

Creating an Undergraduate Construction Management Program in the Developing World

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This paper explores the process of establishing a partnership between a well-established, accredited construction management program in the United States and a new college level training program in Rwanda. The ultimate goal is to establish a fully functioning, sustainable, undergraduate degree program in construction management, primarily staffed by nationals and sanctioned by the local government. Background information is presented on the state of construction and current technical training in Rwanda. Various transnational educational models were researched to assist in developing an effective system for program development that benefits both institutions. A number of challenges were discovered during this planning process that are documented in this paper. This effort is the beginning of establishing a new program in the developing world. Much further work is needed in order to fully develop the partnership and implement the program.

Key Words: international education, transnational education, Rwanda

Introduction

The construction program at John Brown University has a long history of involvement in international construction. Students and faculty have supported mission work by constructing projects in over ten different countries in the 72-year history of the program. Also, around 10% of the graduates spend part of their career overseas using their technical training to build projects fulfilling the mission of the university. In 2010, a broadly represented university task force was formed to develop a campus strategic plan to move the university forward over the next five years. One of the strengths highlighted in the analysis was John Brown University's international focus. Approximately 20% of the current student body comes from a cross-cultural background, and the university manages studies programs in five different countries. One of the strategies defined in the plan is to develop new partnerships with international organizations to benefit John Brown University and to serve the world. This strategy is also consistent with the Construction Management Department's stated value of international participation. The program's faculty recognize that a construction manager must be aware of global issues that affect building resources and construction methods and techniques that vary widely in different international contexts.

In the fall of 2010, the Executive Director of Musanze Opportunity Center in Rwanda contacted the John Brown University Construction Management Department as a possible partner to develop a university-level training program. The mission of the Musanze Opportunity Center is to help Rwandans build a stronger Rwanda. There is a great need in Rwanda for training at all levels of the construction process, from skilled workman to field supervisors to project managers (The New Times, December 2008). The Musanze Opportunity Center hopes to fill this need with a phased development of technical programs that provide entrepreneur training to ensure that each graduate can sustain a successful business for the long term. The primary need for the first phase of a construction management program is curriculum development and instructors. Considering the differences in techniques, materials, and standards, adapting the course material to the context of building in Rwanda will be a major effort. Follow-up phases will lead to the long-term objective of faculty and student exchanges between John Brown University and Musanze Opportunity Center, as well as a self-supported Rwanda campus (staffed and funded) within ten years.

Background

Rwanda is a land locked central African country with a population of approximately eleven million people. With a size of 26,338 square km, it is the most densely populated African country (CIA, 2011). In the recent past, the workforce consisted of a large agricultural sector (90%) and those in the service industries (10%) with 60% of the households ranked below the poverty level. This high percentage of workers in the agricultural sector is reflected in the low number of workers in the skilled construction trades. Fortunately, the gross domestic product (GDP) breakdown shows a shift in recent years to a more industrialized nation, with 44% in the service industry, 42% in agricultural, and 14% in the industrial sector. This transition has been occurring after the well-documented genocide of 1994.

Coupled with this transition has been the election of pro-growth government leadership in Rwanda. The election of President Paul Kagame in April 2000 has set the tone for a nation that wants to help itself break the bondages of poverty and limited education. He was re-elected in 2010 with a 93% vote of the people, indicating support for his approach to creating new educational and economic opportunities for the private sector. In 2011 alone, foreigners invested 128 billion Frw (franc, Rwandan currency) in commercial building construction projects (The New Times, December 2008). The Rwandan Ministry of Commerce has also led the way in attracting private investments for both private and public infrastructure projects.

With the growth in Rwanda's construction sector, the government has recognized the need to be proactive regarding code compliance relative to the quality of construction and professional competence for those practicing in design areas. They are receiving help from the British Standards Institute (BSI) to draft standards that are appropriate for construction in Rwanda (The New Times, December 2008). Any curriculum developed for the Musanze Opportunity Center will be reviewed to make sure it complies with the standards and practices that the government develops with BSI.

