

ORIGINAL ARTICLE

AN INNOVATION SYSTEMS PERSPECTIVES ON TERTIARY-LEVEL AGRICULTURAL EDUCATION IN SUB-SAHARAN AFRICA: (EVIDENCE FROM ETHIOPIA)

David J. Spielman¹, Kristin Davis,² Elias Zerfu³, Javier Ekboir⁴,
and Cosmas M.O. Ochieng,⁵

ABSTRACT

This paper examines how tertiary-level agricultural education in sub-Saharan Africa can contribute to agricultural development beyond its current role as a source of technical training. The paper draws on data and information gathered from semi-structured key informant interviews conducted in late 2006 in and around Addis Ababa, Ambo, Haramaya, Harar, Holetta, and Combolcha, as well as information and analysis from secondary sources. The paper specifically examines tertiary-level agricultural education from an innovation systems perspective, an approach that frames technological change against the actions and interactions of diverse innovation agents, and the complex social and economic institutions that condition their practices and behaviors. The paper argues that while tertiary-level agricultural education is conventionally viewed as key to expanding a country's stock of trained human capital, it should also play a role in building the capacity of organizations and individuals to explore new products and processes that depend on the transmission and adaptation of existing information. To do so, tertiary-level agricultural education systems should focus more on transforming organizational cultures and building innovation networks to strengthen innovative capabilities at both the institutional and professional levels. Key reforms include the introduction of educational programs beyond the formal tertiary-level agricultural education system, and improvement of the incentives that encourage tertiary-level agricultural education professionals and organizations to forge links with other innovation system stakeholders.

¹International Food Policy Research Institute Washington, DC 20006 USA

Email: d.spielman@cgiar.org

²Global Forum for Rural Advisory Services (GFRAS) SWITZERLAND

Email: kristin.davis@g-fras.org

³International Food Policy Research Institute (Corresponding author)

Addis Ababa, Ethiopia

Email: e.zerfu@cgiar.org; ezerfu@yahoo.com

⁴Bosques de Fontainebleau 48 – Casa G, Naucalpan, Edo. de México

Email: jekboir@prodigy.net.mx

⁵Sustainable Agriculture, Land and Water, Lancaster Environment Centre (Room

B27) Lancaster University ENGLAND, UK.

Email: c.ochieng@lancaster.ac.uk

INTRODUCTION

This paper examines how tertiary-level agricultural education can make new contributions to agriculture development in sub-Saharan Africa (SSA) by strengthening the capacity of educators, extension agents, rural entrepreneurs, and small-scale farmers to innovate—to introduce new products and processes that are socially or economically relevant to the growth and development of the agricultural sector in the region.

While there is little disagreement over the importance of tertiary-level agricultural education to agricultural development and economy-wide growth, there is limited discussion of how new or different approaches to tertiary-level agricultural education might strengthen its contribution to the development process. Conventional approaches to tertiary-level agricultural education in many sub-Saharan African countries rely on standard curricula and teaching methods to confer a finite set of technical skills to future farmers, researchers, extension agents, and rural entrepreneurs. More innovative approaches to tertiary-level agricultural education argue that tertiary-level agricultural education has a wider role to play in building the capacity of organizations and individuals to transmit, adapt, and use new applications of existing information, new products and processes, and new organizational cultures and behaviors. However, more analysis is needed on how alternative strategies and selective approaches might broaden tertiary-level agricultural education into this role and, ultimately, into closer, more productive relationships with other actors in the agricultural sector and wider economy in a way that builds on the comparative advantages of different actors to reduce transaction costs, exploit complementarities, achieve economies of scale and scope, and realize synergies in innovation.

Over the last 15 years, the Government of Ethiopia has made efforts to improve the

agricultural system in a manner that is more fitting with the nation's efforts to improve food security and reduce poverty—efforts enshrined in Ethiopia's agricultural development-led industrialization strategy set forth in 1995 (FDRE 2005, 2002, 1993). Key policy initiatives have included investments in research and extension to boost crop yields and output; market-led reforms to increase production and commercialization incentives for small-scale farmers; regional devolution of political, economic, and administrative power following the introduction of the federalist system; and large-scale education initiatives designed to reverse years of educational neglect and inequity (Spielman et al. 2010; Mogues et al. 2007; Beyene et al. 2005). These initiatives require that the tertiary-level agricultural education system produce more, and better trained, professionals to fill the ranks of the public research, extension, and rural administration systems.

Yet in spite of this emphasis on agriculture development, economy-wide growth, and poverty reduction, Ethiopia's capacity to leverage science and technology for innovation in the agricultural sector remains weak. Indicators from the World Bank's Knowledge Economy Index (KEI) Ethiopia, for example, show that the country possesses weak national-level abilities to generate, adopt, and disseminate knowledge. National-level studies by Spielman et al. (2007), IKED (2006), and UNCTAD (2002) similarly suggest that the country is host to a weak and fragmented innovation system, particularly with respect to agriculture.

These observations carry through to in-depth studies of Ethiopia's tertiary-level agricultural education system. For example, Kassa (2004a, 2004b) argues that the

tertiary-level agricultural education system suffers from weak linkages among the public education system, research institutes, and extension services to meet the nation's development objectives.

