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## An African PhD Program in Information Systems: The Case of Addis Ababa University, Ethiopia

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### ABSTRACT

This case study is about the first Information Systems PhD program in Ethiopia and the region, a collaborative effort of thirteen universities around the globe. Fifteen faculty members traveled to Ethiopia to launch the program for classes, which will start in 2009. This paper depicts the program design and program development and an outline of the overall program. The authors share their personal experience in the development of this unique IS PhD program.

### Keywords

Higher Education, Tertiary Education, PhD Program, Africa, Ethiopia

### INTRODUCTION

Information Technology (IT) has permeated the business and academic consciousness of low-income countries. Many have established ministerial and directorate positions in IT and launched certificate programs, but advanced academic degree programs, especially PhD programs, have lagged behind. This case study depicts the launch of an Information Systems (IS) PhD program at Addis Ababa University (AAU) in Ethiopia.

Africa has a very low (<5% compared to 50% in the U.S.) enrollment in higher education (Bloom, Canning, and Chan, 2006). *“Today, more than ever before in human history, the wealth-or poverty-of nations depends on the quality of higher education. Those with a larger repertoire of skills and a greater capacity for learning can look forward to lifetimes of unprecedented economic fulfillment. But in the coming decades the poorly educated face little better than the dreary prospects of lives of quiet desperation.”* (Gillis, M., President of Rice University, 12 February 1999). These thoughts are echoed by Paul Collier (2007) in his study of the bottom billion. Therefore increasing availability and enrollment in higher education must be part of the strategy for African countries to achieve economic growth and become better connected to the global economy.

IT offers many countries the opportunity to quickly create a first-world industry, as demonstrated by India's success with outsourcing. This model has spread to other countries, including the Philippines, Russia, Vietnam, Brazil, and Uruguay. Ethiopia has the basic ingredients (a large population, 80 million, for economies of scale and English as the language of instruction for secondary and tertiary education) to build a successful IT outsourcing industry. First, it must create a cadre of professors who can educate those who will become the critical resource for such an industry.

This case study describes the design and development of the Information Systems PhD program at AAU. The lessons learned from this case study may serve as a guide for similar programs in other developing economies.

## BACKGROUND

Higher education has been neglected in Africa (Bloom, et al., 2006). While Ethiopia has a history of higher education that dates back to 1711, formal establishment did not take place until 1947 at Alamaya University, a public university focusing on agriculture, and in 1950 at Addis Ababa University or AAU. These two universities remained the only higher education institutions until 1991. Between 1991 and 2007, the number of Ethiopia's public universities increased from 2 to 23. The first private higher education institution, Unity College, was established in 1998. Today, there are three dozen public and private higher education institutions in the country.

The IS program is part of an overall PhD program initiative in related computing fields. The formal computing degree is called "PhD in Information Technology" with six complementary tracks including (listed in alphabetical order): Information Systems, Information Retrieval, IP Networking & Mobile Internet, Language Technology, Software Engineering, and Wireless Communication Systems.

The proposed PhD program complements the Ethiopian government's emphasis on Information and Communication Technology (ICT) as a key development agent. The government has established a vice ministerial position for ICT under the Ethiopian Ministry of Capacity Building and a directorate called Ethiopian ICT for Development Agency (ICTDA). ICTDA has oversight over the federal government implementation of ICT applications. Ethiopia's vision to overcome underdevelopment by using ICT as a strategic agent was articulated in a 2005 speech by Prime Minister, Meles Zenawi, "...Now we believe we are too poor not to save everything we can and invest as much as possible in ICT. We recognize that while ICT may be a luxury for the rich, for us the poor countries, it is a vital and essential tool for fighting poverty, for beating poverty that kills, and ensuring our survival..." (ICTs and Transformational).