While construction management training in Rwanda is limited, there are three Rwandan universities that offer technical degrees related to construction. The National University of Rwanda (NUR) is the largest university in Rwanda and offers a degree in Civil Engineering. Kigali Institute of Science and Technology (KIST) was established in 1998 as the first Rwandan university dedicated to technical fields of study and offers a degree in Architecture as well as Quantity Surveying. Finally, Umutara Polytechnic (UP) offers a degree in Building and Construction Technology. This degree program is the closest match to the program being proposed for Musanze Opportunity Center and is analyzed later in this paper. The UP curriculum is found at the following link: <http://www.umutarapolytech.ac.rw/docs/coursestechnology.pdf>. Though these programs exist, they are limited in scope and in the volume of professionals that can be trained in the construction profession.

With the limited number of institutions of higher education in Rwanda in general, and the small number of programs targeting the construction industry in particular, the authors feel that there is great potential for establishing a new undergraduate degree program in Construction Management. Though the staffing, equipment, and facility challenges that current universities face in delivering technical training in Rwanda is large (Pottier, 2011), a partnership with Musanze Opportunity Center would provide a mechanism to create a viable and sustainable program.

International Educational Partnerships

There are a wide variety of ways that universities in the United States export their educational programs. The approaches or models are often driven by the overall strategic objectives of the education exporters. Green and Gerber (1996) provide a broad overview of models and arrangements between international education partners. One broad category is essentially a fully operational branch campus of the stateside university. This requires facilities, qualified faculty, full support staff, and communication systems to operate the programs on the same level of quality that is expected in the home country. Delivery methods may vary, but the degree granted is from the home university. This model requires extensive resources and can be fraught with pitfalls. Another approach is a partnership between existing institutions in which both benefit by "pooling and leveraging of faculties and facilities

to provide educational experiences in line with the schools' global visions." (Green and Gerber, 1996, p.91) This partnership is easier to develop as there is already an academic program established in the developing country, and the stateside university's role is more of monitoring quality control and ongoing support. A third general approach is some level of integration or cooperation of specific academic programs (e.g. integrated MBA program). A fourth approach consists mostly of faculty and student exchanges. All of these approaches typically involve primarily educational institutions and have somewhat common objectives like providing an international link for faculty and students and expanding enrollments for the sponsoring universities.

A somewhat different approach than those previously mentioned is to establish an educational program through partnership with an established non-governmental organization (NGO) and local government, with the eventual goal of independent local operation. NGOs have specific goals and objectives as they operate around the world and are able to gain support from foreign governments to accomplish these initiatives. The objectives of this approach differs from others in that expansion of the "domain" of the sponsors is not a key consideration, but rather acting as a catalyst to begin the development of an indigenous program that becomes self-supporting. The Musanze Opportunity Center would fit this category and they have received strong support from the Rwandan government to accomplish their mission.

The stated objectives of Musanze Opportunity Center are as follows (Rainey, 2011):

- (1) Developing the indigenous capacity of an impoverished community to provide health, education and opportunity for itself by investing expertise, resources and Biblical worldview in its existing and emerging entrepreneurs.
- (2) Mobilizing Christ followers with marketplace expertise to expand the Kingdom by inviting them to join us on a high-impact mission that stretches their faith, uses their strengths, and allows them to lead.
- (3) Empowering both those served and those serving to live out a biblical worldview in their home, business, and community.

It is clear from these objectives that the focus of the Musanze Opportunity Center is the building up of the indigenous Rwandan population, so they will have the ability to improve their nation for the long term. This is not only the charge to the graduates of the degree program but also the staff and faculty. This aligns well with the mission/vision/values of the John Brown University Construction Management program. In addition to the primary task is educating Rwandan students, the interaction of exchange students and faculty would greatly enhance the educational experience of John Brown University students.

Partnership Roles, Responsibilities, and Resources

Clearly defined roles and responsibilities are required for any successful endeavor that involves a large investment of time and resources. Heffernan and Poole (2005) found four variables that were key to successful international education partnerships: communication, trust, commitment, and to a lesser extent, culture. A core element of a partnership that will support these variables is an agreement regarding the roles and responsibilities of the partners. Each partner will need to be culturally sensitive to the context of the other partner when developing this agreement. Table 1 highlights the major areas of responsibility planned for the Construction Management program at Musanze Opportunity Center.