Therefore, this paper examines the tertiary-level agricultural education system in Ethiopia in order to identify gaps and strengths in relation to its potential contribution in strengthening the agricultural innovation system. Specifically, it seeks to respond to the following research questions:

1. Is the Ethiopian tertiary agricultural education system organized to allow the functioning of an effective agriculture innovation system?
2. Does the approach followed by the Ethiopian tertiary agricultural education system adequately prepare its graduates to respond to the current competency needs of the public, private and NGO sectors?
3. How effective is the existing tertiary agricultural education organizational culture and incentive system in supporting innovation?
4. Do we have relevant networks and linkages between the different actors that support effective innovation system?

Understanding innovation: a conceptual framework

This section describes how an innovation systems approach can contribute to reforming tertiary-level agricultural education systems to (a) meet a range of functions—from reducing rural poverty to strengthening competitiveness of modern agriculture, (b) involve a wide range of partners from the different sectors, and (c) promote continuous change in response to new users and new opportunities.

To begin, we define an *innovation system* as the set of agents involved in the innovation process, their actions

and interactions, and the formal and informal rules that condition their practices and behaviors (Lundvall 1988; Metcalfe 1988; Dosi et al. 1988; Freeman 1987; Nelson and Winter (1982). The innovation system perspective contends that there are multiple sources and users of innovation, tertiary-level agricultural education being one of many. Therefore, it can assume a role as one among many in enhancing innovative capabilities by working more collaboratively and strategically with other actors involved in the wider innovation system.

The innovation systems approach offers the following useful insights into the conception of tertiary-level agricultural education for agricultural development:

- Innovation depends on the ability of agents to *learn*—on their ability to gather information and use it creatively in response to market opportunities or other social needs (Lundvall 1999; OECD 1999). Learning depends on the ability of agents to *interact and exchange* information and knowledge (Fagerberg 2005; Nelson and Rosenberg 1993).

The economic or social performance of a country depends on the participation of many innovative agents that foster the emergence of an innovation system, particularly the interaction between a country's scientific base and its business community (Powell and Grodal 2005; Nelson and Rosenberg 1993). These insights imply that a successful innovation system depends on several key elements: the capacity of individuals and organizations to learn and change (innovative capabilities); the organizational norms, practices, behaviors, and incentives that affect learning and change processes (organizational cultures); and the interactions, linkages, and collaborations that inform the content around which learning and change occur (innovation networks).

Innovative capabilities describe the ability to identify and use existing information to create something new. *Individual* capabilities depend on how an individual sees, understands, and interprets the environment in which he/she is immersed. Collective capabilities depend on capabilities resident in the individuals that comprise an organization, along with the information and technology used by an organization, and the organization's specific structure, routines, and coordination methods (Argote and Darr 2000).

An organizational culture can be defined as a set of basic assumptions that are invented, discovered, or developed by a group in the process of learning how to deal with external adaptation and internal integration (Schein 1984). This definition implies several critical points: (a) an organizational culture is a set of beliefs, not values or behaviors; (b) a culture is invented by a group in the early days of the organization and is passed on to newcomers; (c) building a culture takes time because it requires the repeated use of specific approaches to successfully tackle similar problems; and (d) cultures usually change very slowly because the assumptions are

only changed after they repeatedly fail to deal with new situations and are accepted by the organization as a whole (Christensen and Raynor 2003).

Innovation networks are described as interconnected sets of individuals and organizations that emerge to address the scarcity of resources with which to innovate. Innovation networks enable such actors to innovate by generating economies of scale and scope, reallocating labor and human capital more efficiently, reducing transactions costs, exploiting complementarities, and realizing synergies in the innovation process.

Several principles can be drawn from the insights and elements set forth above to improve the analysis of tertiary-level agricultural education reforms in Sub-Saharan Africa. Key principles include the following.

First, innovation goes beyond scientific research and the dissemination of new technologies; the actions and interactions of diverse agents, and the social and economic institutions that condition their practices and behaviors, are of equal importance to understanding the innovation process. Second, innovation depends on the development of individual capabilities: Educational approaches and learning philosophies applied to tertiary-level agricultural education need to cover a wide menu of options that accommodate different types of individuals and individual learning needs. Third, innovation depends on the development of organizational capabilities in tertiary-level agricultural education systems with sufficient reference to other innovation system agents and with an eye to ensuring the continuous ability of organizations to change over time in response to new users and opportunities.

Fourth, innovation depends on the development of organizational cultures and behaviors that transform tertiary-level agricultural education into conduits for transmitting new applications of existing information, new products and processes, and new organizational cultures and behaviors. Fifth, innovation depends on the active participation of tertiary-level agricultural education professionals in networks, partnerships, and other interactions that link a wide range of stakeholders in an agricultural innovation system.

With these principles in mind, this paper analyzes role and contribution of tertiary agricultural education in Ethiopia from an innovation systems perspective.

METHODOLOGY

This paper is based on a case study of Ethiopian tertiary agricultural education system. It draws on data and information gathered from semi-structured key informant interviews conducted in late 2006 in and around Addis Ababa, Ambo, Haramaya, Harar, Holetta and Combolcha, as well as information and analysis from secondary sources. University/college faculty and students, professionals from federal and regional agricultural bureaus, private firms and agricultural research institutes were selected purposively based on their involvement in and relationship to the agricultural tertiary education in Ethiopia.

Purposive sampling based on the appropriateness of the respondent was used to select the respondents for the study. A total of 61 respondents comprising 18 (university/college faculty, education and agriculture professionals and private agriculture firm employees) and 43 students participated in the interview. These include faculties and students of Haramaya University, Jimma University (Ambo College of Agriculture), Combolcha and Holetta ATVET Colleges,

and Menschen für Menschen Foundation (Agro-Technical Training College). A different respondent group of education professionals from the Ministry of Agriculture (ATVET Department) and the Oromia Bureau of Agriculture (ATVET Department) were also included in the interviews.

