 2007). MUPSF is a recent development that brings together the private and public sectors by signing memoranda as well as appointing non-academic honorary professors. Another intermediating network that spans the national boundaries has been the capacity building for research and training. Clearly, postgraduate training and research in the science academic units has been limited (Makerere University 2006b; Muhumuza et al., 2005). Initiatives in the form of international adaptations through networks have generated external funding for simultaneously conducting research relevant for the national economies as well as training of postgraduate students to obtain advanced qualifications as they participate in projects. This has culminated into "Networks of Specialization" in primarily the agricultural sciences across universities in the Eastern and Southern parts of Africa (Wafula and Clark 2005, 688; Ekwamu 2006, 10).

There is evidence of extended management capacity in the science academic units and the university as a whole. Strategically, there have been attempts at the

institutional level to manage pending inventions that scientists and academic units are producing, although the absence of national mechanisms for intellectual property management had been somewhat replicated within the case university (Bakibinga 2006; Ecuru et al. 2008). This is partly because the affairs of the university were run almost directly by the government, which determined who would become the Vice Chancellor or the composition of the University Council (supreme governing board or trustees). Currently, there are new institutional policies for intellectual property management, and research and innovations at Makerere University. In addition, an intellectual property management unit and the research and innovations office have been identified as possible avenues for managing the discoveries originating from the science academic units (Makerere University 2008a). These institutional mechanisms are relevant to the argument that the relevance of the buffer units hinges on the harmonization of institutional goals and the loyalties faculty have, especially to their disciplines. Such buffer units like the intellectual property offices and technology transfer offices are “brokers” or “intermediaries” for the scientific knowledge and products that originate from the university (Hearn and Holdsworth 2002, 137). They constitute the internal complexity to coordinate the dotted initiatives from the different disciplines or units within the institution. This is a response to an equally complex external environment characterized by numerous actors and organizations in the neo-liberal economy (Hölttä 2000; Hearn and Holdsworth 2002; Geiger 2006; 2008).

Components of the theory of academic capitalism offer an interpretive framework for the emerging responses of four science academic units at Makerere University. Because the intention of the study was to illuminate responses that are closely related to the existing market-like behavior in the neo-liberal universities, the academic capitalism theory was more appropriate. Besides, the theory of academic capitalism suitably anchors the neo-liberal university in the neo-liberal economy. Additionally, within the science academic units studied, academic capitalism has taken the pattern of external funding from development partners. Howev-

er, it is inconclusive whether this represents academic and scientific competitiveness or is just a symbol of adaptive capacities to the markets. It is also argued that, in order to reduce the incidence of the ramifications of the initial responses to the neo-liberal reforms at Makerere University, the extended managerial capacity or the steering core must be strengthened in the early stages of the current wave of responses by the science academic units. At the same time, we ought to be mindful of the fact that inventions and innovations are a product of academic work and originate only from scientific laboratories.

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