In addition to clear roles and responsibilities, several other elements of the partnership are being explored and developed. Lenn (2002) lists several questions that partners need to ask as they develop their partnership. Resource issues such as facilities, funding, and faculty are key to the success of the partnership. Educational and student issues such as current educational levels, curriculum, instructional delivery methods, and learning resources must all be coordinated between the partners, which in this case includes not only with the Musanze Opportunity Center, but also with the Rwandan government and possibly other Rwandan higher education providers.

Early communication with the director of the Musanze Opportunity Center indicates that the Center has been given property containing twenty buildings by the Rwandan government on a long-term lease agreement. This is a major step in preparing the Center for the first group of students. Equipping the classrooms and laboratories with appropriate instructional, laboratory, and information technology equipment will need to be assessed prior to the beginning of classes. Solid funding is in place for the first three years of operations, but details on how this funding

is allocated are still being worked out. A network of Rwandan contractors will be developed to support the program by providing internships for the students. Material suppliers will also be engaged to partner with student projects and facility needs of the campus.

Table 1

Roles and Responsibilities

	Musanze Opportunity Center	John Brown University
Governmental approval to operate (foreign and domestic)	Primary responsibility	Supporting information
Facility operation in Rwanda	Primary responsibility	
Overall operation of educational programs, student recruiting, job placement, internships	Primary responsibility	
Financial support of the operations	Primary responsibility	Support role with stateside contacts
Development and maintenance of the educational facilities	Primary responsibility	
Curriculum development	Advise on Rwandan context	Primary responsibility
Produce educational materials	Support role	Primary responsibility
Liaison with ACCE accreditation body	Support role	Primary responsibility
Supply instructors	Joint role	Joint role
Manage travel for instructors	Primary responsibility	
Conferring of degrees	Primary responsibility	

John Brown University has only three full-time faculty to support the staffing needs of Musanze Opportunity Center. Currently, the only release time in the near future to teach courses in Rwanda is the summer months. It will be necessary to rely on a network of alumni from the program and other professional and academic contacts to supply instructors for the program. Also, the plan is to recruit Rwandan staff and instructors to assist in the laboratory sections of the curriculum and ultimately have Rwandan faculty teach the majority of all the courses in the curriculum.

The preparedness of students entering the program is another challenge in evaluating the resources needed to start a program. Rwanda has a standardized test (Rwandan National Examination Certificate) for all students who would like to enter a university program of study. Also, the instruction delivery will be done in English, so an entrance exam will be needed in order to assess whether students need any remediation in that area. A minimum level of math and science background will be needed to be successful in the more technical courses in the program. Musanze Opportunity Center will need to provide for space, staff, and time to support this part of the program.

Adapting the Curriculum

Many construction principles can be applied anywhere in the world. The properties of certain materials are consistent and should be treated as such, regardless of where the project is being built. However, lack of a supply line of material from advanced manufacturing techniques and limited access to heavy equipment can have a major impact on the way projects are constructed in the developing world. It is very common in African construction to utilize abundant manual labor to dig foundation trenches, to hand mix concrete (even when power mixers are available), and to hand make concrete block and brick. The images in Figure 1 are from a recent trip by a faculty member constructing a 20,000 square foot hospital in Africa. They show a very different set of construction methods from what would be standard practice in the USA. Another example of curriculum adaptation is to moving the course content to the metric system, or Systems International (SI).



Figure 1: Developing World Construction Methods

Not only can methods and materials be different in an international context, the expectations for safety, quality, and contracting arrangement can vary with cultures. It is obvious to the partners in this effort that each of the courses will have to be reviewed for content to see what is appropriate to the Rwandan construction industry. The intent of this review is not to eliminate the modern construction procedures described in coursework but to evaluate the content to make sure it is relevant to standard practices in Rwanda. The hope is that graduates from the Musanze Opportunity Center will be immediately productive upon entering the current Rwandan construction industry as well as being the catalyst for updating many of the construction processes to more durable and profitable practices.