Furthermore, private sector actors were represented by Oda Flowers and the Ethiopian Horticulture Association. Professionals from the International Livestock Research Institute were also included to obtain the perspectives of international agricultural institutes.

RESULTS AND DISCUSSION

An Overview of tertiary-level agricultural education in Ethiopia

Ethiopia is primarily an agricultural economy with high rates of poverty and food insecurity (Table 1). It hosts a largely subsistence agriculture sector characterized by small farms, low modern input use, and limited commercialization. It is also a “post-conflict” country, having come out of protracted civil strife in the early 1990s, and has since experienced rapid—and often volatile—economic growth and development.

Over the past 50 years, Ethiopia has invested in building the fundamental structures of a tertiary-level agricultural education—universities, technical/vocational schools, and in-service training programs. The country is host to some of Africa’s oldest institutes of higher learning that focus specifically on the agricultural sciences, including Jimma University and Ambo University College (established as junior colleges of agriculture in 1947), and Haramaya University (formerly Alemaya University and founded as the Imperial College of Agricultural and Mechanical Arts in 1953 along lines similar to a U.S. land-grant institution).

Today, the formal tertiary-level agricultural education system is comprised of seven institutes of higher learning in the field of agriculture,

as well as 25 agricultural technical and vocational education and training (ATVET) colleges, all funded and managed by the federal and/or regional governments.

Table 1 Key Economic Indicators for Ethiopia, c. 2002–04

Indicator	Ethiopia	Sub-Saharan Africa
GDP growth rate (%) ^a	5.2	3.6
Agricultural GDP (% of GDP) ^a	46	18
Rural population (% of total population) ^a	85	66
Agricultural population density (persons/ha) ^b	5	2
Cereal yield (kg/ha) ^a	1,242	1,086
Foreign direct investment (% of GDP) ^a	4	3
Cereal exports (in millions of US\$) ^c	1.73	-
Av. export unit value of cereals (US\$/ton) ^c	330	-
Cereal surplus (export - imports) (in 1,000 tons) ^c	-52	-
Proportion of undernourished in total population ^d	46	33
Poverty (% of population below national poverty line) ^e	44	-
Literacy (% of population age 15+) ^f	42	65
Gross primary enrollment (% of school-age pop., male/female) ^f	76/55	102/88
Knowledge Economy Index scores^g	Ethiopia	All Africa
Economic incentive regime	1.37	2.57
Innovation	0.61	3.03
Education	0.81	1.39
Information and communication technology	0.1	2.51

^a 2000-05 average. Source: World Development Indicators, 2006.

^b 2001-03 average. Source: FAOSTAT, 2006.

^c 2004. Source: FAOSTAT, 2006.

^d 2002-04 average. Source: FAOSTAT, 2006.

^e 2000. Source: World Development Indicators, 2006.

^f 2002. Source: World Development Indicators, 2006.

^g 2004. KEI scores are scaled from 1 (lowest) to 10 (highest). Source: KAM, 2006.

Demand for agricultural professionals

These observations notwithstanding, public policy initiatives and changing market realities in Ethiopia suggest the beginning of an agricultural transformation from subsistence agricultural systems to a more productive, diversified, and commercialized agricultural sector. This transformation will likely generate significant demand for agricultural professionals with new qualifications to facilitate commercialization of smallholder production, as managers and technicians in agro-industrial companies, or as entrepreneurs in other dynamic subsectors of the agricultural economy (Figures 1 and 2).

However, since this transformation is just at its earliest stages, the current demand for agricultural professionals is still driven by the government’s ambitious farmer training center (FTC) program, slated to deploy more than 55,000 ATVET graduates as DAs across the country.

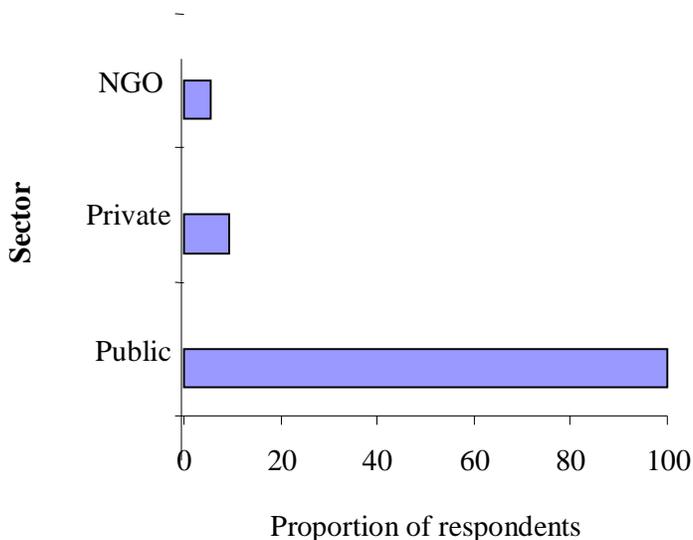


Figure 1. Key informant perspective: Expected employment timeframe for AET graduates (n=53)