The proposed PhD program, the first of its kind in Ethiopia and the region, recognizes the Brain Drain challenge. Brain Drain, the migration of skilled professionals out of economically developing countries, poses a real challenge to Africa's ability to retain its graduates. For example, the International Organization on Migration (IOM) estimated that Ethiopia lost 74.6 percent of its human capital from various institutions between 1980 and 1991 (IRIN, 2004). Another estimate shows that 60,000 Ethiopian professionals made up of physicians, professors, engineers, etc. left the country between 1985 and 1990 (Africa Brain Drain, 2003).

An estimate from 2003 showed a fifteen-year average report indicating that 50 percent of Ethiopians who went abroad for advanced studies did not return. Many of these professionals go to the United States and the United Kingdom. The 2000 U.S. Census showed that Africans with bachelor and advanced degrees led all other U.S. immigrant groups, as shown in Figure 1 (U.S. Census, 2000).

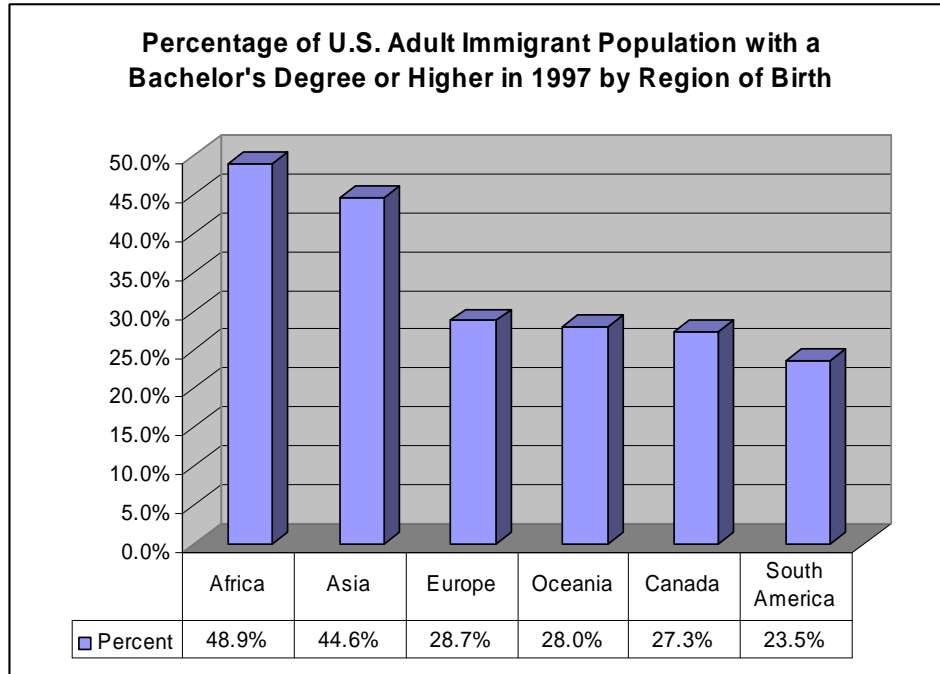


Figure 1. 2000 U.S. Census, Immigrant Population with Bachelor’s Degree or Higher

The Census also showed that Africans with graduate degrees led all other immigrant groups (see Figure 2).

