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LITERATURE REVIEW OF AGRICULTURAL EDUCATION AND TRAINING

SOUND LESSONS FROM THE PAST

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LITERATURE REVIEW OF AGRICULTURAL EDUCATION AND TRAINING

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INTRODUCTION

This literature review tends to provide a brief summary and a list of lessons learned or recommendations put forward in each of the publications cited. In some cases, only one or two findings in the publication are mentioned, due to various reasons, e.g., the publication was not available online, the findings were specific to localities or did not differ in substance from those in other publications, or the reviewer decided only to highlight a particular point made by the publication. Several passages are taken almost directly from the publications, and therefore require editing prior to reproduction.

The review is organized into three parts. The first covers post-secondary AET (or PSAET). The second part includes secondary technical agricultural technical secondary schools (ATS), continuing education often provided by higher-education institutions, non-formal programs and institutions (e.g. agricultural extension) and basic (adult) literacy education. The final part encompasses the subject of education from the perspective of human resource needs (i.e. human capital development) or some aspect of capacity building (e.g. the need for scientific, workforce, public sector administration).

A literature review aims to provide a summary and an assessment of the current state of knowledge or current state of the art in a particular field. However, the phrase “in a particular field” raises an immediate issue with respect to AET: Which field?

The title adopted for the review cites “agricultural education and training” as the subject, nonetheless we are dealing with several domains at one and the same time. As Willett states in his *Agricultural Education Review* (1998), AET involves a web of interrelated educational activities which aim primarily to raise the productivity of the whole natural resources sector in a country, and are thus a central component in the broader rural/agricultural knowledge system. The AET web includes different levels of agricultural and other education (see also Wingert, 2002). Two generic terms are utilized:

- **Agricultural Education and Training (AET):** institutions and courses of agricultural instruction at all levels and duration, from full-time degrees to short-term and continuing education.
- **Tertiary Education:** All full-time education at post-secondary school level, including universities, colleges, polytechnics, and other training institutes, normally awarding degrees, diplomas, and certificates.

In addition to the above broad-based terms, the AET web includes multiple types of institutions each with distinct purposes and clientele:

- **Higher Education:** University (degree) level programs of study.
- **Middle-Level Education:** Diploma/Certificate-level courses, commonly provided in Ministry of Agriculture colleges and training institutes, and in polytechnics, providing pre-service and inservice training. [Note also that much pre-service and inservice training takes place within business arenas and is referred to as Learning in the Workplace or, as “the shadow education system.”]
- **Technical/Vocational Education and Training:** practical and occupational skills-oriented training conducted most commonly at Ministry of Education secondary-level institutions, colleges, and technical high schools below degree level; may include

- vocational subjects for separate vocational streams in primary and secondary schools, vocational training centers for school leavers, youth services, and apprenticeship programs.
- **Continuing Education:** any system of education conducted through on-the-job (inservice) training and/or short courses as a part of the process of life-long learning. Agricultural extension and donor-organized short-term training courses may also fall under this rubric.
 - **Basic Education:** formal primary (“literacy and numeracy”) education, sometimes defined as including secondary education. However, literacy programs in rural areas vary with the definitions of literacy they adopt (Chall, Heron, & Hilferty, 1987). Volunteer programs work mainly with illiterate adults. They serve adults whose reading achievement is below the fourth-grade level. Competency-based programs, on the other hand, work with adults who already have basic reading skills. Community-oriented programs help adults determine their own learning needs, based on the norms of their communities, and may or may not have an academic focus. –This basic education aspect of AET is not adequately deal with in this literature review nor is it adequately dealt with, as far the reviewer could learn, from an international perspective. Indeed, adult literary in the rural areas of developing countries operates on what this reviewer calls ‘the outskirts of the learning society,’ meaning that it is a kind of stepsister in discussions of lifelong learning.

Large interests surround the subject of AET, i.e. socioeconomic development in general and specifically as it relates to agriculture. Indeed, AET institutions are a set of components within a nation’s goals regarding human resources and human resource or human capacity development.

The varied AET institutions also do not operate in a vacuum and are dependent or relevant to other institutions such as policy-making bodies, businesses, and farm organizations. The issue of their relationship to ministries (particularly educational and agricultural) is paramount as well as their relationships with other similar and associated institutions.

Additionally, perspectives on AET institutions have emerged that require attention to their importance as part of agricultural knowledge and information systems (AKIS) and agricultural innovation systems (AIS). AKIS tends to refer to “the knowledge triangle” or REE (research, education and extension linkages. According to the World Bank (2006) AIS is a blending of institutional capacities, coordination mechanisms, communication networks, and policy incentives that fosters innovation led gains in agricultural productivity. Lessons emerging from recent agricultural revitalization efforts demonstrate that a more nuanced understanding is needed of AET’s role in promoting innovation, development, and growth in agriculture.

Finally, at the very practical level there are a host of issues within any one AET institution, such as leadership and management, curriculum and curriculum development, faculty/instructor and student/participant development, physical infrastructure, equipment and communications technology.

This variety of disciplines (e.g. education, agriculture, human resource development), the web of institutions, the numerous purposes, the distinct clientele, the different perspectives, linkages, and specific needs of each institution associated with AET renders the subject complex, which in turn affects the organization of a literature review of the subject.

The literature review as already mentioned has been organized into three parts: (1) post-secondary agricultural education and training (PSAET), which includes documents on university

agricultural schools and colleges and middle-level post-secondary technical and vocational education and training, (2) agricultural technical secondary schools (ATS), post-High School programs, agricultural extension and continuing education, and (3) human resource development perspectives. However, the reader is cautioned to remember that crossovers in focus and perspective in the documents occur more often than not. The three parts are further detailed as follows:

1. PSAET (Post-secondary Agricultural Education and Training). including university and middle-level higher education demands greatest attention in the literature. The largest number of documents reviewed herein deal with universities--only a few with middle-level colleges and institutes.
 - University higher (agricultural) education
 - Middle-level post-secondary education includes technical and vocational education and training (TVET).
2. In addition to higher education programs and institutions, AET studies also deal with (1) agricultural technical secondary schools (ATS), (2) continuing education often provided by higher-education institutions, (3) non-formal programs and institutions (e.g. agricultural extension) and (4) basic literacy education.
 - ATS (Samy, Swanson)
 - Continuing education (often carried out by universities and middle-level post-secondary educational institutions)
 - Agricultural extension programs
 - Other non-formal educational institutions (Amedzro, Busch, Swanson)
 - Also Basic Adult Literacy programs also fall within “the AET web.”
3. Some documents approach the subject of education from the perspective of human resource needs (i.e. human capital development) or some aspect of capacity building (e.g. the need for scientific, workforce, public sector administration). These documents tend to propose transforming or re-designing the AET domain (e.g., Eicher, Gates Foundation, National Research Council of the National Academies, Rivera, Rivera & Alex).

Human resource development in this review refers specifically to the education that takes place in three major educational settings: (1) the school system (i.e. the formal education and training system), (2) the private and public workforce organizations (i.e. the shadow education system), and (3) the informal educational support programs -- such as the continuing acquisition and transmission of rural knowledge and innovation (i.e. the parallel education system). In a separate paper the reviewer suggests that these three educational settings would profit institutionally as would the students and participants in their programs though closer linkages; an initiative is suggested as to how to begin to create such linkage.

LITERATURE REVIEW

Universities and Middle-level Education

Ajayi, J. F. ade, L.K.H. Goma and G. A. Johnson. 1996. The African Experience with Higher Education. Association of African Universities. London: James Currey.

The World Bank publication *Cultivating Knowledge and Skills to Grow African Agriculture* (2007) provides a wealth of information on AET. Various papers were commissioned for the original study and the final publication includes a long list of references several which are included in this literature review. Additionally, many documents are cited for their contribution to the field of AET study, such as the above citation.

Ajayi et al. underscore among other African experiences with higher education that the PSAET literature seldom mentions post graduate education. They attribute this gap to postgraduate education being a newer and less well-established aspect of African higher education. In the final pages of their book on *The African Experience with Higher Education* they discuss postgraduate education largely from a forward-looking perspective that emphasizes the need for regional collaboration in postgraduate training.

Alex, G., and D. Byerlee. 1999. Integrating Universities into National Agricultural Research and Extension Systems. Agricultural Knowledge & Information Systems (AKIS) Good Practice Note. Washington, DC: World Bank.

Experience with AKIS investment in agricultural universities, although limited, teaches several lessons for strengthening university integration into NARSs/NAESs (National Agricultural Research Systems/National Agricultural Extension Systems), such as:

- *Invest Selectively in Agricultural Universities*

Care should be taken not to subsidize universities that are badly underfunded

and intellectually isolated, that lack practical skills and links to their clients, and that fail to produce graduates with skills needed for the current job market. Country commitment to reforms emphasizing responsiveness to market and client needs should be a condition for major university investments (reviewer italics). Until needed reforms are well under way, donors should do little.

- *Establish Mandates and Structures*

At both national government and university levels, improved mandates, strategies, policies, and structures are necessary for effective, productive university involvement in research and extension programs. Needed are:

- A policy statement establishing research as a legitimate university/ faculty activity and emphasizing research objectives.

- A university research strategy outlining research priorities and how research is linked to users, other research programs, and university education and extension programs.
- Incentive systems that reward client-oriented, collaborative research.
- A small management unit to facilitate research funding, execution, planning, monitoring, and evaluation.
- A budget for research with appropriate support for strategic research programs, competitive research grants, and/or research infrastructure development. Bank support for university research capacity building should generally be contingent on Good Practice in University Development and Linkages to major stakeholders.

- *Expand Research Capacities*

After adequate policy statements, strategic plans, and institutional structures are in place, investment is needed to strengthen the capacity of universities to execute high-quality research. Needs include:

- Competitive Research Grant Programs
- Research Infrastructure Development
- Core Research Program Funding
- Postgraduate Program Capacity Building and University Linkage Programs.

- *Find University Roles in National Extension Systems*

Universities need to explore new opportunities to participate in extension and rural information systems. Expansion of programs for commercial,

producer-contracted extension advisory services can draw from the universities' technical expertise, but requires that this expertise be kept

state-of-the-art and relevant to local needs.

- *Focus Broadly During Project Preparation and Supervision*

In preparing AKIS projects, planners should focus on universities and other agricultural technology institutions as components of larger systems for agricultural research, education, and extension.

Alex, G. & Derek Byerlee; with Solomon Bekure, Ed Quisumbing, Ivar Serejski, & Willem Zijp. 2010. Investing in Integration of Universities into National Agricultural Research and Extension Systems. (Draft). Washington, DC: World Bank.

Major recommendations include:

- *Identify Opportunities for Investment in University Research and Extension*
 - "Don't Feed the Beast!" (Don't invest in mediocrity)

- “Don’t Ignore the Potential!” (However, recognize potential)
- Identify Targets of Opportunity
- *Establish University Mandates and Structures for Research and Extension*
 - National Recognition of University Research
 - University Research Policy, Strategy, and Organization
 - Linkages to Clients
 - Publication of Research Results
- *Expand University Research Capabilities*
 - Competitive Research Grant Programs
 - Research Infrastructure Development
 - Core Research Program Funding
 - Establishing Postgraduate Program Capacities
 - University Linkage Programs

Al-Samarrai, Samer & Paul Bennell. 2003. Where has all the education gone in Africa? Employment Outcomes among Secondary School and University Leavers. Brighton, UK: Institute of Development Studies, University of Sussex.

In 2001, the Institute of Development Studies of the University of Sussex conducted tracer studies of 2,500 university graduates from 1980, 1987, 1994, and 1999 in Malawi, Tanzania, Uganda, and Zimbabwe. It found that unemployment rates among graduates were quite low and that most graduates were generally employed in their field of university studies. Agriculture was the main exception (reviewer italics) where between 25 and 50 percent of graduates reported that they were employed in non-agricultural jobs. This disconnect between training and employment was reportedly due to the limited number of attractive jobs in the agricultural sector, where public agricultural officers are frequently posted to remote rural areas.

Bloom, David; David Canning; & Kevin Chan. 2006. Higher Education and Economic Development in Africa. World Bank. Human Development Sector, Africa Region.

The authors review existing research that analyzes the effects of higher education on gross domestic product (GDP) and conclude that tertiary education plays a recognizable role in promoting economic growth. They posit that “investing in tertiary education in Africa may accelerate technological diffusion, which would decrease knowledge gaps and help reduce poverty” (p. 12).

Busch, Lawrence. 1988. Universities for Development: Report of the Joint Indo-U.S. Impact Evaluation of the Indian Agricultural Universities. Washington, DC: A.I.D. Project Impact Evaluation No. 68.

This report focuses on India’s State Agricultural Universities (SAUs) and examines how an ever-changing socioeconomic and technological environment might (should) become incorporated into the mission of all agricultural universities. The report deals with numerous issues such as university management, centralization, and state support, and including building leadership, faculty quality and vacant positions. It calls for regular impact (not merely output) evaluations, information availability and transfer. In addition, attention is paid to the role of women in development, the social sciences, home science, teaching programs, the quality of teaching (including teaching loads, teaching resources) along with the problems of student commitment to

agricultural education and attracting students from rural areas. Research and extension programs are also highlighted. Curriculum, faculty and student development, research applicability and international linkages are other items highlighted as important to the advancement of State agricultural universities in India. Also underscored are non-formal programs such as extension education, the university connection to farmers and rural areas, and the lack of job opportunities for graduates.

Although many issues are outlined, several policy areas receive particular attention. These included the need for the SAUs to establish an interdisciplinary, systems-oriented approach to research and education; the reorientation of the SAUs toward rural development in its broadest sense; the development of larger and stronger social science programs on the SAU campuses and their integration with technical disciplines; the establishment of better relations between the SAUs and other agricultural development organizations at the state level, including the state departments of irrigation, the strengthening of the Indian Agricultural Universities Association; and the decentralization of the SAU system.

Center for the Study of Rural America. 2000. Beyond Agriculture: New Policies for Rural America. Kansas City: Federal Reserve Bank of Kansas City.

The Center for the Study of Rural America states in its *Beyond Agriculture: New Policies for Rural America*, "... rural America would benefit from a comprehensive and coordinated national rural policy that would take into account not only agriculture and traditional economic development but all of the other factors that comprise a rural community" (p.201). Such national policies are equally urgent and overdue in developing countries.

As regards policy development in this area, the late G. Edward Schuh stated an valuable truth: "One of the cardinal rules of making economic policy is that one has to have one instrument for each policy goal. The use of one policy instrument to cover various policy goals, such as the inclusion of rural extension with agricultural extension is the road to disaster. The reviewer would add that agricultural extension, for example, is not rural extension; certainly the two programs meet and overlap but must embrace distinct policy instruments and program direction.

Clark, N. 2006. Application of the innovation systems perspective in the African higher education sector: Experiences and challenges. Paper presented at the Innovation Africa Symposium, Kampala, Uganda, November 21–23.

AET systems in the African region remain, Clark claims, tied to teaching and research approaches that are organized along a linear vision of science—a vision that subdivides faculties into strict disciplinary departments, provides minimal incentives for understanding the wider demand for scientific applications, gives the greatest importance to theoretical research, and discourages interactions with innovative actors outside academia.

Clark (cf. also Idabacha, 2003) argues that AET systems are forced to contend with interference in the determination of their visions, mandates, priorities, curricula, research agendas and operations due to the strong influence of several dominant suppliers of funding such as government ministries and donor agencies.

Collion, M-H.. & P. Rondot. 2001. Investing in Rural Producer Organizations for Sustainable Development. Washington, DC: World Bank, Rural Development Family, Sustainable Agricultural Systems, Knowledge and Information (SASKI).