Source: Authors

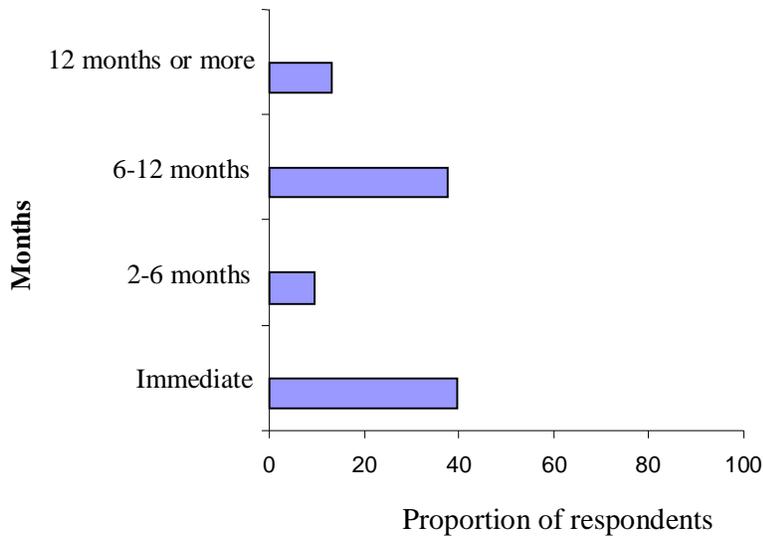


Figure 2: Key informant perspectives: Expectations of top three employment opportunities after graduation, by sector (n=53)

Source: Authors

In addition to the demand generated by the FTC program, demand for agricultural graduates is being driven by other actors in the agricultural innovation system, i.e., the private sector and civil society. For example, private investment in the horticulture sector has expanded rapidly in the last several years, creating around 26,000 jobs for skilled and unskilled workers (EHPEA 2006). The cut-flower export industry, a key component of this sector, has contributed significantly to creating a modern innovation cluster in Ethiopia's agricultural sector, and has created opportunities for managers and semi-skilled workers trained in areas such as plant production/protection, horticultural science, and farm management—opportunities that require mid-level qualifications rarely exceeding the B.Sc.

level. Similarly, the NGO sector—comprised of some 246 local and 122 international NGOs (Rahmato 2002)—has created consistent demand for workers with competencies in plant/animal production and protection, particularly when combined with skills in community mobilization and rural extension.

Yet the potential and real demand for tertiary-level agricultural education graduates is just one part of the story in Ethiopia. The other part, from an innovation systems perspective, is to see whether the tertiary-level agricultural education is developing individuals and organizations with the innovative capabilities, cultures and networks needed to stimulate the growth of a more dynamic and competitive agricultural sector. We examine these issues in detail below.

Supply Responses: The Tradeoff between Quantity and Quality

While the government may be meeting its own quantitative benchmarks in terms of tertiary-level agricultural education graduate output, many key informants to this study argue that few such graduates have the necessary capabilities to participate effectively in the country's changing agricultural sector. Indeed, there is concern that the government's emphasis on increasing access to education (including tertiary-level agricultural education) has been pursued at the expense of educational quality and, implicitly, the development of individual innovative capabilities.

The quantity-quality tradeoff in Ethiopia ties closely to the government's "10+2" education strategy introduced in the early 1990s (Beyene et al. 2005; Saint 2004). The "10+2" system is designed to systematically transition students from 10 years of secondary education into continuing technical and vocational education or two years of preparation for university. While the technical and vocational track feeds directly into the public system of agricultural and nonagricultural training colleges, the university track tends to create students who are ill-prepared for an additional three years at university. Many agricultural professionals interviewed for this study argue that the two preparatory years are taught by instructors with insufficient qualifications, experience, or materials to cover what is essentially a first-year university curriculum.¹

¹ For an in-depth review of the entire higher education system in Ethiopia, see Yizengaw (2007). This study discusses many of the issues identified here, with an emphasis on such issues as governance, access, quality, efficiency, and resource mobilization.

Several key informants to this study argue that Ethiopia's tertiary-level agricultural education is also failing the needs of industry, especially in the rapidly growing horticulture sector. They argue that the system is overlooking graduates' needs for practical, hands-on skills that balance abilities in the hard sciences with an understanding of the social and management sciences. Thus, private companies in subsectors such as the cut-flower industry—which is highly reliant on foreign technologies that are not traditional components of the education curriculum in Ethiopia—draw their skilled employees either from foreign sources (Netherlands, Israel, India, and China, for instance, or Zimbabwe, Uganda, and Kenya, where recent declines in the cut flower sector have provided a surplus of experts for Ethiopia's growing industry) or from more senior local sources (experienced managers from moribund state farms or other state-owned agricultural enterprises).

In recognition of these issues, the government has invested in several reform efforts in the tertiary-level agricultural education. These efforts include several donor-funded projects designed to strengthen scientific and technical staff capacity in the agricultural research and education systems, and upgrade research and university facilities. Many of the country's colleges and universities have also introduced or expanded their courses and specializations in areas such as horticulture science, cooperative management, finance and accounting, and the like. And a growing number of private companies and NGOs have also started offering short-term practical attachments for agricultural students to supplement classroom-based instruction.

Still, evidence from key informants suggests that the tertiary-level agricultural education is generally not geared to providing an education that emphasizes the capabilities needed to develop a dynamic and competitive agricultural sector. Many key informants argue that the scientific curricula are overly theoretical and conceptual; social science curricula are weak in the essential areas of community mobilization, project management; and classroom practices are out-of-touch with modern educational methods. Potential solutions to these problems—for example, engaging the private sector and civil society in the curriculum development process—are rarely explored.

Capabilities and Educational Approaches

According to many key informants to this study, the first major challenge facing

Ethiopia is the need to develop new and different capabilities among Ethiopia's tertiary-level agricultural professionals based on educational approaches that effectively combine technical skills training with more practical instruction in problem solving, decision-making, integrating concepts, and acting independently and creatively.