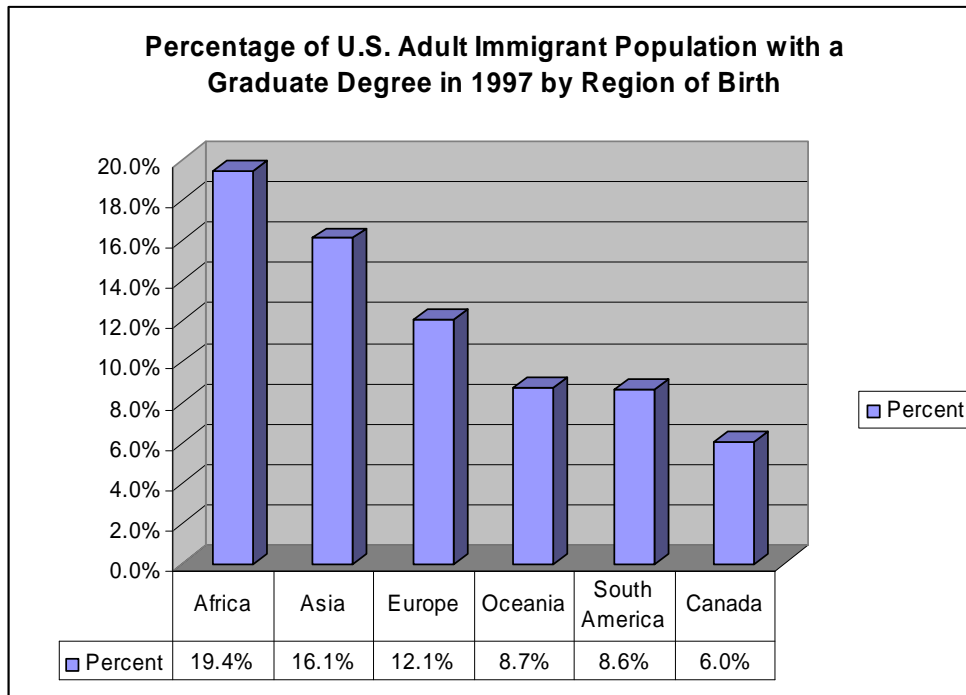


Figure 2. 2000 U.S. Census, Immigrant Population with Graduate Degree

Compared to the overall U.S. population average of 23.1 percent with college degrees and 2.6 percent with advanced degrees, the 2000 Census showed that African immigrants led in both groups (see Table 1).

Education Level	U.S. Population	All Immigrants in U.S.	African Immigrants	Asian Americans	Europe, Russia & Canada	Latin, South America & Caribbean
Not Fluent in English	0.6%	30.5%	7.6%	23.4%	11.5%	44.0%
Less Than High School	17.1%	39.1%	12.1%	21.2%	23.5%	57.4%
College Degree	23.1%	23.3	43.8%	42.5%	28.9%	9.1%
Advanced Degree	2.6%	4.2	8.2%	6.8%	5.8%	1.9%
SOURCE: 2000 U.S. CENSUS; <a href="http://en.wikipedia.org/wiki/Africans_in_the_United_States">http://en.wikipedia.org/wiki/Africans_in_the_United_States</a>						
<b>Table 1. 2000 U.S. Census College and Advance Degrees</b>						

The overall migration of Africans with advanced degree is estimated at 20,000 annually (Emigration of Healthcare Professionals, 2006). The proposed PhD program design must grapple with these realities and will fail Ethiopia if it becomes another channel for the talent Diaspora. To mitigate this threat, the proposed PhD program is designed as a local program. The international faculty travel to Ethiopia in lieu of sending students abroad. The structure of the program, thus, is based on the not-unreasonable assumption that students who are educated in Ethiopia are much more likely to remain living and working in Ethiopia.

**PROGRAM DESIGN**

The PhD program initiative was conceived by a consortium of academic departments that offer master’s degrees in the computing field, including three at AAU: Computer Science, Information Science, and Electrical & Computer Engineering, and the departments of IT and Telecom Engineering in the College of Telecommunication and Information Technology.

**The PhD Program**

The primary objective of the PhD Program is to produce graduate PhD students who have the capacity to identify and solve problems related to IS policy, design, development, and implementation in Ethiopia. Students will learn to apply technical and scientific methods and innovative thinking. The program will prepare candidates for successful academic and professional careers in Ethiopia. It should also try to foster the development of Ethiopia as an IS outsourcing center through the courses it offers, skills developed, and the research undertaken.

Though it would be a loss to Ethiopia if successful completion of the PhD program serves only as an entry point to a career in a high-income country, we should, nevertheless, educate and acculturate PhD students to publish in appropriate international journals.

The PhD Program will be a hybrid between the European research-only model and the U.S. model of course work, comprehensive exam, and dissertation. It is intended to span 3-4 years with course work in the first year and dissertation research in subsequent years. Doctoral candidates are expected to complete a master's degree in a related field before admission to the PhD Program. Incoming doctoral students will join a cohort in their track with a minimum of five students per cohort.