There is no blueprint to support rural producer organizations (RPOs); any support should be tailors-made according to country circumstances and th characteristics of the RPOs in that country. Helping rural producers organize themselves, and supporting the development of their organizational capabilities is *an investment in social capital that addresses two of the key dimension of poverty reduction—empowerment and capacity building* (reviewer’s italics).

Davis, Kristin; Javier Ekboir; Wondimsiamregn Mekasha; Cosmas Ochieng; David Spielman; & Elias Zerfu. 2007. Strengthening Agricultural Education and Training in Sub-Saharan Africa from an Innovation Systems Perspective: Case Studies of Ethiopia and Mozambique. Research commissioned by the World Bank. Washington, D. C.: International Food Policy Research Institute.

This paper examines the role of postsecondary agricultural education and training (PSAET) in Sub-Saharan Africa in the context of the region's agricultural innovation systems. The paper argues that AET in Sub-Saharan Africa can contribute to agricultural development by strengthening innovative capabilities, or the ability to introduce new products and processes that are socially or economically relevant to smallholder farmers and other agents in the agricultural sector. Using PSAET in Ethiopia and Mozambique as case studies, the paper notes that while AET is conventionally viewed in terms of its role in building human and scientific capital, it also has a vital role to play in building the capacity of organizations and individuals to transmit and adapt new applications of existing information, new products and processes, and new organizational cultures and behaviors. The paper emphasizes the importance of improving PSAET systems by strengthening the innovative capabilities of PSAET organizations and professionals; changing organizational cultures, behaviors, and incentives; and building innovation networks and linkages. The paper draws on two main sources of information: the emerging literature on innovation systems in developing-country agriculture, and data gathered from secondary sources and semi-structured key informant interviews conducted in Ethiopia and Mozambique in late 2006. The paper offers several recommendations that can contribute to enhancing the effectiveness of PSAET's contribution to agricultural innovation and development. *Key reforms would include aligning the mandates of PSAET organizations with national development aspirations by promoting new educational programs that are more strategically attuned to the different needs of society; inducing change in the cultures of PSAET organizations through the introduction of educational programs and linkages beyond the formal PSAET system; and strengthening individual and organizational capacity by improving incentives to forge stronger linkages between PSAET and diverse user communities, knowledge sources, and private industry* (reviewer italics).

Devaux, A., J. Andrade-Piedra, D. Horton, M. Ordinola, G. Thiele, A. Thomann and C. Velasco. C. 2010. Brokering Innovation for Sustainable Development: The Papa Andina Case. ILAC Working Paper 12, Rome, Italy: Institutional Learning and Change Initiative.

The Institutional Learning and Change Initiative (ILAC) fosters learning from experience and use of the lessons learned to improve the design and implementation of agricultural research and

development programs. While not directly targeted toward the ATE systems, the ILAC initiative underscores a shift that took place in focus (and paradigm) moving from regional research to regional learning and innovation brokering. It elaborates on a case study (cited in the title) which was designed to strengthen potato research capacity in Bolivia, Ecuador, and Peru through the development of a regional research program in line with the CGIAR strategy at the time. The study highlights the shift in program structure and the relationship of innovation brokering with first-level partners. Discussed is the approach developed to facilitate innovation processes and strengthen national innovation capacities with national partners; hence it serves as an example of innovation brokering and offers a theoretical framework for understanding and managing organizational change. The framework emphasizes that research organizations operate in highly dynamic environments and need to anticipate and respond with agility to changing demands and opportunities for their services. The same might be said of AET institutions.

Donge, L.N. (n.d.). Distance Education for Rural Community Based Organizations: Correspondence Courses for Rural Cooperatives in Tanzania: Moshi, Tanzania: Cooperative College.
<http://www.col.org/forum/PCFpapers/donge.pdf>

Distance education can be effective for people who are at a distance who cannot afford to leave their work to attend schools, such as farmers and those obliged to look after their children. It is also useful for rural community organizations whose members are farmers engaged in cultivating farmland for their livelihood. In Tanzania correspondence courses have contributed to improved member education in cooperatives, with better cooperative knowledge, management and organization skills for farmers and keeping of records of their activities and enhancing their contributions in decision making in cooperative activities. Further development will occur when technologically advanced tools can be installed in the rural areas to preempt the need for costly infrastructure. The use of television, the Internet and mobile phones can further accelerate training by distance education in the rural areas.

Douthwaite, B. (2002). Enabling Innovation: A Practical Guide to Understanding and Fostering Technological Change. London and NY: ZED Books.

The world faces huge challenges in the 21st Century. Much of the response to these challenges will come through innovation. Research can and does enable innovation, but the way that research and innovation processes are conceptualized and managed makes a huge difference to the ability of engineers and researchers to foster change. The paper describes the learning selection model that can guide setting up and managing grassroots innovation processes that capitalize on complexity by building on peoples' ingenuity, motivations, and their implicit theories of how change occurs.

Enabling innovation requires fostering change at different scales. The learning selection model can also help guide "top-down" changes by identifying three sets of interventions that alter innovation rate in a system. These are:

- *Novelty generation:* As a result of random genetic mutations and sexual recombination of differing genetic material, differences between individual members of a species crop up from time to time.

- *Selection*: This is the mechanism which retains random changes that turn out to be beneficial to the species because they enable those possessing the trait to achieve better survival and breeding rates. It also rejects detrimental changes.
- *Diffusion and promulgation*: These are the mechanisms by which the beneficial differences are spread to other areas.

Traditionally agricultural research has attempted to leverage change by changing system novelty, through, for example, breeding new crop varieties. The learning selection model helps us see that bringing about innovation is more about changing how people interact and make decisions, and less about developing new technology.

Eicher, Carl K. 2006. The Evolution of Agricultural Education and Training: Global Insights of Relevance for Africa. Unpublished paper commissioned by the World Bank, AFTHD.

This is an assessment of global AET experience especially regards higher education and research -- in the United States, Nigeria, Japan, Philippines, Malaysia, India, Brazil, Denmark, and The Netherlands. The eight country studies reveal that building a system of core AET institutions requires a multi-generational time frame, a period of time that extends far beyond typical donor-financed projects. *The scientific leadership of a country then has the responsibility to start with the overall vision and develop a science and technology policy statement and strategies to interlink universities, public research institutes, extension and the private sector* (reviewer's italics).

The first lesson from the global AET experience is that mobilizing and sustaining political support for AET investments is the most important and most difficult issue to address in designing and financing a system of agricultural development institutions.

The second lesson underscores the critical role of time and learning from experience about how to nurture the co-evolution of technology and institutions for a particular country. The eight country studies reveal that building a system of agricultural institutions is a multi-generational process. The average time required for the U.S., Japan, Brazil, and India to develop a productive and financially sustainable system was 40 to 60 years.

The third lesson is the futility of promoting one model of agricultural higher education such as the Land Grant model or one model of extension such as the Farmer Field School model (Gallagher 2006). The Land Grant model of higher education was discussed in four (U.S., Brazil, India and Philippine) of the eight country studies as well as Nigeria. To be sure, in many countries it has been impossible to replicate the three components of the Land Grant model because of path dependence and entrenched research and extension departments. Nevertheless, the model has been successful in India, Ahmadu Bello University in Nigeria, Hassan II University in Morocco, and at UPLB in the Philippines.

The fourth lesson addresses the issue of incentives. This relates to brain drain, the diasporas, and the low returnee rate of students on long-term training overseas. But M.S. Swaminathan, former Director of the NARS of India and Director General of IRRI, argues that “not much time should be wasted on questions like the brain drain. What is important is to nurture and care for the brains remaining in the country” (2004:17).

The fifth lesson is that the increasing cost of M.Sc. and Ph.D. training has attracted the attention of many donors who are urging universities in Sub-Saharan Africa to cut the cost of training by adopting the sandwich model or by creating regional centers of excellence in graduate training.

The sixth lesson is that the country studies provide some insights on how to extract more research output from African universities.

The seventh lesson derives from the rapid increase in the area planted to GM crops in Brazil, India and China. By contrast, South Africa is currently the only one of 53 countries in all of Africa that is growing GM crops. This is an important issue because of the widening technology gap between Africa, Asia and Latin America. The GM debate is surrounded by uncertainty and politics – both in terms of using food aid from countries that do not have “identity preserved supply chains” and in terms of the fear of environmental and health risks associated with growing GM crop varieties. There is also intense political concern among African governments about a loss of access to European markets. This poses the question: what types of accelerated human capital improvement programs are needed to enable African nations to close some of the GM gaps between Africa and India, China, Malaysia, Brazil and Chile? What essential equipment is needed for biotech research labs? How should GM research be organized so as to spread the fixed costs of labs and equipment over a number of countries? Also, what can be done to generate science-based information on biotechnology that can better inform African policymakers?

In conclusion the author suggests “raising the stakes and discussing the merits of a large-scale human capital and capacity-building plan to ensure that all M.Sc. training will be available in strong M.Sc. programs in Africa within a ten year period” (p. 41) (reviewer’s italics).

Eicher, Carl. 2007. “Investment in Agricultural Education and Training in Africa.” Unpublished paper commissioned by the World Bank, Washington, D.C.

This paper argues for greater support of postgraduate level AET as an effective means of increasing research output in Africa and reflects the author’s thinking cited above on *The Evolution of Agricultural Education and Training*.

Eicher, C.K. 2009. Building African Scientific Capacity in Food and Agriculture. Review of Business and Economics, LIV:3, July-Sept., 238-257.

After 50 years of independence, Africa is still a profoundly agrarian continent where 2/3 of the people directly or indirectly derive their living from agriculture. The central question facing African governments and donor agencies today is ‘What can be done to transform agriculture in Africa?’ *The most difficult challenge facing Africa is how to borrow and generate new technology that is supported by an efficient set of core institutions that can increase agricultural productivity and reduce poverty. Building an interactive system of three core institutions – research, education and extension – has been, and will remain, a multigenerational challenge* (reviewer’s italics). This paper focuses on building African research capacity and graduate education in Africa in an era of globalization.

Lessons and Implications include:

- Africa’s historical experience in building scientific capacity in food and agriculture has shown that an indigenous and cost-effective human-capital renewal system is central to the long-run sustainability of African universities and research and extension systems. Because of the brain drain and the cutback in foreign aid for overseas training, it follows

- that African universities are needed to train graduate students and increase Africa's scientific capacity (Eicher 2006).
- There is empirical support for the proposition that the virtually invisible process of borrowing technology requires the same capacity as inventing and developing new technology at home. Some countries such as Nigeria, Kenya, Uganda and Senegal are developing science and technology policies to support the development of new technology within Africa.
 - Because policy reforms have failed to reduce poverty in Africa, there is a growing awareness that institutions matter as much as policies for accelerating development.
 - Many universities in Africa have more agricultural scientists with M.Sc. and Ph.D. degrees than are employed by their NARS. However, most African universities have difficulty in developing research partnerships with NARS and the CGIAR centers.
 - The CGIAR system is facing another "Quiet Crisis". Buoyed by the important role that it played in Asia's Green Revolution, the CGIAR system added five new Centers in the early 1990s without an assurance of political support from donors to finance 30 to 50 percent of the core budgets of the Centers. The CGIAR has responded to its over-expansion error by reducing the number of Centers from 18 to 15. Since the CGIAR system allocates around half of its total budget to Africa, it is important to solve its financial crisis. Fortunately, the Gates Foundation is providing badly needed financial support to the CGIAR system.
 - Africa has 51 countries but many are too small to finance high quality graduate programs and a critical mass of researchers. To address the "small country" problem, most African governments and donors have tried for 50 years to organize and finance regional research programs, research networks and regional graduate programs. But many of the regional models are financially unsustainable. New models of private education are needed to develop the skills demanded by the market. But private investment in African research and training trails the expanding role of the private sector in agriculture in both Asia and Latin America. The bottom line is that foreign aid will be needed for a period of decades to help craft and build global research and educational partnerships to address the small country problem (reviewer's italics; cf. also Tongoona et al. 2007).

Evenson, Robert E. 2004. "Private and Public Values of Higher Education in Developing Countries: Guidelines for Investment." *Journal of Higher Education in Africa*, 2:1, pp. 151–176.

This paper argues that while scientific and technical "knowledge" is an international public good, the conversion of knowledge to inventions and innovations is not. Knowledge conversion is affected by natural (soil, climate) and economic (prices, wages) conditions. This means that the conversion of knowledge to economic growth production is quite location specific. Knowledge conversion is also subject to high technology "mastery" requirements. Technology mastery also requires specialization by field of technology. These knowledge conversion conditions place a high premium on applied science and engineering skills. Higher Education programs creating these skills have a "public" externality value that is much higher than the private value of these skills in labor markets. This public value is high enough to justify investments in foreign degree training and in programs to create graduate programs in the invention/innovation fields in many African universities.

EARTH University. A new Approach to Higher Agricultural Education.

This brief summary of the EARTH University lessons learned are highly pertinent:

- To graduate professionals capable of successfully promoting change and sustainable rural development, you must begin with young people with a vocational interest in agriculture, natural resource management, rural development and related areas. In too many universities, students end up in agriculture because they couldn't get into medicine, law and other more prestigious faculties. If and when they graduate, it is highly unlikely that many (or any!) of these individuals will be willing to return to rural areas and engage in the complex and difficult work involved in development.
- Universities have to be engaged with rural communities. Too often universities are located in the capital city and there simply are not enough resources (or the will) to get faculty and students out to rural areas to engage directly with the farmers and their families. Frequent and direct contact with the realities of rural life and the challenges of agricultural production are essential in the formation of future change agents.
- Higher education in agriculture has become increasingly specialized with the result that many graduates have great difficulty integrating knowledge across disciplinary boundaries. The development of robust rural economies requires individuals capable of applying knowledge and skills from across disciplines, often in very practical and applied ways. Particularly at the undergraduate level, a generalist formation would seem to be more relevant to the needs of most developing countries.
- Faculty have to be willing to get their hands dirty, to engage directly with their students in production, in processing and marketing as well as in research and extension activities. Reward and promotion criteria have to be designed so that they encourage innovative teaching and engagement, as well as research. At the same time, teachers and professors must be provided a decent compensation for their service. Substandard salaries and working conditions only serve to drive the best out of education leaving the mediocre in charge.
- Agronomists and other agricultural professionals are the true stewards of the land and there is nothing more important than producing the food and fiber required by all. Agriculture and rural livelihoods in general have become devalued in our society and must be dignified and encouraged. The challenges of feeding an ever expanding population and solving the immense environmental problems confronting the planet require the contributions of the best and brightest among us. Agricultural institutions, faculties and schools require investment and must be equipped with the latest technological advances.

Fontem, Dominic A. 2006. Post Secondary Agricultural Education and Training in Cameroon: Country Study. Unpublished paper commissioned by the World Bank, Washington, D.C.

Cited in World Bank (2007). Curricula in tertiary AET institutions are inflexible, outdated, and dictated by ministries; they have not been revised for 20 years (p.16). Regarding gender at the tertiary level, at the Faculty of Agronomy and Agricultural Sciences 22 percent of students were female, but almost half of these (44 percent) were concentrated in the faculty of economics and sociology, not in agricultural sciences (p. 32). Cameroon also reportedly lacks formal ties between AET institutions and research institutes, even though research stations are dispersed throughout the country near various AET institutions (p. 16).

FARA (Forum for Agricultural Research in Africa). 2006. The Framework for African Agricultural Productivity (FAAP). Accra: FARA.

Part 3.14 of The FARA Framework deals with agricultural training and education. Agricultural training and education has a direct impact on agricultural productivity and on the performance of ancillary businesses and trade. It also stimulates implementation of knowledge driven economic growth strategies and poverty reduction. Most African farmers only have access to primary education. This puts a premium on the quality of agricultural education in primary curricula. In addition, to make careers in farming and related branches of agriculture more attractive, there is also a need for adjusting the way agriculture is presented to students.