Currently, educational approaches and learning philosophies in the tertiary-level agricultural education revolve around traditional modalities of instruction (Figure 3), do not universally rely on the use of modern educational infrastructure or equipment (Figure 4), and provide professionals and graduates with only a limited set of technical skills and abilities.

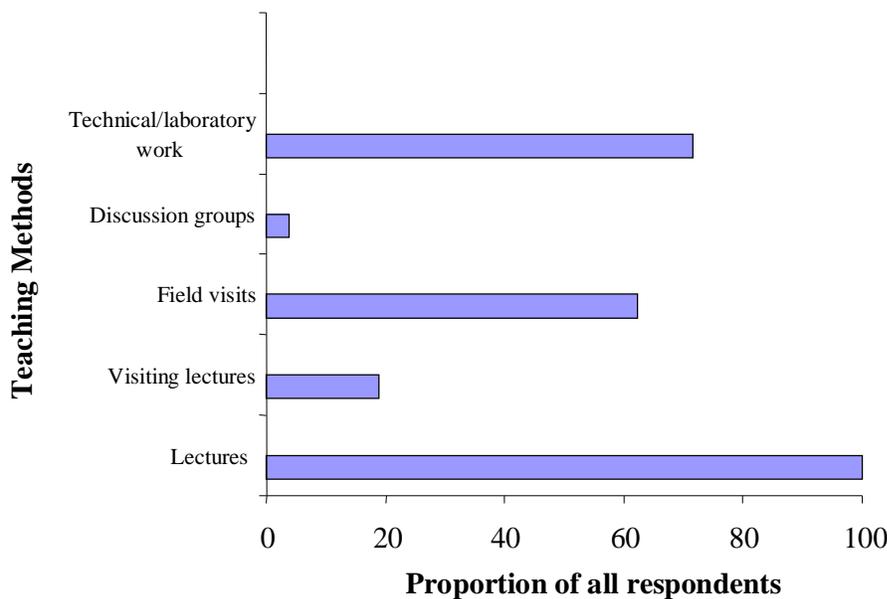


Figure 3 Key informant perspectives: Common AET teaching methods in Ethiopia

Source: Authors

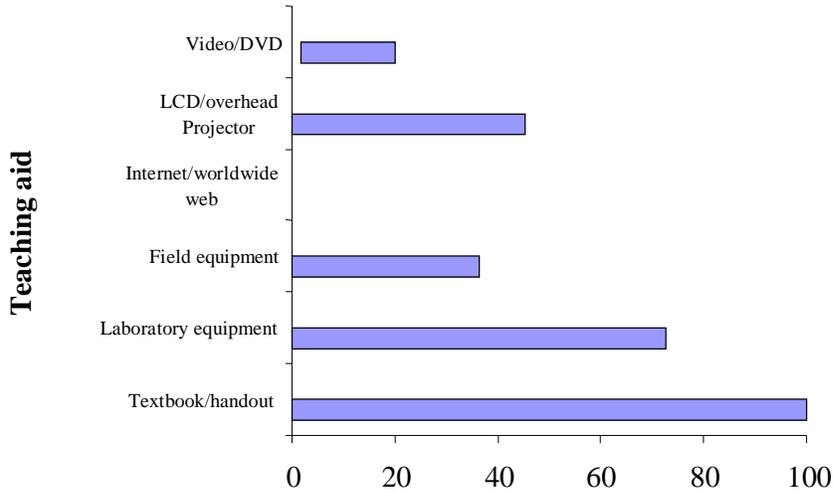


Figure 4 Key informant perspective: Common AET Teaching aids in Ethiopia
Source: Authors

Beyond the classroom, there is also the wider issue of Ethiopia's tertiary-level agricultural education curriculum. The curriculum content tends to overlook the importance of creating opportunities for students to build practical life skills and decision making abilities in the context of a more dynamic and innovative commercial agricultural sector. Yet many students interviewed for this study readily acknowledged *both* a lack of confidence in working with farmers and unfamiliarity with the internet. The curriculum-development process in Ethiopia tends to exacerbate these problems. Few institutions have formal curriculum-development processes that link directly to their budgetary and programmatic planning cycles. As a result, most new courses, programs, or faculty bifurcations and mergers are ad hoc and are rarely based on solid market research, tracer studies, or consultations with industry and other

employers. Worse yet, these up-gradations often require expertise that were rare in Ethiopia; even the most senior administrators in the government interviewed for this study admit to their own lack of expertise in tertiary-level agricultural education curriculum development. There is, however, some evidence of change at a systemic level. There are signs that agricultural colleges and universities are incorporating demand-side needs in the curriculum to a greater degree. Stakeholder workshops, formal consultations, and informal interactions among government, industry, and NGOs on issues relating to tertiary-level agricultural education curriculum are increasingly commonplace.

Organizational Cultures and Incentives

From an innovation systems perspective, efforts to develop individual and collective innovative capabilities are contingent upon changes in the cultures, behaviors, and incentives that characterize tertiary-level agricultural education delivering organizations and systems. These characteristics differ significantly in Ethiopia compared to other sub-Saharan countries. This is partly due to the fact that tertiary-level agricultural education in other sub-Saharan countries developed out of a colonial experience, while tertiary-level agricultural education in Ethiopia emerged from its long independence from direct colonial control. It is also partly due to the different agricultural policies, strategies, and programs pursued by the respective national governments.