Table 2

Curriculum Plan of Study for Bachelor's Degree

Fall Semester	Spring Semester	Summer Sessions (1 month each)
Year One		
CM 0110 Constr. Work Experience (0) EGL 0130 Developm. English I (0) COR 1002 Gateway Seminar (2)	CM 0120 Constr. Work Experience (0) EGL 0140 Developm. English II (0) MTH 0140 Developm. Math I (0)	A. CM 1112 Constr. Tech. I (2) B. CM 1313 Materials of Constr (3) C. CM 2213 Constr Methods I (3)
Year Two		
CM 0210 Constr. Work Experience (0) EGL 1013 English I (3) MTH 0153 Intermediate Algebra (0)	CM 0220 Constr. Work Experience (0) EGL 1023 English II (3) MTH 1113 College Algebra (3)	A. CM 1122 Constr. Tech. II (2) B. CM 2223 Constr Methods II (3) C. CM 1223 Arch Drafting (3)
Year Three		
CM 0310 Constr. Work Experience (0) BBL 1013 Old Testament Survey (3) HST 1013 Western Civ. I (3)	CM 0320 Constr. Work Experience (0) BBL 1023 New Testament Survey (3) MTH 1122 Trigonometry (2)	A. CM 2513 Surveying (3) B. CM 2322 Statics/Strenghths (2) C. MGT 2173 Princ. Of Manag. (3)
Year Four		
CM 0410 Constr. Work Experience (0) PHY 1114 Introd. Physics (4) BUS 2153 Financial Math (3)	CM 0420 Constr. Work Experience (0) CHM 1014 Fund. Chemistry (4) HST 1023 Western Civ. II (3)	A. CM 3413 Estimating I (3) B. CM 3613 Arch Design I (3) C. CM 3603 Mech/Elect Sys. (3)
Year Five		
CM 0510 Constr. Work Experience (0) BUS 2193 Business Statistics (3) ART xxx3 Art Elective (3)	CM 0520 Constr. Work Experience (0) ATG 1163 Accounting (3) COM 2523 Public Speaking (3)	A. CM 3213 Safety/Quality (3) B. CM 3233 Structures (3) C. CM 3623 Arch Design II (3)
Year Six		
CM 0610 Constr. Work Experience (0) BBL 3003 Evangelical Theology (3) MTH xxx3 Advanced Math Elective (3)	CM 0620 Constr. Work Experience (0) ECN 2123 Macro Econ (3) BUS 3153 Business Ethics (3)	A. CM 4423 Estimating II (3) B. CM 4613 Plan/Scheduling (3) C. CM 4323 Constr. Contracts (3)
Year Seven		
CM 4713 Constr. Manag. Capstone (3) BUS 4143 Business Law (3) RPH xxx3 Philosophy Elective (3)	CM 4723 Constr. Manag. Capstone (3) BBL 4002 Bible Capstone (2) BUS 4173 Business Finance (3)	A. INT 3153 Intern'l Marketing (3) B. BUS 4993 Strategic Manag. (3)
39 hours	38 hours	57 hours
Degree Total: 134 hours		

Table 2 summarizes a draft plan of study for a bachelor's degree in the Musanze Opportunity Center program. This initial proposal shows a seven-year plan of study. Part of the rationale for this long schedule is the expected need for remedial work in English and math areas of study. The country of Rwanda has committed to moving toward an English speaking nation over the next ten years. Also, the method of financial support for the Musanze Opportunity Center is dependent on the for-profit sale of housing constructed by the students in the program. This construction work activity will be an integral part of the training of the students throughout the seven years of study, much like a professional apprenticeship program. Third, the scheduling of many of the construction management courses in the summer sessions will allow them to be filled by faculty from accredited construction management programs in the USA. The bulk of the fall and spring semester courses will be general education, business, math, and science. On-line delivery will be considered for several of these courses.