Farmers and pastoralists need the support of enabling extension and advisory services that take advantage of the most appropriate approaches, such as field days and Farmer Field Schools, community radio and village telecentres. In view of the distances and poor infrastructures, agricultural actors must also take advantage of modern information and communications technologies (ICTs) and distance learning methodologies, which empower farmers and allow them to demand for and access suitable knowledge.

The quality of tertiary agricultural education is critical because it determines the expertise and competence of scientists, professionals, technicians, teachers, and civil service and business leaders in all aspects of agriculture and related industries. It raises their capacities to access knowledge and adapt it to the prevailing circumstance, and to generate new knowledge and impart it to others. *There is a consensus amongst recent studies, such as those by the Inter-Academy Council and the Commission for Africa, that urgent action must be taken to restore the quality of graduate and postgraduate agricultural education in Africa* (reviewer' italics).

The number of private education institutions in Africa has increased dramatically but, their contributions are still marginal for agriculture in comparison to public institutions. Public support for strengthening agricultural education should promote a radically new approach to solving individual and institutional problems and maintaining global standards. To be effective it must, among other things:

- Create competitive working conditions that attract and retain the best brains which requires establishing standards for institutional reforms (in structure and programs), as well as increased and better utilization of resources.
- Establish links between national, sub-regional, regional and global institutions.
- Make curricula more responsive to development needs.
- Improve access to locally relevant educational materials based on agricultural research experiences in Africa.
- Breakdown the institutional and programmatic separation between universities and NARIs which result in inefficient use of capacity and unproductive competition.
- Enhance the quality of the delivery of education by upgrading knowledge and skills of researchers and educators.
- Enhance teaching and training in technologies that could make faster progress in addressing African agricultural constraints, including biotechnology and ICT.
- Contextualize teaching in the management of risk and uncertainty related to smallholder agriculture, e.g., climate change, globalization, and international agreements and conventions.
- Prepare students better with the skills and tools they need for developing and implementing knowledge-based innovation systems.

- Improve integration of land use and environmental topics (including biodiversity, bioenergy, carbon sequestration, etc.).
- Enhance the enrolment of women, commensurate with their predominant role in the sector.
- Establish links in the education system from formal teaching to professional training.
- Create synergies among institutions and curricula in education, research and extension.
- Improve aspects of value adding, marketing and agri-business.

Gêmo, H.E. 2006. Agricultural Education in Mozambique: Brief Description of Its Evolution and Present Challenges. Washington, D.C.: World Bank.

Using the AET system in Mozambique as a case study, this paper examines the role of AET within the context of an agricultural innovation system. This innovation-systems perspective offers an analytical framework to examine technological change in agriculture as a complex process of interactions among diverse actors who generate, exchange, and use knowledge, conditioned by complex social and economic institutions. The paper argues that while AET is conventionally viewed as key to the development of human capital, it also has a vital role to play in building the capacity of organizations and individuals to transmit and adapt information, products and processes, and new organizational cultures and behaviors (reviewer's italics). The paper emphasizes the importance of improving AET systems by strengthening the capabilities of organizations and professionals; changing organizational cultures, behaviors, and incentives; and building innovation networks and linkages. The paper offers several recommendations to enhance the effectiveness of AET for agricultural innovation and development. *Key reforms include aligning the mandates of AET organizations with national development aspirations; inducing change in the cultures of AET organizations through the introduction of educational programs and linkages beyond the AET system; and enhancing innovative individual and organizational capacity by improving incentives to forge stronger links between AET and other stakeholders* (reviewer's italics).

Givá, Nícia. 2006. "Demand Profiles and Supply Responses for Agricultural Education and Training at the Post-Primary Education Level in Mozambique." Paper prepared for the Farmers of the Future, World Agroforestry Centre (ICRAF), Nairobi, Kenya.

Givá underscores the disconnect between AET institutions and the private sector, and notes that employers and companies are only involved marginally in defining learning contents and quality standards (:iii, 9).

Gore, J.S. & M.J. Odell, et al. 2009. Higher Education Partnership in sub-Saharan Africa: An Impact Assessment of 12 Higher Education Partnership. Prepared for the United States Agency for International Development's Bureau for Economic Growth, Agriculture and Trade (EGAT). Washington, DC.

Findings from this impact assessment of 12 higher education partnerships in sub-Saharan Africa demonstrate that HED/USAID higher education partnerships provide impact (reviewer's italics) in terms of: (1) cost-effectiveness measured by cost-share and leveraged funds; (2) enhanced human and institutional capacity building in institutions of higher education both abroad and in the United States; and (3) important contributions to national development goals.

Between 2007- 2009, HED conducted impact assessments of 58 partnerships from more than 300 partnership awards in the five regions since 1999. This is the fifth in the series of impact studies reviewing a broad range of modestly-funded higher education partnerships in Southeast Asia, South Asia, Africa, the Middle East and Mexico over the past decade. The study reports on 12 selected higher education partnerships in Sub-Saharan Africa funded by two to three-year grants since 1998, focusing on:

- Impact of partnerships to strengthen the capacity of host country faculty and institutions to deliver quality higher education;
- Impact of increased capacity of host country higher education faculty and institutions to support national development goals;
- Impact of partnership activity on U.S. faculty, students, and institutions; and
- Suggestions for improving the HED/USAID higher education partnership program.

The study, according to the authors, reveals important trends in higher education. The following are some examples.

- Higher Education for Development (HED) partnerships are contributing to national development goals through policy dialogue and action around critical issues and sectors involving agriculture, food security, nutrition, health, workforce development, and the environment.
- HED partnerships create lasting relationships that generate substantial cost sharing and leveraging of on-going funding, hallmarks of foreign assistance cost efficiency and effectiveness.
- HED partnerships are tapping local resources and re-engaging host country nationals at home and abroad by helping to reverse the ‘brain-drain’ phenomenon; students are finding jobs after graduation instead of joining the ranks of the educated unemployed
- The legacy of the U.S. land-grant university engagement in foreign agriculture research and development, born in Asia, is re-appearing in Africa, and is demonstrating sustainable impact that can provide a foundation for a new African ‘Green Revolution’ attributed to food production in Asia in the sixties.
- The HED capacity building partnership model brings immediate results through increased knowledge and skills of faculty and students, and institutional changes to update management, curricula, courses, teaching methods, research, publications and public policy/extension work.
- U.S. institutions also benefit through expanded knowledge of faculty and students, critical research, internationalization of curricula, publication opportunities, and long-term collegial relationships among U.S. and host country colleagues.
- HED partnerships are becoming more effective and sustainable as host country partners play greater roles in determining program objectives and selecting the U.S. partners.

Harawa, Rebbie. 2006. “A Field Study on the Post Secondary Agricultural Education and Training in Sub-Saharan Africa: Malawi Country Study.” Unpublished paper commissioned by the World Bank, Washington, D.C.

The Harawa case study was one of several commandeered by the World Bank 2006, result in the publication *Cultivating Knowledge and Skills to Grow African Agriculture* (2007). The World Bank study notes that in tertiary AET, only two of the seven countries reviewed showed relative stability in their teaching force. The average experience of instructors in Ghana and Uganda was from 15–20 years. In Malawi and Rwanda, it was less than six, a suggestion of high turnover

(Rivera 2006:19). Harawa states since 1990 there has been an exodus of senior academics in Malawi to NGOs, the private sector, and international positions. Low pay is cited as a principal cause (Harawa 2006: 9). The same applies to teachers at midlevel agricultural schools in Mozambique (Vandenbosch 2006:72).

Idabacha, F. S. 2003. "Creating the New African University." Paper prepared for the international seminar series on Sustainability, Education and the Management of Change in the Tropics (SEMCIT). Retrieved from www.changetropics.org on June 6, 2006.

The reform agenda associated with an enhanced understanding of tertiary education revolves around the visions and mandates for various types of tertiary institutions, their relevance to national development priorities, greater stakeholder representation in their institutional governance, increased autonomy (with accountability) in institutional management, changes in curricula and teaching practices, improvements in incentive systems for academic staff, alternative financing strategies, public-private partnerships, and the realization of new opportunities arising in science and technology -- according to New Partnership for African Development 2006; Juma 2005; InterAcademy 2004; and Idabacha 2003).

Juma, C. (ed.). 2005. *Going for Growth: Science, Technology and Innovation in Africa*. London: Smith Institute.

A compilation of articles by leading professionals on science, technology and innovation in Africa. Juma contributed the chapter on "Reinventing Growth" (pp.10-20).

Kroma, M.M. (2008). *Delivery of technical education and training services to increase labor productivity in rural areas in Sub-Saharan Africa*. Presented at CAADP/IFPRI international invitation conference on "Convergence between social services provision and productivity enhancing investments in the development strategies," held in Pietermaritzburg, South Africa, 27-29 January.

There is a mounting literature on the need for post-secondary agricultural technical education and training institutions to provide practical education for farmers (Davis et al., 2008; Kroma, 2008; Rivera, 2006; Rivera, 2008). Figure 2 suggests an innovative framework.

National Research Council of the National Academies. 2009. *Transforming Agricultural Education for a Changing World*. Washington, DC: The National Academies Press.

The NRCNA recommends that academic institutions with undergraduate programs in agriculture implement the following steps to better meet the needs of students, employers, and the broader society:

- Implement Strategic Planning
- Broaden Treatment of Agriculture in the Overall Curriculum (reviewer's italics)
- Broaden the Student Experience
- Prepare Faculty to Teach Effectively
- Reward Exemplary Teaching

- Build Stronger Connections among Institutions
- Start Early—K-12 Outreach
- Build Strategic Partnerships
- Focus Reviews of Undergraduate Programs in Agriculture

Under the rubric number 2 on “Broaden Treatment of Agriculture in the Overall Curriculum,” the Council notes that topics related to agriculture are found in numerous disciplines, from engineering and technology to chemistry and biology to the social sciences. Accordingly, academic institutions should *broaden the treatment of agriculture in the overall undergraduate curriculum* (reviewer’s italics). In particular, faculty in colleges of agriculture should encourage discussion of agriculture in courses throughout the institution and work with colleagues from other departments to develop shared introductory courses that serve multiple populations and can illuminate underlying themes shared by agriculture and other disciplines.

*** In this regard, the reviewer notes an example of a broad treatment of the Colombia University MDP (Masters in Development Practice): The MDP core curriculum integrates substantive knowledge spanning the disciplines of health sciences, natural sciences and engineering, social sciences and management in order to foster the development of practical, cross-disciplinary skills necessary to prepare students for the field of sustainable development practice.

- Health Sciences: Nutrition, population sciences and reproductive health, basic epidemiology of infectious and non-infectious disease, health policy, health system design and management
- Natural Sciences and Engineering: Agriculture, forestry and fishery management, water management, energy, engineering, environment and climate science, information management systems and design
- Social Sciences : Anthropology, economics, education, politics and international political economies, statistics
- Management : Project design and management, budget planning and financial management, commodities management, communication and negotiations, critical self-reflection, geographic information systems and decision making tools, institutional resource and human resource management, monitoring and evaluation

In addition, specific learning outcomes for the MDP program identify essential knowledge and skills that each MDP graduate should acquire throughout the course of the program. Although the MDP learning outcomes are categorized by discipline and knowledge area, specific courses and learning activities are anchored in an understanding of the inter-relationships between fields and course content is aimed at integrating cross-disciplinary approaches for sustainable development.

Kibwika, P. & J. Hagmann. 2007. "Moving from Teaching to Learning in Universities: Implications for Competence and Management." Paper presented at the biennial conference of the Regional Universities Forum for Capacity Building in Agriculture, Mangochi, Malawi, April 22–28.

According to the World Bank (2007) postgraduate programs do not normally include training in teaching techniques, use of instructional materials, or lesson planning, and institutions rarely take the initiative to make up for these oversights. However, this problem is increasingly being recognized and met. For example, Makerere University and RUForum have partnered to produce an inservice short course for academic staff that emphasizes personal mastery of the "soft skills" needed to facilitate interactive classroom learning. The 12-module course covers a range of communication, class management, and social psychological skills. It has been successfully piloted with 26 staff, according to Kibwika and Hagmann.

Kwarteng, J. A. 2006. "Post Secondary Agricultural Education and Training in Sub-Saharan Africa: Ghana Country Study Report." Unpublished paper commissioned by the World Bank, Washington, D.C.

As noted by the World Bank (2007), there is a clear disconnect between AET and private sector needs. The same lack of ties with producers and producer organizations applies in Ghana, according to Kwarteng (31). Weak articulation and analysis of demand means that the market for AET graduates is not well defined. There is a lack of dialogue between AET institutions and the productive sector. Employers and companies are only involved marginally in defining learning contents and quality standards (cf. Givá 2006, :iii, 9; and Rivera, 2006 Uganda mission report).

Maguire, Charles. J. 2000. "Agricultural Education in Africa: Managing Change." Paper prepared for Workshop 2000, Sasakawa African Association, Accra and Cape Coast, Ghana.

Maguire lists some of the main problems in African universities, e.g.:

- Enrollments are often greater than the capacity of universities to handle
- Unsustainable patterns of expenditure for higher education
- Decline in the quality of education
- Declining relevance to national needs (Saint, 1992)
- Exodus of teaching and research staff to areas of higher pay and better conditions
- Too many universities in certain countries unsustainable with existing budgets
- Disconnect with the employers of graduates from the universities.

He also lists some of the main problems with agricultural education, e.g.:

- Isolation of the agricultural university from other parts of the university system
- Lack of communication with the employers of the graduates of the university, the market.
- Poor practical skills
- Decreased funding as urban focus gathers strength
- Weak connection with other parts of the agricultural education system – colleges, vocational schools, farmer training networks

- High unemployment of graduates from the university, often due to lack of relevance of curriculum.
- Failure to attract the best quality students from secondary schools
- Inbreeding. Teaching and research staff are frequently graduates of the same university or college thereby excluding the entry of new ideas from the wider world of academia and research.

A significant point made by Maguire is that *the AET system is itself a sub-system of the higher order (agriculturally focused) system (or bounded network) of rural development* (reviewer's italics) which includes the clientele, organizations and institutions in both the private and public sectors, and both non-government and community-based organizations.

A second point of note regards the World Bank's investment. For too long, he states, *the focus of international donor agencies has been on elements of the AET system* (reviewer's italics). The World Bank, in the twenty-six years between 1963 and 1989, supported agricultural education in sixty-seven of its 135 higher education projects. As a 1992 World Bank Review notes, agricultural colleges and universities were among the first education institutions to receive Bank assistance, and the Bank itself was among the earliest multilateral donors to support these institutions. Bank assistance was based upon the need to supply technicians to support the science-based agriculture, which was to play such an important part in increasing food security and promoting economic development. Governments looked to these higher education institutions to produce the technical personnel, managers, teachers, researchers, and extension workers required to staff agricultural agencies. It is now clear that the emphasis of these investments was *on one element of the system, the higher education element, but not on the system itself* (reviewer's italics).

Makelele, Kilyobo. 2006. "Système d'Éducation et de Formation Post-Sécondaire en Agriculture au Rwanda." Unpublished paper commissioned by the World Bank, Washington, D.C.

In some countries, such as Rwanda, institutional-level curricula reforms are gaining momentum. The Rwanda Institut Supérieur d'Agriculture et d'Élevage has adopted a competency-based curriculum to replace its classical programs (p. 32–33).

Millington, Clarie. The Use of Tracer Studies for Enhancing Relevance and Marketability in Online and Distance Education. St. Michael, Barbados, W.I: Barbados Community College.

Over the last two decades online and distance education has greatly developed as a methodology for providing education for those who formerly may have found further education inaccessible for various reasons. As with most education processes, it is customary to have students complete an evaluation of the course or program. This type of evaluation usually focuses on issues such as course content, the instructional material provided, the usability of the technology, and rating the performance of the course facilitators. According to Millington, this form of assessment focuses on the production process of ODL (Online and Distance Learning), rather than on the product of the learning process, which is the acquired knowledge and skills of the student. ODL providers should know the fortunes of their graduates in order to make a complete assessment of how the educational process has impacted graduates. With such data modifications can be made that could enhance students' chances of achieving success.