The demand for terminally qualified faculty in Ethiopia is high. More than 200 PhD holders are needed to meet current demand for teaching at public universities. This projection is only for public academic institutions, not including private institutions, industry, and other R&D needs.

The proposed program will use foreign and local faculty to initiate the program. The foreign faculty will initially take the lead role in designing a class. A local faculty member will be designated as the coordinator for each class and will be its potential future teacher. The local member will work with the corresponding foreign faculty, administer the course, and support students. The foreign faculty will mentor the local faculty member. At least one foreign professor for each course will travel to Ethiopia for 1-3 weeks during the face-to-face mode of the course.

The dissertation will be jointly chaired by a local and foreign advisor. The dissertation process will require intense collaboration between the student and dissertation advisors.

Doctoral candidates will write and orally defend their dissertation. Students will be expected to defend their dissertation proposal at the beginning of their second year, following course work completion.

### **Transferability and the scarce resource design principle**

The PhD program is a suitable candidate for applying a scarce resource principle to its design. The scarce resource in this case is the foreign faculty member willing to travel to Ethiopia on multiple occasions. It is likely that a reasonable number of faculty will consider making one or two trips. The number of faculty likely to make multiple trips is, however, quite small. Thus the program should be designed around the scarcity of foreign faculty willing to commit to multiple trips to Ethiopia. This means the transfer of doctoral teaching and supervision needs to occur as rapidly as feasible, and we believe the goal should be to transfer all teaching to local faculty within three cohorts and all dissertation supervision within 10 years.

Local faculty will take over the teaching of a course after it has been taught two or three times jointly with a foreign faculty member. For this to occur, an appropriate foreign faculty member must be at Addis Ababa University during face-to-face mode of the course for the first two or three offerings.

Local faculty will take over dissertation supervision after they have co-supervised two dissertations.

In order to support the depth of interaction and thinking that are often so necessary for the development of a dissertation, we recommend that the doctoral program operate a workshop each year in conjunction with a conference in Africa and host international conferences such as International Federation for Information Processing's Working Group 9.4 IFIP WG 9.4. This recommendation has several positive features. First, it is not too expensive to send students to a conference in Africa. Second, it will enable other universities to observe the AAU PhD model in operation and thus facilitate its spread and help to establish the reputation of AAU as a leader in African doctoral education. Third, foreign faculty will be given an opportunity to visit another African country, which they should be able to fund out of their travel budget, and this will be another incentive for keeping them engaged in the program.

## Infrastructure

A supporting infrastructure is needed for both teaching and dissertation supervising. For the course content management system, we selected an open source system, Moodle, which offers a robust content management that we can modify for the PhD program. Moodle is already being used at AAU.

## Teaching

Moodle has been selected as the course management software. A server has been established in the U.S. at Kennesaw State University, and a backup server in Ethiopia, at AAU, will be setup. Foreign faculty will post their teaching and advising material on the U.S. server. The local facilitator and students will have access to the U.S. server, access to Internet connectivity notwithstanding. As a backup, the contents of the U.S. server will be synchronized with the AAU server.

## Advising

Internet-based technologies will be used to facilitate communication between the student, local faculty advisor, and foreign advisors. However, bandwidth intensive, synchronized technologies (e.g., video conferencing) are often unreliable, especially in Ethiopia. We expect that e-mail will be widely used because of its low bandwidth needs, and the time zone difference between Ethiopia and some of the foreign supervisors, and thus it is the expected media preference for many remote supervisors. Also, foreign advisors will be able to use Skype to make low cost international calls to their students and the local advisor. Local regulations do not permit the use of Skype on a PC-to-PC basis.

## Textbooks

It is proposed that, where appropriate, each PhD class develop a book as part of the learning process. Each class will use the book developed by the prior class and improve it as part of their assigned work. It is proposed that all books created by the Addis Ababa University IS PhD project be placed in the Global Text Project library.