Organizational cultures reflect shared beliefs. Study findings suggest that Ethiopian tertiary-level agricultural education organizations and professionals hold several shared beliefs about agricultural development, food security, poverty reduction and the roles and functions of tertiary-level agricultural education. There is a shared, and somewhat limiting, understanding that the formal tertiary-level agricultural education system's role is to create the researchers and extension agents who develop and disseminate these technologies.

As a result, policies in both agriculture and education focus almost exclusively on science-based strategies to boost yields through adoption by smallholders of technology packages. Incentive mechanisms in the tertiary-level agricultural education system are largely driven by public-sector regulations. Tertiary-level agricultural education educators are poorly paid and receive relatively few benefits, a reality compensated by the long-term benefits of secure employment, public pension schemes, and low expectations in terms of output. Instructor remuneration in

Ethiopia's public tertiary-level agricultural education system follows civil service salary scales. This is apparently insufficient to retain professionals, particularly in the ATVET colleges where turnover is high. Instructors and faculties have little control over their finances, while administrative systems, management practices, and financing mechanisms are typically focused on maintaining strict control and accountability over resources. There are some signs that incentive structures are changing in Ethiopia, specifically through efforts to upgrade tertiary-level agricultural education instructors' qualifications, introduce more practical education through curricula reform, invest more in tertiary-level agricultural education infrastructure and equipment, and reach out to stakeholders in industry and the NGO sector. Higher-paying job opportunities and short-term contracts in both the private and NGO sectors may be motivating a new generation of tertiary-level agricultural education graduates to excel not only as technical experts, but as independent entrepreneurs and innovators as well. However, there is limited empirical evidence to suggest that new incentive structures (or market realities) are yet generating the desired changes in organizational cultures and behaviors in the tertiary-level agricultural education system.

Innovation Networks and Linkages.

The dynamism of a tertiary-level agricultural education system relies partly on its ability to interact with agents in the wider innovation system through what we have described earlier as innovation networks (Figure 5). Here, we highlight one particularly important aspect of networking—the notion that innovation occurs in the nontraditional—rather than traditional—links of a network.

Tertiary-level agricultural education institutions in Ethiopia operate in networks dominated by the traditional links of academics with similar individuals and organizations.

Nontraditional links—where new knowledge and information can be exchanged, and where innovation is most likely to occur—is uncommon. Few incentives exist to promote network formation, although several exceptions suggest possibilities for change.

Findings from this study suggest that tertiary-level agricultural education remains largely de-linked from the wider innovation system. Key informants to this study suggest that despite the importance of tertiary-level agricultural education to public extension services—and therefore to agricultural development—the system is only weakly linked to other public-sector sources of innovation, namely agricultural research organizations. They also suggest that the tertiary-level agricultural education system is essentially de-linked from newer players in the system, such as private companies and civil-society organizations.

Some successful experiences and structures suggest that these issues are being addressed.

Organizations such as the Ethiopian Institute of Agricultural Research are experimenting with new approaches to innovation that move beyond the conventional transfer of technology approach, as suggested by public efforts to link smallholders with technologies,

markets, businesses, and other key actors and institutions.

Structures such as the Federal Research and Extension Advisory Council work to foster linkages among researchers, educators, extension agents, and farmers at the federal, regional, and research-center levels, and are comprised of representatives from across the innovation system. Councils at the regional level and within specific research centers are structured similarly to achieve similar goals.

Yet feedback from key informants suggests that the system, having undergone repeated restructuring and transformation, is still plagued by weak linkages between and among key actors. Although efforts are being made to set priorities and create structures that promote greater integration, there is limited empirical evidence to suggest that the requisite linkages are forming, that incentives structures to promote linkage formation are being designed, or that linkages are effectively integrating the critical end users—the small-scale, resource-poor farmers.

CONCLUSIONS AND RECOMMENDATIONS

As the findings of this study suggest, there are signs that the tertiary-level agricultural education system in Ethiopia is undergoing some degree of reform in response to changing scenarios in agricultural policies and markets. However, very few of these reforms seem to capture the key elements of the innovation systems perspective.

Few reforms focus on strengthening individual and collective capabilities to innovate; changing organizational cultures, behaviors, and incentives; or building innovation networks and linkages. Few seem to prioritize the creation of a more dynamic and responsive tertiary-level agricultural education system through the introduction of new and different educational approaches, learning philosophies, and shared beliefs and practices—and through opportunities to build networks that link a wider range of stakeholders in the agricultural innovation system.

These findings tend to reflect experiences elsewhere in sub-Saharan Africa. Thus the recommendations for improving tertiary-level agricultural education from an innovation systems perspective are offered here for consideration by tertiary-level agricultural education policymakers, managers, professionals, and clients. However, these recommendations should also be viewed only as possible options based on the findings of this study and on wider global practice in tertiary-level

agricultural education. Furthermore, these recommendations should only be considered in the context of country-specific priorities and capabilities.

Develop the Human Capital Base by Enhancing Innovative Capabilities

In the medium term, efforts to further develop the country's human capital base would focus on the provision of learning opportunities geared to the specific needs of actors in the innovation system. This would entail linking tertiary-level agricultural education and research agendas more closely to the needs of different user communities, fostering stronger linkages between formal tertiary-level agricultural education and national extension systems, exploring new ways of leveraging expertise and resources from international research organizations and foreign universities, and working to meet the needs of private industry.