Muir-Leresche, Kay. 2006a. Improving Approaches for Effective Teaching and Learning: Tertiary Agricultural Education. An ANAFE publication. Nairobi, Kenya: World Agroforestry Centre.

The educator's role should be to promote analytical skills, self-esteem, a sense of personal competence, and the capacity to participate in community and national affairs, as well as to build interpersonal trust and satisfaction (Muir-Leresche 2006a). The use of case studies can help to teach these qualities.

Muir-Leresche, Kay. 2006b. "Challenges for Women in Changing African Universities." In Geoffrey Tusiime and Gilbert Mwanjololo (eds.), Enhancing Women's Role and Participation in Science for Food and Nutritional Security in Africa. RUFORUM Working Document No. 1. Kampala, Uganda: Regional Universities Forum for Capacity Building in Agriculture, pp. 57–64.

Targeted recruitment policies, affirmative action initiatives, academic enrichment programs, and earmarked scholarships can be used to boost female enrollments. These measures deserve to be tested systematically in order to ensure that a country's best minds are engaged in its development efforts (p. 59).

Muir-Leresche, Kay. 2003. "Transforming African Agricultural Universities and Faculties: Examples of Good Practice." Paper prepared for the international seminar series on Sustainability, Education and the Management of Change in the Tropics (SEMCIT). Retrieved from www.changetropics.org on June 6, 2006.

Selection for university admission is generally based on a rank ordering of academic qualifications, with agriculture well down the list of student preferences. As a result, large numbers of university students end up assigned to agriculture without having chosen it. This creates problems of motivation and professional commitment, according to Muir-Leresche (p. 10).

National Council for Tertiary Education, Ministry of Education and Sports. Statistical Digest of Polytechnics, Accra, Ghana.

A statistical digest on tertiary education in polytechnics in Ghana.

Ng'ethe, Njuguna and Charles Ngome. 2007. "University-Industry Linkages in Kenya: With Special Reference to the Jomo Kenyatta University of Agriculture and Technology (JKUAT)." Processed. Washington, D.C.: World Bank.

The World Bank (2007:52) states, African higher education institutions have traditionally emphasized scientific publications as a main criterion for academic promotion, a requirement that has created an incentive system that encourages pure science and esoteric publication while ignoring problem-solving science. The Bank argues that for university research to contribute more directly to solving the challenges of national development, the present incentive system for promotion will need to be modified. For example, the Jomo Kenyatta University of Agriculture and Technology in Kenya weighs intellectual property contributions (i.e., applied science patents)

highly in the consideration of staff merits for promotion. This has paid off with the university registering 26 patents in the past five years (Ng'ethe 2007).

Obua, Joseph. 2006. "Post-Secondary Agricultural Education and Training: Uganda Country Report." Unpublished study for the World Bank, Washington, D.C.

Important initiatives to increase gender mainstreaming in the agricultural professions are currently underway in Africa. The Female Scholarship Initiative, initiated by Makerere University in Uganda and funded by the Carnegie Corporation, might serve as a model for initiatives elsewhere. It provides full scholarships of USD 1,200 each to 19 women of limited income to pursue studies in agriculture, so far with encouraging academic results (p.18–19).

Rondot, P. & M-H. Collion (eds.) 2001. Agricultural Producer Organizations: Their Contribution to Rural Capacity Building and Poverty Reduction. Washington, DC: World Bank.

A compilation of case studies providing lessons related to rural producer organization (RPO) capacity building. In general the cases argue that it is important to encourage the emergence and strengthening of RPOs, but not to expect miracles; pragmatism and perseverance are need. Governments and their service must be persuaded that the development of RPOs is not contrary to their interests. RPOs will have a hard time succeeding in the face of government opposition. There is no universal approach to supporting RPOs. Support must be tailor-made, learning-by-doing process that will vary according to the country circumstances and to the specific needs of the RPOs in that country.

Rygnestad, Hild, William Saint and Eija Pehu. 2006. "Agricultural Education and Training in Sub-Saharan Africa FY86–06. Unpublished paper for the World Bank, Washington, D.C.

Postsecondary agricultural education is only beginning to gain financial attention by donor. PSAET received just 2 percent of the World Bank's USD 4.8 billion of global investment from 1987 to 1997, whereas agricultural research and extension received 98 percent of the total. Bank financing for agricultural higher education was awarded to just three African countries during that decade.

Saint, William. 2005. Who Understands African Agriculture? Too few! World Bank Study on Agricultural Education and Training in Sub-Saharan Africa, presented at conference on Skills Development for Rural People: A Renewed Challenge, held in Rome on Nov. 10-11, 2005.

This conference paper solicits comments on the study of AET in general. In passing, it notes that the teaching staff are often poorly trained, financing is a chronic problem and that management of the AET sub-sector is often too centralized, controlling, rigid and unresponsive to changes.

Sanders, John H., Richard L. Meyer, Roger W. Fox and Fernando C. Peres. 1989. "Agricultural University Institution Building in Brazil: Successes, Problems, and Lessons for Other Countries." *American Journal of Agricultural Economics*. 71 (5): 1206–1210.

Brazil's human capital improvement is impressive. According to the document, the University of Fortaleza in the Northeastern State of Ceará, had only 2 percent of the faculty had advanced degrees in 1963. A decade later, 82 percent of the faculty held advanced degrees (Sanders et al. 1989 in Schuh 2006 in Eicher 2006: 23). When EMBRAPA became operational in 1973, it took the difficult strategic decision to upgrade the quality of its scientific staff by retaining only half of the 6,700 employees in the old agricultural research system. EMBRAPA used a USD 100 million World Bank loan plus its own funds to send 500 agricultural researchers for PhD degrees. It then spent 20 percent of its total budget from 1974–1982 on training programs in Brazil and abroad. In the late 1970s and early 1980s, EMBRAPA had an average of more than 300 researchers enrolled each year in postgraduate training programs. Today half of EMBRAPA scientists hold a PhD degree.

Spielman, David J.; Javier Ekboir, Kristin Davis, Cosmas M.O. Ochieng. 2008. *An innovation systems perspective on strengthening agricultural education and training in sub-Saharan Africa*. Amsterdam: Elsevier.

This paper examines the role of postsecondary agricultural education and training (AET) in sub-Saharan Africa in the context of the region's agricultural innovation systems. Specifically, the paper looks at how AET in sub-Saharan Africa can contribute to agricultural development by strengthening innovative capacity, or the ability of individuals and organizations to introduce new products and processes that are socially or economically relevant, particularly with respect to smallholder farmers who represent the largest group of agricultural producers in the region. The paper argues that while AET is conventionally viewed in terms of its role in building human and scientific capital, it also has a vital role to play in building the capacity of organizations and individuals to transmit and adapt new applications of existing information, new products and processes, and new organizational cultures and behaviors. The paper emphasizes the importance of improving AET systems by strengthening the innovative capabilities of AET organizations and professionals; changing organizational cultures, behaviors, and incentives; and building innovation networks and linkages. Specific recommendations in support of this include aligning the mandates of AET organizations with national development aspirations by promoting new educational programs that are more strategically attuned to the different needs of society; inducing change in the cultures of AET organizations through the introduction of educational programs and linkages beyond the formal AET system and strengthening individual and organizational capacity by improving the incentives to forge stronger linkages between AET and diverse user communities, knowledge sources and private industry.

Swanson, Burton E., 1986. "The Contribution of U.S. Universities to Training Foreign Agricultural Scientists." In Lawrence Busch and William B. Lacy (eds.) *The Agricultural Scientific Enterprise: A System in Transition*. Boulder: Westview Press. pp. 229–238.

A review of the contribution of U.S. universities to training foreign agricultural scientists which appeared in *The Agricultural Scientific Enterprise* edited by Lawrence Busch and William B. Lacy.

Swanson, B.E. (n.d.). Agricultural Education and Training.

This report provides an overview of secondary, intermediate, and higher agricultural education, including formal and non-formal agricultural training programs and institutions as these refer to Egypt, but nevertheless concentrates on universities in Egypt.

The report notes currently there are two Faculties of Agriculture in the West Bank, one at Hebron University and a second at An-Najah National University in Nablus. Al-Azhar University in Gaza initiated a Faculty of Agriculture in 1992, and other universities, such as Bethlehem and Birzeit, have one or two faculty members who offer agriculturally related courses or training programs. Hebron Technical Engineering College offers post-secondary education in agricultural mechanization. Vocational agricultural education is currently offered at two secondary agricultural schools, one at Al-Arroub (near Hebron) and a second at Beit Hanoun in Gaza. In addition, the Arab Development Society offers vocational education in agriculture at its school near Jericho. The programs, faculty, and facilities for each of the principal agricultural education institutions are described, as well as the important informal agricultural training programs.

The report recommends that (1) only one Faculty of Agriculture be supported, (2) this Faculty be developed at a new location that will allow for the development of appropriate teaching and research facilities, and (3) this new Faculty emphasize both practical skill training and the theoretical knowledge that graduates will need to contribute fully to the development of the agricultural sector. This final recommendation implies that the curricula of this institution should be oriented toward practical problem solving.

Swanson, B.E.; R. Kirby Barrick; & Mohamed M. Samy. Transforming Higher Agricultural Education in Egypt: Strategy, Approach and Results.

Faculties of Agriculture in many developing countries face serious challenges in keeping their academic programs up-to-date and linked to the human resource needs of the agricultural sector. In many cases, faculty members have limited opportunities to conduct research, and linkages with the private sector may be weak, so academic programs are not effective in preparing students for technical and managerial jobs within agribusiness firms. This paper describes a strategy being implemented in collaboration with five universities in Upper Egypt to transform their academic programs and to bring specific institutional changes that would strengthen linkage between these universities and private sector firms and commercial farms.

The project began with a skill-gap analysis to identify the specific needs of private sector employers and weaknesses in current academic programs. Based on this analysis, the first step was to introduce active teaching-learning methods to faculty members to enhance the development of higher level cognitive skills needed by private sector employers, including critical thinking, problem-solving and decision-making skills. Through specific course and faculty development activities, it was possible to up-date the content of “core” courses being taken by all agriculture students. Next, based on a strategic planning exercise carried out by academic and private sector leaders, universities organized external advisory committees and internship programs, as well as career resource and extension-outreach centers. Two independent reviews verified that these activities had successfully transformed these academic programs and that most faculty members had up-dated their courses and were now using active teaching-learning methods.

Conclusions and Educational Importance

To remain competitive in the global economy, developing nations will need to strengthen their existing universities as well as to establish new institutions of higher education. Yet, as Holm Nielsen points out, “While there are exceptions, the quality and relevance of research, teaching and learning has continued to decline in public tertiary education institutions. Many universities operate with overcrowded and deteriorating physical facilities, limited and obsolete library resources, insufficient equipment and instructional materials, outdated curricula, unqualified teaching staff, poorly prepared secondary students, and an absence of academic rigor and systematic evaluation of performance (Holm-Nielsen, 2001, p. 9). These are the specific problems that MUCIA attempted to address through the Capacity Building Component of the AERI Linkage Project. As demonstrated through this AERI Linkage Project, with a relatively modest USAID investment: “...faculty members at all five partner universities have successfully revised and implemented course content changes that provide more practical, employment-oriented subject matter skills to improve the employability of students completing undergraduate degrees in the agricultural sciences.

Temu, August B., Per G. Rudebjer, James Kiyapi, and Pieter van Lierop. 2005. Forestry Education in Sub-Saharan Africa and Southeast Asia: Trends, Myths and Realities. Rome: Food and Agriculture Organization.

The endowment value of forests and woodlands in Africa is enormous, and can be used to promote a wide range of livelihood opportunities, including increased income and enhanced livelihood security. However, as forests and woodlands are declining, primarily as a result of increased woodfuel collection, clearing of forests for agriculture, illegal and poorly regulated timber extraction, conflicts, increasing urbanization and industrialization, these opportunities are diminishing. Between 1990 and 2000, Africa’s forests and woodlands receded faster than the global average; deforestation in Africa took place at an average of 0.8 percent, as compared to the world average of 0.2 percent.

Policy, legal, institutional, technical and economic constraints have undermined wider adoption of sustainable forest management as well as limited opportunities for development.

One major constraint is that Africa has not been able to take advantage of its wealth of raw materials and traditional knowledge to invest in processing. This continues to undermine opportunities for employment and income generation. With increasing private-sector involvement, including foreign-based companies, there is a good opportunity for governments to foster viable partnerships with the communities and civil societies in the protection of traditional rights of forest-adjacent communities, and equitable sharing of benefits from forest resources to promote livelihood security and ensure sustainable use of forest and woodland resources. This is consistent with obligations under the Convention on Biological Diversity (CBD). Additionally, it is essential for there to be increased investment in the development of micro- and small and medium enterprises (SMEs) if people are to have the opportunity to move away from subsistence-based livelihoods.

Temu, August, Inonda Mwanje and Keadire Mogotsi. 2003. Improving Agricultural and Natural Resources Education in Africa: A Stitch in Time. Nairobi: World Agroforestry Centre.

The main purpose of agriculture and NRM, natural resource management, education should be to improve the well being of society. Because of this, the old paradigm of seeing agriculture as a separate entity dedicated to producing food should be discarded. To achieve food production and

environmental protection, there must be radical changes in tertiary agricultural education programs and the way they are implemented, especially the integration of scientific disciplines to bridge the gap between mining of land and efficient utilization and conservation of natural resources for sustainable development. There is a need to re-examine our sociopolitical paradigms on poverty reduction and economic growth, with the aim of establishing progressive and responsive technological innovations and advancement, good communication and involvement of stakeholders in education, research and development. This approach should help put to productive use, graduates from tertiary agricultural education institutions, thereby avoiding wasteful investment in agricultural and natural resources education.

Tongoona, P and M. Mudhara. 2007. "Regional Training Strategies for Post-Secondary Agricultural Education in Sub-Saharan Africa: When Do They Work and How Should They Be Done." University of KwaZulu-Natal. Unpublished.

A study by Collaborative Masters in Agricultural and Applied Economics (CMAAE) on research and training indicated linkages among departments of agricultural economics in the region and revealed that almost all departments had linkages with institutions outside Africa, but only a few had linkages with other AET institutions in East and Southern Africa (Tongoona and Mudhara 2007:13). Thus, regional collaboration presents itself as a largely untapped resource, not only for staff development but also for fostering agricultural innovation systems.

USAID. 1990. Beyond the Neoclassical University: Agricultural Higher Education in the Developing World-An Interpretive Essay. Washington, DC: Program Evaluation Report No. 20. (by Gary E. Hansen, Center for Development Information and Evaluation, A.I.D).

Hansen claims that three policy factors tend to affect an agricultural university's effectiveness as a significant actor in rural and agricultural development. These factors are (1) the university's relationship with the ministry of agriculture, (2) the degrees of autonomy and accountability that undergird the university mandate, and (3) policymakers' vision of the role of the university.

He argues in particular that agricultural universities are more effective when they function in close partnership with a ministry of agriculture. This might seem to be an obvious conclusion, since the ministry of agriculture is one of the primary employers of university graduates in agriculture and may also be a primary source of financial support for university programs. What is obvious, however, is not commonplace: most agricultural universities do not function in a close partnership with the ministry of agriculture.

He further underlines the importance of the university's mission, structure, and student and faculty development. How the mission of the agricultural university is defined will say much about the capacity of that university to learn from its environment and to build effective working relationships with clients and constituents. Unfortunately, the prevailing view of the university mission has stifled the development of these capacities, thereby leaving many universities relatively isolated from their environment and bereft of the sources of experience and support that are needed to maintain institutional vitality.