The Global Text Project is based on the following software:

- . OpenOffice for chapter and book preparation. Authors can write in another word processor, but ultimately all material must be converted to open document format.
- . Zotero for bibliographic data. This is an add-on for Firefox and plug-in for OpenOffice.
- . O3Spaces for document management and collaboration. There are plans to add semantic capabilities to O3Spaces as part of the Global Text Project.

Both OpenOffice and Zotero are open source and thus free. The Global Text Project can cover the cost of O3Spaces accounts for AAU IS PhD students and faculty.

All book preparation will follow the style guidelines of the Global Text Project, which are based on the *United Nations Editorial Manual* and international standards.

In addition to writing a chapter, PhD students will be expected to teach a class related to that chapter and develop appropriate exercises to test the other students' knowledge of the key concepts covered in the chapter. Ideally, a PhD student will teach the chapter in the presence of a local and foreign faculty member, who will be expected to provide feedback on the quality of instruction. Writing a chapter will be part of the student's term project assignment. All such chapters will be reviewed by a local and foreign faculty member prior to presentation.

The chapter writing model should increase the depth of learning, accelerate transferability of knowledge, and create a resource for future students at AAU and beyond. We have learned from other graduate level education experiences that writing a chapter is very effective for transferring knowledge.

### **Sustainability**

The five-year budget for the proposed PhD program is U.S. \$5-\$6 million dollars. Initial funding was acquired from the Ethiopian government, the World Bank, and the governments of The Netherlands, France, and Germany.

A research center that operates under the PhD in IT program is proposed. In addition to its academic value, the center is expected to contribute to program sustainability. The research center, for a fee, will undertake research and consultancy projects. The center will use practicum models led by a professor. Doctoral candidates will work with the lead professor to deliver the project. Fees collected from the projects, beyond compensation for participants, will help offset program costs.

The research center will create government and industry linkages that identify local needs. The local needs serve as input for selecting dissertation topic. Thus, the research center vets research topics for doctoral students.

### **PROGRAM DEVELOPMENT**

Planning for the PhD program started in 2006 under the leadership of Tesfaye Biru, former vice president for Business & Development at AAU. A consultative meeting among the two initiating institutions, AAU and the College of Telecommunication and Information Technology, was conducted to garner broader support for the initiative (International Workshop, 2007).

Subsequent to approval by the initiating institutions, a two-day international workshop was held to discuss the structure and operation of the program (International Workshop, 2007). The two initiating institutions and six international universities participated in this first international workshop. The participating international universities include: Aalesund University College, Norway; Freie Universitat of Berlin, Germany; Johannes Kepler University Linz, Austria; Kennesaw State University, the United States; University of Cape Town, South Africa; and Universitat Hamburg, Germany. The participants agreed to begin the program launch with two tracks: software engineering and information systems. Dr. Christiana Floyd from Universitat Hamburg and Dr. Solomon Negash from Kennesaw State University were tasked to coordinate international faculty participation for the software engineering and information systems tracks, respectively.

The IS curriculum was developed by fifteen international faculty from seven institutions including Claremont Graduate University, Georgia Institute of Technology, Georgia State University, Kennesaw State University, Royal Melbourne Institute of Technology, Southern University and A&M College, and the University of Georgia. The curriculum development was coordinated by Kennesaw State University. The international IS team worked with AAU faculty to create synergy with other tracks and finalize the curriculum. The IS curriculum was subsequently approved by the AAU senate. Approved IS courses are shown tables 2 and 3.

In developing the curriculum, the international IS faculty considered two important needs, beyond the need to provide education in IS research skills and scholarship. First, they identified the need for an “appropriate education.” The PhD research model for high-income countries, particularly as implemented in the U.S., emphasizes theory building. The IS faculty felt that a low-income country needs to emphasize building practice so that the lag time between the investment in an advanced IS



education and the return to the community is shortened. Thus, it recommended that dissertations should be field based with the intent of improving IS practices in Ethiopia. Thus, highly relevant research methods for the program are case studies and action research.