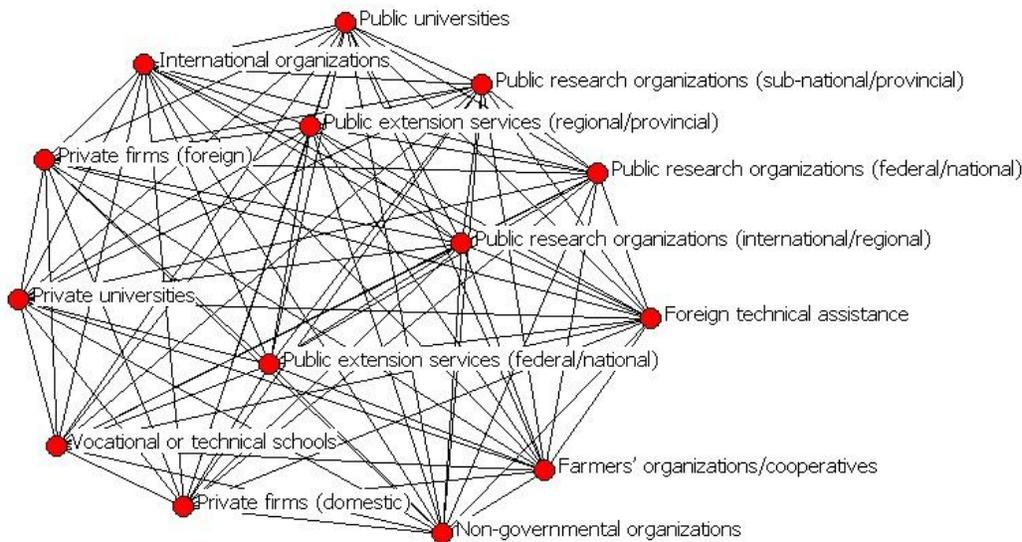


Figure 5 Hypothetical innovation networks in an AET system

Source: Authors

Facilitate the Flow of Information and Technology through Networks and Linkages

Emphasis in the medium term might also be placed on fostering the development of the innovation networks needed to put this information and technology into socially or economically relevant use.. This should be complemented by renewed efforts to engage international agricultural research centers, foreign universities, and foreign entrepreneurs more aggressively in these networks.

Induce Change in Organizational Cultures, Behaviors, and Practices. In the long term, efforts to induce change require recognition by policymakers, public administrators, tertiary-level agricultural education professionals and other actors that formal tertiary-level agricultural education organizations are not the only ones conducting research and training, and that linkages with a wide array of other stakeholders can effectively serve higher learning institutions and the country's innovation system. Policies and programs should encourage greater openness in higher learning institutions to collaboration and should focus on strengthening individual and organizational incentives to develop and retain capacity on a national scale, and on introducing organizational and managerial innovations into system itself.

Monitor and Evaluate the Tertiary-Level Agricultural Education System

Continuous evaluation of higher learning institutes and the tertiary-level agricultural education system as whole is also necessary. Teams of domestic and international experts in tertiary-level agricultural education can play a critical role in assessing progress and designing roadmaps for change. These evaluations can help organizations redefine their mandates and goals relative to changes in the country's tertiary-level agricultural education system, wider agricultural innovation system, and the availability of resources.

Support Autonomous Changes in tertiary-level agricultural education

The menu of educational options in many developed and developing countries is expanding in response to emerging social and productive needs (Christensen, Anthony and Roth 2004). As Ethiopia integrates further into the global economy, it is highly likely that new local and foreign options will also emerge, as is demonstrated by the creation of new private universities and the training provided by NGOs. Rather than concentrating all resources on formal, traditional higher learning institutions, policymakers can allocate moneys to explore these emerging options and foster the expansion of the more successful ones.

Create an Appropriate Policy Environment

The long-term transformation of tertiary-level agricultural education systems in Ethiopia also requires an appropriate policy environment and policymakers with the knowledge and skill to facilitate the transition process. Creating the right policy environment would require, among other things, developing courses on research and

technology management and facilitating policy dialogue among different actors in the innovation system that put policymakers into direct contact with researchers, research managers, private firms, and civil society. Higher learning institutions can constructively contribute to the process by serving as a convening force, providing information and analysis of policy options, and participating actively in repeated discourse.

REFERENCES

- Argote, L., & Darr, E. (2000). Repositories of Knowledge in Franchise Organizations. In G. Dosi, R.R. Nelson & S.G. Winter (Eds.), *The Nature and Dynamics of Organizational Capabilities*, New York: Oxford University Press.
- Beyene, Y., Gaumnitz, A., Goike, C., & T. Robbins, T. (2005). *Stimulating Community Participation in Primary Schools: Perspectives on the BESO II Project in Bahir Dar, Ethiopia*, unpublished manuscript, George Washington University, Washington, D.C.
- Christensen, C.M., Anthony, S.D., & E.A. Roth. (2004). *Seeing What's Next. Using the Theories of Innovation to Predict Industry Change*, Boston, Mass.: Harvard Business School Press.
- Christensen, C.M. & Raynor, M.E. (2003). *The Innovator's Solution. Creating and Sustaining Successful Growth*, Cambridge, Mass.: Harvard Business School Press.
- Dosi, G., Freeman, C., Nelson, R., Silverberg, G., & Soete, L. (Eds.). (1988). *Technical Change and Economic Theory*, London: Pinter.
- EHPEA (Ethiopian Horticulture Producers and Exporters Association), (2006) data extracted from official records, EHPA, Addis Ababa.
- Fagerberg, J. (2005). Innovation: A Guide to the Literature', in Fagerberg, J., Mowery, D. C., & Nelson, R. R. (Eds.). *The Oxford Handbook of Innovation*, Oxford/New York: Oxford University Press.
- FAOSTAT (Food and Agriculture Organization (FAO) Statistical Database), (2006). *Agriculture, Fishery, Forestry and Nutrition 2006* (CD-ROM), Rome: FAO.
- FDRE (Federal Democratic Republic of Ethiopia), Ministry of Finance and Economic Development (MOFED). (2005). *Ethiopia: Building on Progress: A Plan for Accelerated and Sustained Development to End Poverty*, Addis Ababa: MoFED.
- FDRE (Federal Democratic Republic of Ethiopia), Ministry of Finance and Economic Development (MOFED). (2002). *Ethiopia: Sustainable Development and Poverty Reduction Program*, Addis Ababa: MoFED.