The way an organization is structured usually betrays its principal mission. In the case of the agricultural universities, almost without exception, the scientific disciplines constitute the primary basis of the organizational structure, as formalized in discipline-based departments. Inherent

within the discipline-based organizational structure is a goal or mission that emphasizes advancing the frontiers of knowledge, within the boundaries of the particular discipline, through basic and applied research.

Organization by discipline-based departments may be inappropriate for enabling the larger university to pursue its avowed goal of improving rural livelihood. Departments have a tendency to turn in on themselves and to define standards of relevance and priorities in research and education that may not be directly responsive to larger university goals.

The highly didactic mode of education practiced in most developing country universities is a reflection of the dearth of learning materials available to students and faculty. Library materials and textbooks are frequently out of date or simply unavailable. Similarly, audiovisual equipment, if it is available, is often in disrepair. However, it is unlikely that an increase in supply of these learning aids would change existing educational practices. The traditional approach to education is deeply ingrained.

USAID. 2010. Agriculture long-term Training: Assessment and Design Recommendations. Prepared by the Aguirre Division of JBS International, Inc. (Authors: Andrew Gilboy, Cornelia Flora, Ron Raphael, and Bhavani Pathak). Washington, DC:

The report notes “the unprecedented increase in funding designated for *African agricultural capacity building*, U.S. Agency for International Development (USAID) Washington and Mission officials will gain insights from this assessment on how to plan, implement, and monitor new activities that will get results.”

The objective of the report was to identify the most effective ways to *improve performance* at African agricultural institutions using, among other interventions, long-term U.S. graduate degree training with its over 40 years of lessons learned.

This report focuses narrowly on one implementation mode of capacity building: graduate agriculture training in the U.S. It assumes that a decision to improve the capacity of a partner institution begins with a holistic HICD (Human and Institutional Capacity Development) performance gap analysis, which may identify gaps in knowledge, skills, and attitudes (KSAs) to be addressed by training. It also assumes that other areas of institutional weaknesses may be addressed with appropriate interventions other than training.

The assessment team assessed six programs, three of which were pilot activities for which USAID funded implementation between 2003 and 2009 to test different features to help determine which ones worked best. In addition to discussions with USAID/Washington staff and U.S. implementing partners and faculty advisors, the assessment team visited eight countries, conferred with Mission staff, conducted focus groups, and administered two survey questionnaires to learn which features had the most impact on building capacity. The purpose was to identify the features, not evaluate the programs in depth, so the report provides an overview of each program with the emphasis on what worked and what did not.

The team made many recommendations that, if implemented, would help build capacity and improve performance based on our assessment of past efforts.

- Implement recommendations within a larger HICD approach.

- Using the HICD approach, focus on the African institution’s performance improvement rather than training African individuals out of context (as was often done earlier in the “Best and Brightest” programs.)
- Establish clear links between the U.S. degree program and specific institutional (not just individual) performance gaps that will be addressed by the training.
- Require that graduate research topics be jointly developed by and with African institutions and U.S. advisors, and that research be conducted in Africa.
- Promote partnerships between U.S. and African institutions in tandem with providing support for training of carefully-selected faculty and staff.
- Fund graduate training for employees of African institutions, not outstanding students from the general public.
- Ensure that the selection criteria for candidates for U.S. degrees include leadership potential and the level of the employee’s commitment to apply the new knowledge and skills acquired upon return.
- Identify the need for Masters and PhD degrees according to employment realities and institutional need, not according to a student’s ability to migrate to a higher degree.
- Require that African participants in U.S. degree programs be placed only at U.S. institutions with strong ongoing programs in Africa to ensure that leverage in sustained, long-term capacity building stretches beyond an individual student’s program and USAID’s five-year project windows.
- Design “sandwich” training programs that combine U.S. and African study and research experiences to avoid selection of research topics not directly related to home country needs and to minimize long absences from the home institution and family.

Many of the report’s recommendations are refinements to previous programs that USAID and con-tractors can institute with little cost implication. Others are reminders to USAID Missions, which no longer have training officers familiar with participant training, not to repeat the mistakes of the past. The assessment finds that having participants return to their home country to conduct research after their coursework is completed can be a cost-effective feature, in that the allowances spent on a comparable U.S. stay would be allocated to a return trip and research stipend. But the issue, according to the report, is not about the cost of the training, but the investment needed to obtain the performance result USAID and its African partners are seeking.

USAID, Bureau for Economic Growth and Trade, Education Office.
Generations of Quiet Progress: The Development Impact of U.S. Long-Term University Training on Africa from 1963 to 2003. Vols. I, II and III -- An evidence-based impact assessment of the value obtained from major investments in graduate education for 3,219 African professionals by USAID and its partners in the ATLAS and AFGRAD programs. Washington, DC: Prepared for the U.S. Agency for International Development by Aguirre International under the Global Evaluation and Monitoring IQC, Contract FAO-I-00-99-00010-00, Task Order 13.

How many opportunities exist to assess development impact in Africa from a single program that covered 45 countries and lasted for 40 years? Established at the moment of independence for many African nations, the USAID-funded AFGRAD Program (African Graduate Fellowship Program [1963-1990]), and its successor ATLAS Program (Advanced Training for Leadership and Skills1 [1991-2003]), came to a close last April, having traversed many well-known development challenges and obstacles. Through these four decades, the TLAS/AFGRAD regional

program, managed by the Africa-America Institute (AAI), trained over 3,200 African professionals for PhD and MA degrees at U.S. universities in fields critical to their country's growth.

What development impact on African institutions resulted from investing \$182 million? to bring highly qualified African professionals to the United States for graduate training? Were USAID's development goals well served? To answer these and other questions, the USAID Africa Bureau's Sustainable Development Office commissioned a study in October, 2003 to find out whether development impact occurred from the longest-running and largest long-term graduate training programs for Africa: ATLAS and AFGRAD. This was in response to several issues:

- The impending end of the program and a need to derive lessons learned from future planning; and second, questions being raised by U.S. universities, scientists and researchers, African institutions, and U.S. diplomats as to why USAID, the lead foreign-assistance agency, was not investing in replenishing the stock of U.S.-educated leaders in Africa.
- Interest in sustainable and significant changes introduced by participants sponsored through these two well-known programs that received U.S. Government funding of some \$182 million over 40 years; and, if so, what can be discovered about that impact? Was the
- Impact at the individual level, or was the impact felt at the institutional, community, sectoral, national, regional, or international levels?
- An assessment of whether USAID's overall development objectives were well-served by such large investments.
- Questions of differences in terms of participant effectiveness in bringing about positive changes linked to their U.S. academic programs by variables of gender, language, and education level.

The results and observations discussed in the report were developed from evidence-based findings, which draw from both quantitative and qualitative information. A quantitative, statistically based survey of 203 participants representing an estimated 1,921 participants, or 60 percent of the actual universe of 3,219 graduates, drives the report, supplemented by hundreds of examples from participants themselves that ground their affirmations of significant impact. The assessment team's visits to seven of the largest "sending countries" led to site discoveries of examples where the U.S. training made the critical difference in an institution, sector or community. Even an Internet search turned up remarkable "hits" where the achievements of former participants were influencing change far beyond their country's borders.

The ranges of findings of the assessment include:

Finding 1: USAID's multi-million dollar investment in long-term training for over 40 years produced significant and sustained changes that furthered African development in measurable ways.

Finding 2: Long-term degree training at U.S. institutions was critical in creating the necessary foundations for significant impact to occur.

Finding 3: Participants reported that changes in institutional performance were attributable to U.S. training and gave concrete examples as justification.

Finding 4: Running against prevailing views, participants cited critical thinking and research skills rather than improved technical and scientific knowledge more frequently as critical to achieving impact.

Finding 5: Changes in attitudes towards work consistently appeared as major benefits.

Finding 6: No difference in impact was observed between PhD and master's graduates.

Finding 7: Improved management was a frequently cited training benefit even though it received minimal attention during training.

Finding 8: Participants from the Education sector reported consistently higher impact and less difficulty applying their acquired knowledge and skills in their institutions than other sectors.

Finding 9: Participants with degrees in financial fields, or those with MBAs, recorded lower impact than those in Agriculture, Health and Education.

Finding 10: Although women reported more difficulty applying their knowledge and skills at the workplace than men, they reported impressive anecdotal examples of impact where they were able to apply their skills and knowledge.

Finding 11: No correlation could be found regarding impact and the frequency with which participants returned to their original workplace.

Finding 12: Participants returned to their home countries after their U.S. training when conditions permitted. There is no significant evidence that long-term U.S. training under these sponsored programs contributed to any brain drain of African human resources.

Finding 13: ATLAS/AFGRAD participants surveyed were well-advanced in their careers, making significant contributions to development.

USAID/Mexico. 2008. Evidence of Success: Results from Higher Education for Development—Site Visits to Six Partners. Washington, DC: Sponsored by USAID/Mexico and Managed by Higher Education for Development (HED). Cooperative Agreement Number 523-A-00-06-00009-00.

The six site visits, according to the authors, provided evidence of improved partnership management techniques such as wire transfers of funds, and shifts in training locations to avoid cumbersome visa issues. Evidence gathered through site visits to these six partnerships confirms faculty innovation and institutional strengthening that are present across TIES (Training, Internships, Exchanges and Scholarship) initiatives in higher education partnerships in Mexico.

USAID/ Sudan. 2010. Southern Sudan Agricultural and Environmental Sciences Higher Education Needs Assessment: Final Report. Prepared as a performance milestone under SANREM CRSP Cooperative Agreement No. RLA-A-00-09-00001-00. The SANREM CRSP is managed by the Virginia Tech Office of International Research, Education, and Development.

This report describes the “needs assessment for higher education in agriculture and natural resource management” undertaken with Southern Sudan and U.S. partners through an associate award from USAID-Khartoum under the leadership of the SANREM CRSP and Virginia Tech. Through a series of two workshops with local, regional and international participants and a “key informant” survey of stakeholders in three states, short and long-term higher education needs were assessed. Among the greatest needs identified were the following:

- Huge deficiency in numbers of current and projected university-trained agriculturalists
- Universally recognized urgent need for practical, field-based training for degree candidates at all levels
- Urgent need for shorter-term certificate and diploma programs
- Shorter-term development needs require many more bachelors degree graduates with broad-based, general agricultural training
- Facilities and faculty training needs are acute and general
- Higher education to increase regional food security is priority number one

In response to these needs, this report outlines curricula changes and other recommendations judged to be required for an optimal response to the challenges of post-conflict Southern Sudan. Curricula changes are made based on the needs assessment and a cross-sectional analysis of the core curricula nine other regional and international universities. Specific curricular adjustments and recommendations for both the Catholic University of Sudan and the University of Juba are made subject to the assumption that required resources will become available.

General recommendations:

Short-term agricultural tertiary education efforts should focus on the training of agricultural generalists who could function as extensionists to assist smallholders and medium sized farmers and herders to improve their productivity and general food security in the region. Southern Sudan universities should take the lead in implementing these tertiary education programs.

Wallace, Ian and Esse Nilsson. 1997. The Role of Tertiary-level Agricultural Education and Training in Improving the Responsiveness and Performance of Public Sector Services for the Renewable Natural Resources Sector. London, UK: Natural Resources Policy Advisory Department, DFID.

Research (mainly in sub-Saharan Africa) has indicated a number of successful innovations in agricultural education and training (AET), however AET has generally been unresponsive to changing patterns of demand for trainees, which are influenced by the changing roles of public and private sectors. Much can be done to improve the design and management of AET, and to strengthen the policy framework through which support and direction are channeled. There is also a need to enhance the interactions between AET institutions and the formal schools sector, as well as AET institutions' linkages with local communities, NGOs and other intermediary organizations. The low level of dissemination of the results of research or of successful innovations has meant that too few new ideas have been flowing into AET.

Willett, Anthony. 1998. Agricultural Education Review: Support for Agricultural Education in the Bank and by other Donors. Washington, DC: Agricultural Knowledge Information Systems (AKIS) thematic team; The World Bank's Rural Development Network.

Willett's World Bank review, though slightly dated, puts forward a rich menu of ideas, options, and arrangements which he compiles from the experience of the different AET donors. He underscores the benefits of an integrated and dynamic agricultural education, research, and extension system, and to forging links between the elements of that system and farmers. The pieces of the review's "menu" include:

- A shift from limited interventions in single institutions toward an approach that promotes systemic institutional change, policy reform, and good governance ideally throughout and interconnecting all levels of the AET system
- Long-run commitment (some agencies do not become involved because they realize involvement requires long-term commitment)
- Rationalization
- Policy- and sector-based lending
- A broader view of agriculture, and education's contribution to the agriculture sector, as demonstrated by approaches to science and technology research and education, and

- identification of other disciplines and cross-cutting themes that contribute to environment and natural resources management
- Responsive, market-oriented, and demand-driven curricula and courses
 - Establishment of regional centers
 - New, more competitive funding arrangements and incentives to encourage reform
 - More interaction between agricultural educational institutions and other stakeholders in agricultural education, particularly private sector employers
 - Use of joint funding and cooperative agreements between donors and universities, NGOs, and the private sector to promote networks, linkages, twinning, and other partnership arrangements between developed and developing country educational institutions
 - Emphasis on relevance, quality, and efficiency of teaching and learning
 - Greater attention in enrollment procedures to issues of equity and access of needy and intended beneficiary groups

Wingert, S. 2002. Agribusiness Education in Mozambique, 2004–2010: Concept Paper. Maputo: United States Agency for International Development.

Wingert states that AET systems in sub-Saharan Africa are commonly structured around at least four different components at the post-secondary level: universities, colleges, technical/vocational schools, and non-formal educational organizations and activities. He maintains that each of these components plays a role in fostering agricultural innovation, a role that depends on the strengths of the specific countries and elements of the agricultural economy that it serves.

Adopting an innovation approach, Willett reviews several general implications for AET reform. However, he argues that an immediate step towards improving AET systems in sub-Saharan Africa would be to realign the visions and mandates of AET organizations with national development aspirations (reviewer's italics). In short, rather than replicate the mandates of western-style universities and education systems established under colonial regimes, AET organizations may want to rethink their visions and mandates more strategically and in relation to their country's development objectives and the changing realities of their economies and societies.

The goal he concludes is to move the AET system into closer, more productive relationships with other actors within a country's innovation system (reviewer's italics again), rather than into alignment with what other countries have done previously or with international best practice. Thus, the process of realigning visions and mandates should be driven not by predictable, top-down priority-setting exercises, but by consultative processes that rely on inputs from user communities—from private agribusinesses, rural producer associations, research organizations, extension services, non-governmental organizations and other sources of demand for AET graduates, professionals and services. Such consultative processes should be backed by labor market and graduate tracer studies to gauge demand for particular skills; and be led by interdisciplinary teams drawn from different interest groups within an organization (rather than from only administrative bodies for which priority-setting exercises are routine obligations), and supported by facilitators with professional experience in leading such processes.

World Bank. 2006a. “Enhancing Agricultural Innovation: How to Go Beyond the Strengthening of Research Systems.” Washington, D.C.: Agricultural and Rural Development Department, the World Bank.

Research is an important source of knowledge for innovation, but it serves principally as a complement to other knowledge and other activities. Many countries have an urgent need to develop the other elements of the innovation system, particularly more extensive patterns of interaction and the attitudes and practices that support interaction. Once research is better integrated into this wider set of activities, it will become clearer where research capacity is limiting and where it needs strengthening. This way of thinking reflects a shift in the kinds of interventions that are required. Rather than supporting activities and actors in isolation, such as research and research organizations, or supporting the generation of outputs, such as agricultural knowledge and information, governments should place their emphasis on supporting outcomes that lead to sustainable development through agricultural innovation systems (cf. Hall 2002; Fukuda-Parr, Lopes, and Malik 2002) (table 7.1).