Course #	Course Title	Hours
CIT 820	Systems Thinking on Sustainability	3
CIT 821	Advanced Topics in Info. Systems	3
CIT 822	Research Methods in Info. Systems	3
CIT 823	Advanced Seminar in Info. Systems I	1
CIT 824	Advanced Seminar in Info. Systems II	1
CIT 825	IT Management, Leadership, and Implementation	3

**Table 2. List of Required Courses**

Course #	Course Title	Hours
CIT 826	Business Process Innovation	3
CIT 827	Information System Security: Processes, Technologies, and Management Issues	3
CIT 828	Business Intelligence, Data Warehousing, and Data Mining	3
CIT 829	Knowledge Management	3

**Table 3. List of Elective Courses**

Second, the international IS faculty urged AAU to pay attention to the most important problem facing the world: How do we build a sustainable environment? In particular, how do we build information systems that support sustainable organizational and societal practices? Thus, this PhD program might well be unique in the world, because it contains a course titled “Systems Thinking on Sustainability.” Consequently, the students and faculty in this PhD program have a unique opportunity to lead the world in one area of IS PhD education. It is fitting that a new PhD program should stimulate new thinking about a critical problem.

Applicants with a master’s degree must take 20 additional credit hours: 14 credit hours of required courses and 6 credit hours electives. The six required courses include four courses with three credit hours each and two courses with one credit hour each (see Tables 2). The advanced seminar courses are designed to support the student’s dissertation activities. Students are also required to take six credit hours of elective courses. The initial list of electives includes four courses (see Table 3) with three credit hours each.

Doctoral students are expected to complete the course work in one year.

The IS PhD program was advertised nationally. At the close of the application due date, April 2008, fourteen applications had been received. All applicants had a master's degree in related fields (business, information science, or computer science). As an incentive, AAU has proposed to maintain salary compensation and reduce the workload for its instructors that join the PhD program.

Twenty-seven professors have indicated their interest to teach and serve in a dissertation committee. Table 4 shows the affiliation of interested professors.

	<b>Institution</b>	<b>Country</b>	<b># of Professors</b>
1	Appalachian State University	Boone, North Carolina, United States	2
2	Claremont Graduate University	Claremont, California, United States	2
3	Georgia Institute of Technology	Atlanta, Georgia, United States	2
4	Georgia State University	Atlanta, Georgia, United States	2
5	German University in Cairo	Cairo, Egypt	1
6	Kennesaw State University	Kennesaw, Georgia, United States	4
7	Oakland University	Rochester, Michigan, United States	1
8	Royal Melbourne Institute of Technology	Melbourne, Australia	3
9	Southern University and A&M	Baton Rouge, Louisiana, United States	2
10	University of Cape Town	Cape Town, South Africa	1
11	University of Georgia	Athens, Georgia, United States	3
12	University of Oslo	Oslo, Norway	3
13	University of Pennsylvania	Philadelphia, Pennsylvania, United States	1

**Table 4. Affiliation of Participating Professors in the AAU IS PhD Program**

The software engineering track held an opening session in January 2008, and began classes at that time. The IS track completed an international workshop, March 27-29, 2008, to formally begin its program (IS International). Fifteen international faculty from eleven institutions, two dozen AAU faculty, and fourteen potential doctoral students participated in the IS International Workshop. Participating faculty presented their research agenda. The potential doctoral candidates also presented their research interests at the workshop. The IS program plans to begin classes in the 2008/2009 school year.

## **FUTURE DIRECTION**

The 2007/2008 AAU ten-year strategic plan calls for 5,000 (five thousand) PhD graduates from 85 disciplines. This provides institutional support for the proposed PhD in IT. Arrangements are underway for a local anchor, among the international faculty, to manage the IS PhD program. The authors plan to write a follow up on the implementation of this unique IS PhD program. Lessons learned from this case study will advance our knowledge on how to establish IS PhD programs in a developing economy that is both appropriate for the country and also contributes to the world's knowledge on sustainability. The

international collaboration and teaching and research modalities proposed in this program should be of interest to the academic community.

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