- FDRE (Federal Democratic Republic of Ethiopia), Ministry of Planning and Economic Development (MoPED). (1993). *An Economic Development Strategy for Ethiopia*, Addis Ababa: MoPED.
- Freeman, C. (1987). *Technology Policy and Economic Performance: Lessons from Japan*, London: Pinter.
- IKED (International Organization for Knowledge Economy and Enterprise Development). (2006). *Ethiopia: Innovation and Growth in International Comparison*. Paper prepared for the Triple Helix Conference on Transforming University-Industry-Government Relations in Ethiopia, Addis Ababa, May 29–31.
- Kassa, B. (2004a). Postgraduate Training in Agricultural Sciences in Ethiopia. *Higher Education Policy* Vol.17, pp. 49–70.
- Kassa, B. (2004b). *Linkages of Higher Education with Agricultural Research, Extension and Development*, unpublished manuscript, Alemaya University, Ethiopia.
- KAM (Knowledge Assessment Methodology). (2006). *The World Bank Knowledge for Development (K4D) website: Knowledge Assessment Methodology*. <http://web.worldbank.org/>
- BSITE/EXTERNAL/WBI/WBIPROGRAMS/KFDLP/EXTUNIKAM/0,menuPK:1414738~pagePK:64168427~piPK:64168435~theSitePK:1414721,00.hm l). December 15, 1006.
- Lundvall, B.A. (1988). Innovation as an Interactive Process: From User–supplier Interaction to the National System of Innovation, In G. Dosi, C. Freeman, R. Nelson, G. Silverberg, and L. Soete, eds., *Technical Change and Economic Theory*, London: Pinter.
- Lundvall, B.A. (1999). Technology Policy in the Learning Economy', in Archibugi, D., Howells J., and Michie, J. (Eds.). *Innovation Policy in a Global Economy*, Cambridge, UK: Cambridge University Press.
- Metcalf, J.S. (1988). The Diffusion of Innovations: An Interpretive Study, in G. Dosi, C. Freeman, R. Nelson, G. Silverberg, and L. Soete, eds., *Technical Change and Economic Theory*, London: Pinter.
- Michelsen, H., & Hartwich, F. (2004). *University-based Agricultural Research: A Comparative Study in Sub-Saharan Africa*, research report 26, The Hague: International Service for National Agricultural Research.
- Mogues, T., Ayele, G., & Paulos, Z. (2007). *The Bang for the Birr: Public Expenditures and Rural elfare in Ethiopia*, International Food Policy Research Institute discussion paper no. 702, Washington, DC: IFPRI.
- Nelson, R. & Rosenberg, N. (1993). Technical Innovation and National Systems', in Nelson, R. (Ed.). *National Innovation Systems, A Comparative Analysis*, New York: Oxford University Press.
- Nelson, R.R. & Winter, S.G. (1982). *An Evolutionary Theory of Economic Change*, Cambridge, Mass.: Belknap Press. OECD (Organization for Economic Cooperation and Development). (1999). *Managing National*

- Innovation Systems*, Paris: OECD.
- Rahmato, D. (2002). Civil Society Organizations in Ethiopia, in B. Zewde and S. Pausewang, eds., *Ethiopia: The Challenge of Democracy from Below*, Stockholm and Addis Ababa: Nordiska Afrkainstitute and Forum for Social Studies. pp. 103-119.
- Saint, W. (2004). Higher education in Ethiopia: The vision and its challenges', *Journal of Higher Education in Africa* Vol. 2(3), pp. 83–113.
- Schein, E.H. (1984). Coming to a new awareness of organizational culture', *Sloan Management Review* Vol.25, pp. 3–16.
- Spielman, D.J., D. Byerlee, D. Alemu, and D. Kelemework. (2010). Policies to promote cereal intensification in Ethiopia: A review of evidence and experience. *Food Policy* Vol. 35 (3), pp. 185–194.
- Spielman, D.J., Negash, M., Davis, K. , & Ayele, G. (2007). Agricultural Innovation in Ethiopia: A Systems Overview of Opportunities and Constraints,' in E. Wale, S. Regassa, D. Gebre-Michael, and B. Emanu, eds., *Reversing Rural Poverty in Ethiopia: Dilemmas and Critical Issues. Proceedings of the 9th annual conference of the Agricultural Economics Society of Ethiopia (AESE)*, Addis Ababa: AESE.
- UNCTAD (United Nations on Trade and Development). (2002). *Investment and Innovation Policy Review: Ethiopia*, UNCTAD/ITE/IPC/Misc.4, Geneva: United Nations.
- World Bank. (2008). *World Development Report 2008*, Washington, DC: World Bank.
- Yizengaw, T.(2007). *The Ethiopian Higher Education: Creating Space for Reform*. Addis Ababa: St. Mary's UC Printing Press.