World Bank. 2010. Designing and Implementing Agricultural Innovation Funds: Lessons from Competitive Research and Matching Grant Projects. Washington, DC: Agriculture and Rural Development Economic Sector.

Many countries are using innovation funds in the agricultural sector to support innovators and their links to public institutions, private entrepreneurs, and other actors, such as groups of rural producers. These funds create platforms for innovative activity by providing incentives for quality and collaboration. This report synthesizes experience with the two main innovation funds that the World Bank has used to fund agricultural innovation—competitive research grants and matching grants—and offers lessons and guidelines for designing and implementing them. Although the report draws extensively on experience with World Bank investments, the lessons are relevant in other contexts. The practical aspects of designing and implementing successful grant schemes are emphasized throughout.

Grants are used to promote diverse activities, such as demand-driven research, adaptive research, research-extension-farmer linkages that improve the relevance and dissemination of new technologies, demand-driven services, productive partnerships, and links to markets. Thus the rationale for providing grants is often associated with the public good nature of the investment; the promotion of innovation, learning, or partnerships; or the reversal of market failures. As instruments of government policy, grants should be coordinated with other policy instruments, and their benefits should exceed their cost.

The document discusses primarily competitive research and matching grants and elaborates on the procedures as well as the monitoring and devaluation of such grants.

Yusuf, Shahid & Kaoru Nabeshima. 2006. How Universities Promote Economic Growth. Washington, D.C.: World Bank.

With the competitiveness of firms in an open and integrated world environment increasingly reliant on technological capability, universities are asked to take on a greater role in stimulating economic growth. Beyond imparting education, they are now viewed as sources of industrially valuable technical skills, innovation and entrepreneurship.

The authors maintain that both developed and developing countries have made it a priority to realize this potential of universities to spur growth, a strategy that calls for coordinated policy actions.

Zuidema, Larry. 2007. Agricultural Education and Training in Africa: An Economic Justification for Investments. Unpublished paper commissioned by the World Bank, Washington, D.C.

This paper was produced among several as background for the World Bank volume, *Cultivating Knowledge and Skills to Grow African Agriculture* (2007), and primarily seeks to justify economic investment in agricultural education and training in Africa.

ATS & Post-High School

Alex, G. Mid-term Evaluation of the Building Agribusiness Capacity in East Timor Project. (Final Draft). Project funded under USAID/Timor-Leste Cooperative Agreement Grant Number: 486-A-00-06-0001 I-04.

The Building Agribusiness Capacity in East Timor (BACET) Project is a USAID funded activity implemented by Land O'Lakes and the Timor-Leste Ministry of Agriculture and Fisheries (MAP). The objective of the activity is to establish a sustainable program within three educational institutions in East Timor to produce trained technicians and practitioners in agricultural business. Land O'Lakes and the Ministry of Agriculture and Fisheries (MAP) have developed a one-year, post-high school agribusiness certificate program.

Amedzro, Albert D.K. & A. Youdeowei. 2005. Non-formal Education for Training in Integrated Production and Pest Management in Farmer Field Schools. Accra, Ghana: Ghana University Press.

Non-formal education is an important aspect of training for agricultural extension agents and farmers. This study written as a field guide draws on long experiences of national integration production and pest management programs in Asian countries, where the UN Food and Agriculture Organization developed its concepts. By appropriately adapting these concepts to local field and farming situations in Ghana, the guide provides basic topics and exercises to enable the incorporation of non-formal education into training for farmers in West Africa. The guide gives additional information on the general principles of adult learning, methodology of non-formal education, teamwork, leadership and decision-making.

Atchoarena, David, and Lavinia Gasperini, eds. 2003. Education for Rural Development: Towards New Policy Responses. A joint study conducted by FAO and UNESCO. Rome: FAO.

Of particular interest is the study's emphasis on rural development and the role of basic education in promoting rural development. For this purpose, the study calls for more coordinated approaches by donors, and claims that the World Bank and other inter-governmental institutions, such as the Food and Agriculture Organization of the United Nations (FAO) and UNESCO, need to revive interest among donors in basic education (including for adults) in rural areas. The FAO/UNESCO flagship program on 'Education for rural people' is heralded as an illustration of this movement.

Basant, Rakesh and Pankaj Chandra. 2006. "Linking Technical Education to Business Growth: A Case Study on Building Technical Skills in India." Processed. Ahmedabad: Indian Institute of Management.

As applied knowledge and technological innovation become more important for global economic competitiveness, nations have begun to look at their "technical education pyramid" (p. 13). This is the distribution of enrollments across the various levels of technical education, i.e., post-secondary technical, non-university polytechnic-type technical, university science and technology (sciences and engineering), and postgraduate (undifferentiated). -- As quoted in World Bank 2007 *Cultivating Knowledge and Skills to Grow African Agriculture*.

Ellis-Jones, J., Joseph Hella, John Stenhouse, Howard Gridley, Paul Amaza and Daimon Kambewa. 2010. Mid-Term Review of the Program for Africa's Seed Systems (PASS). Submitted to The Alliance for a Green Revolution in Africa (AGRA). Nairobi, Kenya.

This mid-term review commissioned by AGRA has established PASS achievements to date to determine the extent to which program activities and processes are leading to the achievement of the intended goal. The review has evaluated PASS' performance from its commencement in March 2007 to date. Over this period PASS made 142 grants and a representative sample of these were reviewed, based largely on grant memorandum and to a lesser extent on grantee and program officer reports and importantly discussions with grantees and beneficiaries in nine countries.

A six person team undertook the review providing reports for the countries visited detailing changes in formal seed systems since PASS was initiated, detailing the grants awarded, assessing outcomes and outputs to date, challenges faced and opportunities for AGRA. Common issues have been identified and an assessment made of progress, achievements and challenges for each of PASS's sub-programs and their management which are presented in the body of this report. This totals 24 recommendations put forward to AGRA.

Fauliau, C. 2004. Rural training—A Key to the Millennium Goals. *Agriculture and Rural Development*, 11:2, pp. 54–56.

The author notes that comparatively greater attention that has been given in recent research to analysis of the educational and informational needs of producers and how best to meet them, and that rural training is key to the millennium goals.

Kroma, Margaret. 2003. Reshaping extension education curricula for 21st century agricultural development in sub-Saharan Africa. Paper presented at the 19th Annual Conference of the Association of International Agricultural and Extension Education, Raleigh, N.C., April 8–12. (cited in Davis, et al., *Strengthening...*).

A major challenge facing extension systems in sub-Saharan Africa in the 21st century is how to contribute to the process of transforming rural and agricultural systems in sustainable ways. This

places a tremendous burden on institutions of higher education to reshape their extension education curricula.

Ndejuru, Emile and Callixte Gatali. 2006. "Demand Profiles and Supply Responses for Agricultural Education and Training at the Post Primary Education Level in Rwanda." Paper prepared for the Farmers of the Future of the World Agroforestry Centre (ICRAF.)

Ndejuru and Callixte (p. 66) point out that work placements are essential, not a luxury, for Africa. They expose students to actual problems of production, processing, and marketing. They connect classroom teaching with the real world. But available school farms tend not to be used much or well (Ghana, Kenya), and practical lessons are limited (Kenya, Rwanda) (see also Vandebosch 2006:79. In addition, guidelines are missing for assessment of practice and examinations ignore practical lessons. With respect to the latter the World Bank (2007:34) cites Kenya and Rwanda. Ndejuru and Callixte claim that if a subject is not examined, students and parents will tend not to take it seriously. Elsewhere Vandebosch (2006:76) cites however some refreshing exceptions, e.g. in Ethiopia, students undertake an eight-month apprenticeship as part of their training (p.79), and in Mozambique, a substantial component of the curriculum. And Rivera (2006:27) notes the new Polytechnic Institute of Chokwe consists of field practices during the students' first two years.

Rivera, W.M. (1998). Agricultural extension as adult education: Institutional evolution and forces for change. *International Journal of Lifelong Education*, 17, 260-264.

Agricultural extension is generally considered by adult educators to be one of the many different providers of adult education. Agricultural extension's pragmatic, specialized content and its task-oriented field-directed methodologies for providing information and technology transfer, and often other services as well, places this education provider in a unique category, so unique in fact that it is often overlooked in discussions of formal as well as informal education. This paper briefly reviews the value and current reforms taking place to improve agricultural extension, through structural, financial and managerial decentralization strategies and through the shift of government power and responsibility to market-oriented approaches.

Samy M.M. 2008. Final Technical Report of the AERI Institutional Linkage Project: A Project Funded by The U.S. Agency for International Development Agreement No. 263-A-00-03-00044-00, Sept 2003 – March 2008. New Maadi, Cairo, Egypt, submitted by The Midwest Universities Consortium for International Activities (MUCIA).

The MUCIA AERI Linkage Project designed an intervention strategy to promote needed curriculum changes and active learning techniques that would improve the employability of ATS (Agricultural Technical Secondary School) graduates and integrate private sector needs into ATS educational programs. This strategy included the following activities.

Transform the ATS Curricula: The first activity sought to improve the existing curricula and educational programs at each participating ATS by making them more “competency-based”.

Improve Teaching-Learning Methods and Techniques: This training activity focused on the ATS classroom that was desperately in need of improvement. MUCIA put together teacher educator teams, assisted by Egyptian faculty members who had participated in university capacity building programs.

Improve Teachers’ Technical Skills: This in-depth technical training provided short-term, technical courses and workshops to 957 ATS teachers and supervisors, updating their knowledge and skills in the areas of horticulture, agricultural mechanization, animal production, and agricultural economics. The MUCIA Technical teams provided technical workshops in the ATSSs, which gave the teachers the opportunity to practice technical skills they needed to teach their students.

Develop Supplemental Instructional Materials for All 31 Courses in the Five Selected Technical Fields. The major focus of this activity was the development or translation and duplication of overhead transparencies and other teaching aides (e.g., educational materials on DVDs and CD ROMs) for use with overhead projectors, video monitors/DVD players and computers with LCD projection or data-show units. The instructional materials were developed by a MUCIA Instructional Material Team and the equipment was procured and distributed to the participating ATSSs.

The MUCIA AERI Linkage Project also designed an intervention strategy to promote a more innovative research environment directed to the needs of the private sector and facilitate a more efficient transfer of knowledge and technology to small-scale producers in Upper Egypt in the areas of export crops and food safety. This strategy included the following three activities: Forming and utilizing Technical Working Groups (TWGs); Implementing the Impact Grant Program; and Creating the Market Development Team (MRD), a new cadre of public-private market specialists, to disseminate information about quality requirements and market opportunities for exporting horticulture crops to international markets.

Swanson, B.E.; J. Cano; M.M. Samy; J.W. Hynes; & B. Swan. (n.d.). Introducing Active Teaching-Learning Methods and Materials into Egyptian Agricultural Technical Secondary Schools (ATSSs).

This paper summarizes activities undertaken by teacher-educators from several U.S. Land Grant Universities to introduce active teaching-learning methods and materials into 25 agricultural technical (secondary) schools (ATSSs) in Upper Egypt. The goal of the project was to transform

the cognitive and psychomotor skills being taught in these schools from knowledge recall and comprehension to higher-level cognitive skills, including problem-solving, critical thinking and decision-making, as well as practical skill training. Each of the seven steps taken to implement this pilot project are summarized and discussed. The steps include:

- Step 1: Training the ATS Teachers in Active Teaching-Learning Methods.
- Step 2: Developing Instructional Materials for Use by ATS teachers
- Step 3: Developing Lesson Plans for Each ATS Course
- Step 4: Headmaster Study Tour to the Netherlands
- Step 5: Refocusing ATS School Farms and Utilizing Them for Practical Skill Training.
- Step 6: Training ATS Teachers in Using Lesson Plans and Instructional Materials
- Step 7: Assessing Progress and Refining the Lesson Plans and Instructional Materials

This project is educationally significant because vocational agriculture education programs have been neglected in most developing countries; also, most international donor agencies allocate the majority of their educational resources to strengthening basic education. As a result, this effort to pilot-test and validate how vocational agricultural education programs in these ATSs can be strengthened has considerable educational significance, not only in outlining a methodology for strengthening the remaining 105 ATSs in Egypt, but also in outlining a strategy and approach that could be used to strengthen vocational agricultural education programs in other developing countries.

The authors conclude that: Vocational agricultural education has been neglected in most developing countries as governments and donor agencies have concentrated on expanding primary education. In Egypt, the government had invested in vocational agriculture schools but, until the 2006–07 school year, ATS teachers concentrated on rote learning and teaching for the test at the end of each school year. These schools were poorly equipped to provide practical training for students and most courses and curricula had not been up-dated for two decades or longer. As a result, the focus of these ATSs is no longer relevant to the changing employment demands of the agricultural sector, in general, or to the current technical and managerial needs of commercial farms and agribusiness firms in Upper Egypt. As a result of this intervention, teachers are now helping to improve the cognitive skills of the students by enabling them to analyze and solve problems. This relatively low-cost approach to transforming the teaching-learning process is directly applicable to the other ATSs in Egypt and to vocational agricultural programs throughout the developing world.

USAID. 2010. Agriculture Exports and Rural Incomes (AERI). Value Chain Training (VCT) For Agricultural Technical Schools. Year Two. Fourth Quarterly Progress Report (Jan.-March) submitted by Midwest Universities Consortium for International Activities, Inc. (MUCIA).

The USAID Agricultural Export for Rural Income (AERI) Project, in collaboration with the Midwest Universities Consortium for International Activities, Inc. (MUCIA), has developed and implemented the Value Chain Training (VCT) Project for 54 Agricultural Technical Schools (ATSs) in Upper Egypt and Sinai. The VCT Project includes three major components: (1) Improving the Learning Environment, (2) Supervised Partnership/ Ownership, and (3) Career Skill Development. These components are designed to improve the quality and effectiveness of agricultural education programs and to increase the employability of agricultural school graduates.

Vandenbosch, Tom. 2006. Post-Primary Agricultural Education and Training in Sub-Saharan Africa: Adapting Supply to Changing Demand. Nairobi: World Agroforestry Center (ICRAF).

Post-primary agricultural education and training in sub-Saharan Africa has generally been very unresponsive to rapidly changing patterns of demand for trainees and failed to adapt and respond to new realities. This is putting serious pressure on post-primary agricultural education and training systems, especially because the change in demand profiles is much faster today than ever before. This rapid change in demand profiles is due to radical transformations in the agricultural environment combined with the fast alteration of rural and urban labor markets. As a result, post-primary agricultural education and training in sub-Saharan Africa currently finds itself very much in an “adapt-or-perish” situation.

Zonon, Abdoulaye. 2006. “Demand Profiles and Supply Responses for Agricultural Education and Training at the Post-Primary Education Level in Burkina Faso.” May. Washington, D.C.: Unpublished study commissioned by ICRAF and the World Bank.

The World Bank (2007) commandeered this paper. Noted is that the pyramid specific to enrollments in agricultural education and training should ideally approximate employment opportunities in the labor market. The wide base would correspond to training of producers through informal and secondary level vocational education, the smaller middle band of the pyramid would reflect practically skilled agricultural technicians at the post-secondary certificate and diploma level (e.g. extensionists, NGO specialists, marketing representatives, and program managers), and the narrow apex would represent agricultural professionals trained at the degree level and above.

In this regard, the FAO suggests that the ratios in this pyramid should be 12 technicians and 40–100 producers trained for each university graduate (Rowat, FAO, 1980). However, in many countries this pyramid is top-heavy. For example, Burkina Faso produces just 3.6 technicians and only 0.32 young producers for each university graduate (Zonon 2006:46). Astonishingly, according to the World Bank report (2007), this implies that fewer agricultural producers are trained in Burkina Faso than university graduates in agriculture.