Part of this research effort is to find and assess existing construction management programs in Rwanda to determine their capability for producing construction professionals and for comparison with accreditation requirements. There are very few programs that are comparable to a typical construction management program in the USA. Several were found that have a civil engineering technology emphasis. The closest program evaluated is at Umatara Polytechnic. Table 3 shows a comparison of the American Council for Construction Education (ACCE) minimum standards with the John Brown University (JBU) degree and the Umatara Polytechnic (UP) degree in Building and Construction Technology.

Table 3

Comparison of ACCE minimum standards

ACCE categories (minimum hours)	JBU current program (hours)	UP BTC program
General Education (15 hrs)	English I & II, Western Civ I & II, American Government, Arts elective, Philosophy Elective (21 hrs)	English I & II
Mathematics and Science (15 hrs)	Survey of Calculus, Chemistry, Physics, Financial Math, Statistics (15 hrs)	Engineering Mathes I, II, III, & IV, Engr Science I & II, Computer Programing,
Business and Management (18 hrs)	Accounting, Economics, Spreadsheets, Ethics, Principles of Management, Organizational Behavior, Business Law (20 hrs)	Budgeting/Finance, Contract Law, Entrepreneurship, Civil Engr Law, Civil Engr Econ, Environmental Quality Management
Construction Science (20 hrs*)	Graphics, Materials, Methods I & II, Statics, Surveying, Concrete and Steel Structures, Mechanical/Electrical Systems for Buildings, Architectural Design I & II (29 hrs)	BC Tech I, II, III, & IV, Tech Drawing I & II, Architectural Design, Materials, Surveying, Soils, Structures I & II, Structural Detailing, Timber/Masonry Design, Building Services, Concrete Tech, Maintenance Tech, Civil Engr Manag, Traffic Manag, Public Health Manag,
Construction (20 hrs*) (*50 hrs CS+C minimum)	Construction Techniques, Internship, Safety and Quality, Estimating, Planning and Scheduling, Construction Management Capstone (27 hrs)	Workshop Tech I, II, III, & IV, Quantity Surveying I & II, Construction Management, Project implementation, Internship, Final Year Project
Other (to make 120 hrs total program minimum)	Gateway, wellness, Trig, Bible courses, speech (21 hrs)	Intro to Computers, Communications I & II, Engineers in Society, Proposal Writing
120 hours total program minimum	133 hours	(* credit hours not listed)

Though some commonalities are evident, without published credit hours for the Umatara Polytechnic courses, an accurate comparison of the three program requirements is not possible. Also, not all of the courses in the John Brown University program would be applicable to the program at Musanze Opportunity Center, especially in the general education category. However, it appears that an undergraduate program in construction management at Musanze Opportunity Center would provide a different skill set for the professional constructor in Rwanda than is currently available. It would offer a broader general education foundation along with additional business and management courses. Further it would focus more on building construction with less civil engineering emphasis. This would position the program well to serve graduates who want to create small construction companies to build the housing developments needed for the future growth of Rwanda as well as construction expertise to support the necessary expansion of infrastructure within the country.

Challenges

The initial effort in establishing this undergraduate program in the developing world has revealed several challenges. Getting initial support from university administration has been mixed. There is consensus to allow faculty to spend summers teaching courses in Rwanda and offering curriculum support, but the university will make no financial commitments until much further in the process, when risks can be more readily evaluated and success can be measured. Also, refining the scope of responsibilities, resolving compatibility of mission and vision, and agreeing to clear expectations is an ongoing effort that will be needed beyond this initial phase. Adapting the curriculum to the context of Rwanda will take a concerted effort by the faculty and administrators of the program. Not having visited Rwanda has limited the authors to fully understanding the context for the new program and curriculum. Also, there is currently no access to the history or academic record of the students who will be entering the program, except general information published about the state of education in Rwanda. Finally, it is critical that Musanze Opportunity Center acquire funding streams that secure the operation of the program for the long term. The logistics of putting these resources on another continent will require a well-organized support staff in the United States.