HRD (LINKAGES)

Crawford, E.W. & M. Suvedi. 2010. Institutional Capacity and Training Needs Assessment for the Feed the Future Initiative in Nepal. End of Trip Report. Washington, DC: Funded under the Food Security III Cooperative Agreement Leader Award (GDG-A-00-02-00021-00) between the Department of Agricultural, Food, and Resource Economics, Michigan State University, and USAID, Bureau for Economic Growth, Agriculture and Trade, Office of Agriculture and Food Security.

The conclusions from Institutional Capacity Assessment indicate:

- Government institutions lack their own capacity for empirically based food policy research and analysis.

- The capacity built within public universities through past programs has faded, and needs reviving.
- New models of training are needed to promote training relevance and trainee retention.
- Nepal lacks capacity to produce hybrid and other improved seeds.
- Nepal's NGO's include a number with significant expertise, experience, and capacity.
- Private agro-enterprises seem to be underutilized as potential partners in pursuing Nepal's agricultural growth and food security goals.

FAO. 1995. Women, Agriculture and Rural Development: Findings of a FAO Study in Africa. Rome: United Nations Food and Agricultural Organization.

The FAO has outlined a number of future strategic goals and objectives needed for promoting the advancement of women. The following six strategies have been identified:

- Improve the collection, analysis and dissemination of data disaggregated by gender
- Increase research on resource allocation within the household and on the gender division of labor
- Establish or strengthen WID/gender units within the Ministry of Agriculture as well as within the line ministries, and reorganize extension systems to reach rural women more effectively
- Promote participatory methodologies in project formulation, planning, monitoring and evaluation
- Increase support for local initiatives and strengthen women's groups and associations
- Abolish discriminatory legislation.

However, the FAO document emphasizes that the effectiveness of efforts to promote the advancement of women are, overall, influenced by the policy environment in which they are taken. Government commitment to, and investment in, the agricultural sector, and the women and men farmers within it, is a prerequisite to attain the development goals envisioned.

FAO/World Bank. 2000. "Agricultural Knowledge and Information Systems for Rural Development: Strategic Vision and guiding Principles." FAO, Rome; World Bank, Washington, D.C.

The AKIS/RD vision document is intended as a vehicle for sharing ideas and principles with the various stakeholders addressing the causes, and for seeking solutions for rural poverty.

The document puts forward an extensive number of guiding principles to achieve AKIS/RD objectives – poverty reduction, agricultural productivity gains, food security and environmental sustainability. Such programs, according to the document, will display the following design characteristics:

- Economic efficiency. The benefits of AKIS/RD programs are shown to be commensurate with costs, and programs are tailored to a scale that is commensurate with, and justified by, expected outcomes.
- Careful match between comparative advantages of organizations and the functions they perform. The rationale for all organizations involved must be clearly stated and in

accordance with the concepts in the box on pages 16 and 17. This means that the public sector's involvement in AKIS/RD programs is clarified and focuses on "core" public good functions.

- **Subsidiary.** Operational authority and responsibilities for AKIS/RD programs are allocated based on the principle of subsidiary, whereby decision-making devolves to the lowest possible level of government consistent with organizational competencies and efficient use of funds. Resources, including funds, are assigned to each level based on its allocated responsibilities.
- This often implies the decentralization and devolution of authority and responsibility within the public sector for service delivery.
- **Clear repartition of costs.** The main stakeholders in AKIS/RD programs share the burden of funding AKIS/RD activities based upon agreed criteria, including their ability to pay and their use of services. The central government assumes a share of the cost burden, covering the cost of public goods and avoiding investment in private goods. Local governments, the private commercial sector and client farmers themselves also shoulder part of the financial burden.
- **Careful assessment and optimal mixing of funding and delivery mechanisms.**
- **Funders do not necessarily have to be implementers.** Even though central and local governments help fund AKIS/RD programs, they do not necessarily directly deliver program services. Some AKIS/RD services and products are contracted to outside sources such as private firms and NGOs which may broaden the range of service providers, raise the operational efficiency of AKIS/RD programs and make AKIS/RD workers more accountable for their performance and results. Similarly, private funds from the commercial sector and civil society may be used to support public sector delivery.
- **Pluralistic and participatory approaches.** Various approaches to service delivery attuned to local conditions are used that lead to the empowerment of local communities and other AKIS/RD stakeholders releasing their initiative and problem-solving ability and mobilizing their resources. A range of stakeholders and organizations with different strengths are promoted to increase mutual learning, self-correction and the robustness of AKIS/RD
- **Effective linkages among farmers, educators, researchers, extensionists and other AKIS/RD stakeholders.** AKIS/RD programs and institutions are explicitly designed to create synergies and collaboration among stakeholders in all three AKIS/RD domains. Farmers and their partners in each AKIS/RD program area are provided with resources and/or the authority to purchase and/or influence the services provided in each of the other domains.
- **Building human and social resources.** AKIS/RD programs incorporate resources and incentives for educating a new generation of staff capable of empowering their rural clients to exploit fully the latest relevant advances in agricultural technology, in rearranged public/private responsibilities, in new information and communication technologies, and in concepts for participatory learning and problem solving.
- **Sound monitoring and evaluation.** AKIS/RD programs would be results-oriented with rigorous systems for monitoring progress towards achieving goals and for evaluating outcomes.
- **Monitoring and evaluation are based not only on economic criteria for calculating cost-effectiveness, but also on human resource, institutional, and environmental criteria to ensure comprehensive impact accounting.**

Gates Foundation, Bill and Melinda. Human capital: An essential ingredient for success in our Agriculture program. March 2010. Microsoft ppt.

The Gates Foundation document lists the following findings:

- Human capital is a critical success factor for our Agriculture Development program in Africa; targeted, strategic investments in human capital will be required to:
 - Ensure success of individual grants across the portfolio (which currently invest nearly \$200 million in developing human capital, but does so in a one-off basis without a strategy to create long term, sustainable impact with the investments)
 - Effectively scale our human capital investments to support the transformation of 150 million smallholder farmers lives
 - Ensure sustainability of our interventions beyond our specific grants to the overall agriculture sector (because there is a high risk/ incidence of our grants temporarily distorting the labor market)
- Our strategy for human capital development has three elements
 - Systematically identify the human capital necessary for individual AG grants to succeed, and develop groups of high-impact agriculture professionals that advance the grants' objectives within the context of a longer term strategy
 - Develop "node-and-network" centers-of-expertise in high-priority African countries and key areas of importance to smallholders to mobilize collective action by critical players in the ecosystem
 - Use a pilot-and-scale approach to test transformative/innovative models, and drive proven models to larger scale
- To ensure scalable and sustainable impact, the human capital strategy is based on four design principles
 - Focus exclusively on the skills necessary for successful execution of the core AG strategy
 - Develop talent locally with incentives to ensure that will stay local
 - Relentless focus on innovative and transformative models leveraging technology vs. incremental approaches
 - Strengthen local institutions as a spillover outcome to ensure long term, sustainable impact
- 4. The vision (and measures) of success of the human capital strategy are defined along three time horizons
 - Near-term (2-5 years): All AG grants requiring human capital investments develop these resources within institutional nodes to ensure multiple resources are mobilized towards long term, sustainable impact of these human resources
 - Medium-term (5-10 years): A cadre of world-class agriculture professionals in high-impact areas critical to our AG programs are effectively deployed; and an ecosystem of funders/actors are strategically coordinated towards developing institutional networks for longer term sustainable impact on the sector
 - Longer-term (>10 years): Individuals/institutions developed through the human capital program directly helping the AG program achieve massive scale towards

lifting 150 million farmers out of poverty; in addition, a sustainable ecosystem of partners continues to produce world-class agriculture professionals to lift more smallholders out of poverty

Idachaba, Francis S. 1997. “Human Capital and African Agricultural Development. In G.H. Peters and D.D. Hedley, eds. Agricultural Competitiveness: Market Forces and Policy Choice. Proceedings of the Twenty-Second International Conference of Agricultural Economists, Harare, Zimbabwe, 22–29 August 1994. Aldershot, UK: Dartmouth, 540–553.

- Idabacha (p.543), quoted also in the World Bank (2007), discusses human capital theory, education (and by implication AET), and the influences of education on agricultural productivity. Idachaba notes several positive effects:
- • The “worker effect” by which more farm output is realized from a given bundle of inputs through enhanced worker productivity;
- • The “allocation effect” by which additional years of formal education enhance farmers’ ability to choose optimum combinations of farm inputs and farm outputs;
- • The “innovative effect” by which additional schooling enhances a farmer’s ability to acquire and adapt new technologies, thereby reducing innovation time lags; and
- • The “market efficiency effect” by which additional years of schooling foster the capacity to exploit new market opportunities. (see also Atchoarena and Gasperini 2003:56).

Menyeh, Aboagye. 2005. “Four Decades of Human Resource Development in Basic and Applied Sciences at the Kwame Nkrumah University of Science and Technology, Ghana”. Paper presented at the First African Conference of Vice-Chancellors, Provosts and Deans of Science, Engineering and Technology held in Accra, Ghana on November 15–17, 2005. Nairobi: UNESCO Regional Bureau for Science.

The situation in agriculture seems to closely parallel high vacancy rates experienced in science and technology. For example, the College of Science at KNUST, Ghana, has a 63 percent staff post vacancy rate with only 99 out of 268 posts filled. Likewise, the vacancy rate for science technicians in the College is 55 percent, according to Menyeh.

Rivera, William. 2006. Transforming Post-Secondary Agricultural Education and Training by Design: Solutions for Sub-Saharan Africa. Unpublished paper. Washington, D.C.: World Bank.

A great deal has been written about the establishment of between research, extension, and AET, yet the review of tertiary AET institutions in seven countries found all to have poor links with research and extension institutions.

Establishing meaningful institutional linkages—knowledge networks, public-private partnerships, system coordination mechanisms—constitutes one of the main challenges to AET systems in general and PSAET in particular.

Countries need to achieve better strategic alignment of AET curricula with national agricultural priorities (Rivera 2006:13, 36) and also among the various formal, informal and inservice

business education programs. One way to do this would be to create discussion platforms among stakeholders for setting national priorities in AET vis-à-vis agriculture development plans in each country.

Rivera, W.M. & Gary Alex. 2008. Human Resource Development for Modernizing the Agricultural Workforce. Human Resource Development Review, 7:4, 374-386.

This article places human resource development in the context of current concerns for the development of national knowledge economies and “education for the knowledge economy.” First, the territory is defined. Then the part training plays in capacity development within organizations in the agriculture workforce is examined. In the view of the authors, the need is for new and necessary policy, institutional, and program reform. Agricultural education systems, including extension, formal education, in-service training, and mass media/distance education programs are examined for their importance and their need to network to prepare the agricultural workforce to meet new challenges.

Rivera, W.M. (to be published 2011). Public Sector Agricultural Extension System Reform and the Challenges Ahead. Journal of Agricultural and Extension Education (Wageningen). Paper originally presented at international seminar organized by the National Federation of Coffee Growers of Colombia, Bogotá, Colombia, September 2008.

Three clear challenges confront extension: to support commercial interests, to advance the worth of human capital, and to promote a knowledge economy through the advancement of appropriate innovations.

In cases where the extension service is already privatized or operates as a function of private sector companies, then government will likely be involved mainly as a regulatory and possibly subsidizing or supportive agent as well as a client for special program development. However, the issue of providing extension to small, poor, and subsistence farmers remains. And the problem of poverty reduction and food security could become a major dilemma if not addressed head-on.

While the ideological shift from the welfare state to private-sector hegemony has tended to reduce the involvement of some governments in public services, the argument in this paper is that the so-called demise of the nation state is grossly exaggerated. On the contrary, the state still determines what an institution such as extension will be; it determines whether, or if, agricultural extension will be privatized and whether or not a national pluralistic system will be put into place. Moreover, government continues to bear various responsibilities vis-à-vis both the commercial sector and the general public good. Among these responsibilities, argued in the paper, is government’s role in balancing sector interests in agricultural and rural development. Economists, albeit with cautionary notes, are beginning to call for re-expansion of the role of the state as an essential ingredient in policy development, regulation and the provision of basic services, as well as in facilitating export growth (Khan, 2006).

Agriculture is increasingly systematized with consequent advantages and disadvantages. This systematization is strongly impacting the demands on agricultural extension systems regarding efficiency and direction. As noted herein, the present market-oriented ideology and the advancement of e-technology are also radically affecting the priorities and promise of agricultural

extension. The challenges ahead for extension and its reform are not so much issues of a system in transition but one which requires major overhaul.

Ruttan, Vernon W. (ed.) 1994. *Agriculture, Health, and Environment: Sustainable Development in the 21st Century*. Minneapolis: University of Minnesota Press.

The book results from the Conference on Agriculture, Health and Environment held at the Rockefeller Foundation Conference and Study Center at Villa Serbelloni in Bellagio, Italy in 1991. It examines the implications of a series of changes underway at the global level for institutional design and policy reform to achieve sustainable agricultural development and emphasizes the interconnectedness for research and practice of agriculture, health and environmental sustainability. A unique feature of the book is its interdisciplinary breadth.

Sokoine University. 2005. "Job Market Survey, Training Needs Assessment and Tracer Studies for Sokoine University of Agriculture Graduates." Final consultant reports of K-Rep Advisory Services Limited, Development Associates Ltd., and Afrozone. Morogoro, Tanzania: Sokoine University.

Between 1991 and 2000, women's share of enrollments in Ethiopian agricultural sciences rose from 14 to 20 percent (cf. Stads and Beintema 2006). Sokoine University of Agriculture in Tanzania provides an impressive example of what can be accomplished in this area. It increased its graduate output of women tenfold over the past decade and raised their share in Sokoine enrollments from 17 to 29 percent (cf. Sibunga 2007).

Tadesse, Mulugeta. 2006. "A landscape of knowledge systems in Ethiopia—The Case of Public Institutions Involved in Rural Development." Paper submitted to Ethiopia Strategy Support Program Policy Conference, June 6–8 on "Bridging, Balancing, and Scaling Up: Advancing the Rural Development Agenda in Ethiopia." IFPRI and Ethiopia Development Research Institute.

Tadesse, quoted by World Bank (2007), highlights the interrelated importance of education, research, and extension in enhancing agricultural production and reducing rural poverty is well recognized in many developing countries. However, evidence suggests that the traditional education-research-extension "triangle" may be increasingly ill-equipped to respond to the new opportunities and challenges now associated with agriculture in Sub-Saharan Africa (Kroma 2003; Tadesse 2003). The entry of new actors, technologies and market forces, when combined with new economic and demographic pressures, suggests the need for more comprehensive approaches to strengthening agricultural education, research, and extension (cf. IFPRI 2006).

Topouzis, Daphne. 2000. "The impact of HIV on agriculture and rural development: implications for training institutions." *Human Resources in Agricultural and Rural Development*. Rome: FAO.

Many rural institutions and agricultural and rural development projects and programmes in developing countries, whose mandate is to enhance food security and sustainable agriculture/rural development do not have the capacity (know-how and/or financial resources and/or supporting materials) to address vulnerability to the HIV/AIDS epidemic.

USAID. 2003a. Regional Agriculture Sector Training and Capacity Building Needs Assessment. Washington, DC: Submitted to USAID by World Learning, Inc.

The Regional Agriculture Sector Training and Capacity Building Needs Assessment identify training and capacity building needs for the university faculties of agriculture in Kenya, Tanzania, and Uganda.

The assessment notes that the situation facing faculties of agriculture in Africa in the new millennium are very different from the situation in an earlier era (1960s through the 1980's) of capacity development projects. Currently, there are many more trained people in Africa with clear ideas about what is needed and how to proceed. At the same time, the changing patterns of global trade, diminishing public funds, the ravages of HIV/AIDS, declining soil fertility, as well as a number of other issues pose real challenges to meeting the overall goal of food security. The complexity of the situation, the many unknowns, requires a flexible and genuinely collaborative approach in developing the capacities of faculties of agriculture to respond to the changing environment.

USAID 2003b. "Mozambique Human Capacity Building Assessment: Agriculture Sector." A Joint USAID and BIFAD Assessment. Washington, D.C.: Board for International Food and Agricultural Development (BIFAD).

Constraints are found in both the private sector and public sector. The following issues provided the basis for capacity building recommendations.

- Vocational/technical areas important to farming and agribusiness: The agriculture sector as a whole is characterized by lack of basic skills in areas important to farming: machinery maintenance, motor mechanics, metal work, basic electronics. As described by the representative of regional director of agriculture in Manica the lack of 'know-how' in the Mozambican farmer prevents his ability to grow and improve.
- Lack of trained technical extension specialists serving rural populations: The extension system is small, between 600 and 700 persons, the majority of whom have a low technical education level. The government recognizes the many constraints to an effective service and, as a partial solution, has begun to outsource extension services to some NGOs in rural areas. Nevertheless, extension remains an area where capacity building activities especially through short-term knowledge building and methods courses, could make a significant difference.
- Lack of basic business and management skills across the workforce: A common refrain echoed by business leaders and donors alike was the need for the most basic business skills at all levels. Representatives from the business roundtable emphasized the need for extensive and basic business skills from the technical, i.e., 'grower level' to the small and mid enterprise level. "Businesses need employees who know how to do things" from manual work to decision-making. Basic numeracy and literacy, simple bookkeeping, carpentry and mechanics as well as orientation to running a business were all cited as needed to improve private sector performance. Very clearly stated was the absence of practical workplace skills among recently graduated employees, even those from the technical agricultural schools. Related to the constraints on business from an unskilled workforce was the lack of confidence and trust that employers place in their workers.
- Entrepreneurship: The absence of an entrepreneurial tradition due to the colonialist and socialist past is frequently cited as an explanation for the weak private sector in

Mozambique. Educated people have generally been groomed in professional areas and are not oriented to the notion that business ownership or self-employment is a real and viable option. The uneducated or poorly educated population that represent the vast majority of Mozambicans have little exposure to a model of successful business ownership and thus do not aspire to ownership and, even less, entrepreneurship. The idea that surfaced repeatedly in interviews was that of incorporating into the educational system courses in business development. The idea has wide currency in Mozambique and should be explored further.

- Limited access to credit for small enterprises in rural areas: Credit is acknowledged to be in short supply and costly. Interest rates reach above 30% with no special provisions for rural or agricultural endeavors. Overall, the process of strengthening access to credit through rural institutions is a larger issue than capacity development alone. Developing an approach to improving access to credit was beyond the scope of the assessment team; however, associations and forums organized by CLUSA have provided training and continue to review credit requests for GAPI. Basic knowledge and experience with credit, loan analysis, general business and management skills are needed at the enterprise level. Loan recipients need training in the basics: calculating interest, obligation to repay loans, fiscal responsibility as well as growth oriented, commercial business precepts. Associations as well as schools can be the conduit for training people to start businesses, provide quality service, understand the obligation to repay loans and basically develop the approach that will make them a sound risk for creditors.
- Limited number of university trained staff capable of structuring and carrying out research in specific relevant areas: The needs of the government Agricultural Research Institute (INIA) can be summarized under two headings: the need for an increase in the numbers of trained scientists and technicians followed by the need to direct the research focus to areas not currently covered. A frequently expressed concern related to agricultural research is the insufficient number of scientists who can formulate and carry out agricultural research relevant to Mozambican needs. Excluding support staff there are fewer than 500 professional level employees in the research system. Just over 100 have degrees. Very few have graduate level training adequate to formulate and supervise research studies. Technicians who carry out the experiments also need training and skills upgrade. Though some technicians have BSc degrees, most have the equivalent of a secondary school education. Focusing on the research staff the goal of the Ministry is to upgrade each level. Thus technicians at Nivel Medio should have BSc degrees, the BSc should receive MSc and so on. The team recommendation will focus on the Masters level augmented by short, topic-specific courses.
- Training extension workers is also a priority for increasing smallholder productivity: As presently organized the extension service under the Ministry of Agriculture and Rural Development (MADER) is a new organization beset with staffing problems. It was started in 1988 and presently has approximately 600 extension workers, most with low academic and professional training. (As a point of reference Tanzania has 5,000 and Zimbabwe 8,000 extensionists.) An important institutional problem faced by most agencies within MADER is that as specialists becomes trained, be they scientists or technicians, they are quickly hired away by one of the NGOs who offer better salary and equipment. Though they recognize the need for better trained extension workers as mentioned above under the private sector discussion, there is no motivation for getting an additional qualification. Neither salary nor status within the Ministry changes. Notwithstanding the internal issues that must be resolved by the Ministry, there is a clear case for providing training for extension agents.

- As the agricultural programs are probable conduits, the team reviewed agricultural education at various levels as to how existing programs supported the rural farmer and how agribusiness skills were promoted. At the technical school level we visited agricultural schools in Choimoio in Manica Province and Boane in Gaza province (Nivel Medio). Though graduates work as extension agents as well as in the private sector, we were unable to find strengths in the agricultural education programs directed toward agribusiness and entrepreneurship. The team also held discussions with professors from UEM with a view to constructing twinning programs with U.S. institutions.
- Future Agricultural Education Program: Under the Ministry of Higher Education, Science and Technology (MSCAT) a completely new system of polytechnical education similar to the South African Technikon is projected to open in 2005. These are to offer a three year course of study beyond the secondary level, thus Educacion Superior. The technikons will offer a three year program answering the need for a practical curriculum that will respond to the business community, encourage self-employment, and act as incubators to new businesses. Students will enter after completing grade 12. Because these schools are to be located outside of Maputo (one in Boane and one in Chimoio) they will serve both the provincial student population and serve the surrounding business community as a resource. This is an area where USAID may be able to offer effective support in the future.
- Recommendations to Address Constraints to Private Sector Growth: vocational skills and basic business skills
- The assessment team identified a number of basic issues that should govern the training approach in any plan adopted for Mozambique:
 - The preponderance of training should take place in Mozambique or in the region;
 - Initial training should be designed as short-term, intensive workshops focused on near-term needs;
 - Short-term research programs focused on special topics are a priority;
 - To the extent possible all capacity building should have a practical component;
 - Programs in Brazilian agricultural universities should be identified to minimize language barriers;
 - Appropriate agricultural programs in South African universities, e.g., The University of Natal, should be identified;
 - Graduate level training should be offered through new Academic Institutes; and
 - Twinning programs with international universities can be established thus requiring minimal time outside the country.

Van Crowder, L. & J. Anderson. 1996. Integrating Agricultural Research, Education, and Extension in Developing Countries. Paper on FAO website. FAO, Rome. <http://www.fao.org/sd/EXdirect/EXan0009.htm>

The authors conclude that to improve linkages, and thereby improve the effectiveness of agricultural technology systems, several elements stand out as particularly important:

- Despite institutional divisions, which are likely to remain, it helps to view REE (research, education and extension) as an integrated agricultural knowledge and technology system;
- A focus on REE functions, instead of just organizational structures, might broaden the dialogue to include other partners and improved integration;

- A pluralistic approach is likely to have advantages, but to be effective linkages must be formed and strengthened. Policy and mandate changes, as well as changes in "organizational attitudes", may be needed;
- Linkages may be best improved through the promotion of informal networking at many levels with an incentive system that rewards collaboration.

Strengthening and empowering "client groups", especially typically hard to reach groups (e.g., women farmers) can result in more demand-driven REE services and put pressure on the system to improve linkages.

World Bank. 2002. "From Action to Impact: The Africa Region's Rural Strategy." Washington, D.C.: Rural Development Operations, the Africa Region.

The strengthening of agricultural services, research, and education features prominently in the subsequent 2002 document, *From Action to Impact: The Africa Region's Rural Strategy*, which proposes a 50 percent net increase in the number of agricultural scientists (World Bank 2002:38). It also argues for greater attention to women farmers and advocates new approaches to extension in order to achieve greater pluralism in the provision of demand-driven and relevant advisory services to diverse client groups. To this end, it may be necessary to decentralize resources and responsibilities to local governments and communities, outsource extension services to NGOs and private groups, and improve linkages among farmers, educators, researchers, and extension agents (World Bank 2002:22).

World Bank, 2003. Reaching the Rural Poor: A Renewed Strategy for Rural Development. Washington, D.C.: World Bank.

As with the Bank's 2002 "From Action to Impact," the Bank's 2003 policy statement, *Reaching the Rural Poor*, underscores the importance of agricultural education and training for rural economic growth (World Bank 2003:153). Although not always explicit, all of the above recommendations point to a central role for post-secondary agricultural education and training.

World Bank. 2004. Agriculture Investment Sourcebook: Agriculture and Rural Development. Washington, D.C.

A major document covering 11 modules: (1) building agricultural policy and institutional capacity, (2) investments in agricultural science and technology, (3) investments in agricultural extension and information services, (4) investments in sustainable agriculture intensification, (5) investments in sustainable natural resource management, (6) investments in agribusiness and market development, (7) investments in rural finance for agriculture, (8) investments in irrigation and drainage, (9) investments in land administration, policy and markets, (10) managing agriculture risk, vulnerability and disaster, and (11) scaling up agricultural investments in the Bank's changing internal environment.

World Bank. 2005. Agricultural Growth for the Poor: An Agenda for Development. Washington, DC: Agriculture and Rural Development Department.

The World Bank agenda for development states that agriculture has a central role in meeting the Millennium Development Goals and that investment in core public goods (e.g., infrastructure, education, and natural resources) have high payoffs in the form of economic growth and reduced poverty. It argues that investments in agricultural research, education, and rural infrastructure are

often the most effective in promoting agricultural growth and reducing poverty, though a significant amount of time may pass between the initial investment and its visible impact

World Bank. 2006. "Enhancing Agricultural Innovation: How to Go Beyond the Strengthening of Research Systems." Washington, D.C.: Agricultural and Rural Development Department, the World Bank.

Support to agricultural research and extension systems is necessary but not sufficient to expand the capacity for innovation in agriculture. New ways of enabling innovation are required to deliver economic growth and reduce poverty. This paper puts forward two broad sets of conclusions. The first set concerns the nature of innovation and innovation capacities and the corresponding needs for intervention that these findings imply. The second set of conclusions concerns the utility of the innovation systems concept and resulting intervention framework for diagnosing the needs of innovation systems and designing interventions.

Nine findings are enumerated under the nature of innovation. The document argues that the innovation systems concept offers a new framework for analyzing the role of science and technology and its interaction with other actors to generate goods and services. The document posits an intervention framework that identifies common weaknesses in innovation capacity in commonly encountered situations, provides principles (as opposed to prescriptions) for intervention, and provides examples of options for intervention.

World Bank, Agriculture and Rural Development Department, Africa Region Human Development Department. 2007. Cultivating Knowledge and Skills to Grow African Agriculture: A Synthesis of an Institutional, Regional, and International Review. (Written jointly by R.K. Johanson and W. Saint). Washington, DC: Report 40997-AFR.
<http://www.fao.org/SD/ERP/documents2009/cultivatingknowledge.pdf>

This is a very rich volume and is referred to throughout the present literature review. The document examines AET as a whole, but concentrates on post-secondary agricultural education and training. Proposed are seven 'common priorities' for consideration by government officials, institutional managers, and donor representatives. In brief these are (1) create political will, (2) establish productive external linkages, (3) rebalance the AET enrollment profile, (4) adapt curricula to the "new agriculture," (5) replenish and retain human capital, (6) mobilize finance, and (7) achieve gender parity. Each is discussed in detail in the document.

In a ppt presentation, Peter Materu synthesizes these seven into priorities into the following five things that need to be done:

- Bring post-secondary AET into the agricultural innovation system (and learn from others)
- Re-balance the AET pyramid by (1) strengthening faculties of agriculture, (2) upgrade, expand and invest in polytechnic level AET, (3) promote student choice, not assignment, and (4) expand continuing education for producers and professionals
- Modernize curricula and pedagogy

- Build up national postgraduate programs by strengthening (1) subject areas that promote national goals and labor market needs, (2) applied research, (3) recruit women students, with a view to ensuring that all M.Sc. and Ph.D. training takes place primarily in SSA
- Strive for excellence in a few select areas, such as training Ph.D.s in targeted areas, planning for staff retention, and collaborating and coordinating among countries

Although missing in the five things “that need to be done,” the issue of political will likely remains paramount, as does that of establishing productive external linkages.

Miscellaneous

CAADP/NEPAD. 2009. Accelerating CAADP Country Implementation: A Guide for Implementors. Midrand, South Africa: New Partnership for Africa’s Development (NEPAD).

This document discusses factors in implementation of CAADP country projects. It provides a guide to following five components in the Country Implementation ('ROUNDTABLE') process:

- Engagement with stakeholders and the public
- Evidence-based analysis around common priorities
- Development of investment programs, partnerships and alliances
- Assessment and learning from process and practice
- The sequencing of the CAADP country implementation process.

CAADP/NEPAD. 2010. Post Compact Review: Guidelines.

This document is intended to guide governments in the African Member States, working with the Development Partners in preparing National Agriculture Investment Plans (NAIPs) following the successful completion of a CAADP Compact, and those whose task is to review such plans. The document gives concise guidelines and milestones to move past signing of the country CAADP Compact.

Once the compact is signed, the next major milestone is to prepare for the design or formulation of a National Agriculture Investment Plan. The main thrust for the Post Compact Strategy and Roadmap, therefore, is to rally expert support to the country CAADP implementation process to develop and design quality national agriculture Investment Plan and programs.

Gasparini, Lavinia. 2000. From agricultural education to education for rural development and food security: All for education and food for all. Rome: FAO, Extension, Education and Communication Service (SDRE).

Given the multifaceted character of poverty and food security, the FAO Education Group sees the following areas for systemic action:

- Target multiple stakeholders, focusing on "Education for All" and Food for All
- Contribute to placing education at the core of the global and national development agenda³³ and food security agenda, by focusing on the following priorities: (1) expanding access to education and improving school attendance in rural areas, (2) improving the quality of education for rural development and food security, and (3)

- institutional capacity in planning and managing education for rural development and food security.
- Foster inter-disciplinary and new partnerships.

Saint, William. (2005). Bibliography on Higher Education in sub-Saharan Africa. Washington, DC: World Bank

This bibliography covers higher education in SSA in general.

Zubovic, J.; Ivana Domazet; & Ivan Stosic. 2009. Development of Human Capital as a Tool for Improving Productivity of Agriculture Sector – Case of Serbia. Belgrade, Serbia: Paper prepared for presentation at the 113 EAAE Seminar “The Role of Knowledge, Innovation and Human Capital in Multifunctional Agriculture and Territorial Rural Development”.

Training and education is a life-long process. For that reason all levels of that process needs to be examined by policy makers and at the household level. Changes in educational programs and holding seminars for improvements in food industry are not sufficient. Inservice training is essential for enhancing acceptability of education, followed by a wide span of other knowledge sources.

The centralized and authoritarian approach to education, which was present during last few decades, has to be the core of reforms, allowing private capital to enter and improve its quality. Current reforms in agricultural schools have to lean on curricula which combines teaching and practical training of local farmers, and especially on continuous education of elderly population. An accent has to be placed on solving high unemployment levels among rural population, with reorientation of human resources by offering them training programs that would help increase productivity of the agrarian sector which is at present trailing in Serbian economy.

Low levels of human capital in agrarian sector, with over 50% of rural population having only primary education or less are the key reason for low productivity and weak competitiveness of the sector. Urgent institutional reforms are crucial for the agrarian he sector to achieve sustainability in the long term, and not become the black hole of Serbian economy.