Conclusion

Undergraduate construction management programs in the United States should continually review their programs to make sure they are relevant to the industry receiving their graduates. This involves updating curriculum with new technologies used in the construction process and better management systems to handle the complex nature of today's project. Globalization is another factor that is affecting more and more areas of the construction industry. This expanding international participation is leading the Construction Management department at John Brown University to develop a partnership with Musanze Opportunity Center to create a construction management degree program in Rwanda. There are numerous benefits to both partners in this endeavor. Rwanda will increase their capability to educate their own core of construction managers to meet the pressing housing needs of a nation that experienced intense personal and material suffering. Both partners will be able to expand their personal influence of hope to each person engaged in this academic pursuit. John Brown University faculty and students will be challenged to learn construction methods applied in a developing world context and stretched culturally to better prepare them for management positions with domestic contractors or with international companies. The effort and challenges inherent in creating a transnational academic program are large, but the unique nature of this opportunity has led the partners to continue the process with confidence of long-term success.

References

- 4ICU, 4 International Colleges and Universities, *Universities in Rwanda, by 2011 University Web Ranking* [WWW document]. URL <http://www.4icu.org/rw/>
- American Council for Construction Education Document 103: *Standards and criteria for accreditation of post-secondary construction education degree programs*, p. 9 – 17.

Briggs, P. & Booth, J. (2006). *Rwanda – The Bradt Travel Guide* (3rd ed.). London: Bradt Travel

CIA (2011), *The World Fact Book* [WWW document]. URL <https://www.cia.gov/library/publications/the-world-factbook/geos/rw.html>

Flanigan, S. T. (2007). Paying for God's Work: A Rights-Based Examination of Faith-Based NGOs in Romania. *Voluntas*, 18, 156–175.

Green, R.T. and Gerber, L. (1996). Educator Insights: Strategic Partnerships for Global Education – Linkages with Overseas Institutions. *Journal of International Marketing*, 4 (3), 89-100.

Hefferenan, T.& Poole, D. (2005). In search of “the vibe”: Creating effective international education partnerships, *Higher Education*, 50, 223–245.

International Development Association (IDA). "Rwanda: Bringing Clean Water to Rural Communities". [WWW document]. URL <http://web.worldbank.org/WBSITE/EXTERNAL/EXTABOUTUS/IDA/0,,contentMDK:21256336~menuPK:3266877~pagePK:51236175~piPK:437394~theSitePK:73154,00.html>

Karger, H., Iyiani, C., & Shannon P. (2007). The Challenge of Community Work in a Global Economy. *Journal of Sociology and Social Welfare*, 34(2), 69-85.

Lenn, M. P. (2002) The Right Way to Export Higher Education, *The Chronicle of Higher Education*, 48(25), B.24.

Ministry of Finance and Economic Planning (MINECOFIN), Republic of Rwanda (June 2002). "Poverty Reduction Strategy Paper". [WWW document]. URL <http://www.imf.org/external/np/prsp/2002/rwa/01/>

Ministry of Infrastructure (MININFRA), Republic of Rwanda (July 2009). "Electricity".

NUR, National University of Rwanda, *Historical Background* [WWW document]. URL <http://www.nur.ac.rw/spip.php?article1>

Pottier, N. (2011), *Learning to Swim by Reading a Book – The State of CS Education in Rwanda* [WWW document]. URL <http://blog.nyaruka.com/learning-to-swim-by-reading-a-book>

Rainey, R. (2010), *About our Mission and our Team* [WWW document]. URL <http://musanzeinc.com/about/>

Skilbeck, M. and Connell, H. (2009). Commonwealth Education in its Changing International Setting. *The Round Table*, 98(405), 687–709.

The New Times (February 2008). Industrial, construction boom boosts economy. URL [http://www.newtimes.co.rw/index.php?issue=13746&article=11732&term=CONSTRUCTION BOOM](http://www.newtimes.co.rw/index.php?issue=13746&article=11732&term=CONSTRUCTION%20BOOM)

The New Times (December 2008). Construction Boom: Rwanda Importing Construction Workers. URL [http://www.newtimes.co.rw/index.php?issue=13449&article=4395&term=CONSTRUCTION BOOM](http://www.newtimes.co.rw/index.php?issue=13449&article=4395&term=CONSTRUCTION%20BOOM)

World Resources Report (2011). "Maintenance of Hydropower Potential in Rwanda Through Ecosystem Restoration".