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## **AC 2012-5583: GLOBALIZATION AND THE NEW CHALLENGES FOR CONSTRUCTION ENGINEERING EDUCATION**

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# **Globalization and the New Challenges for Construction Engineering Education**

## **Abstract**

The world has been transformed in past decades by a phenomenon affecting us all, what we call globalization. Globalization brought a critical inquiry into the shifting ground of ethical thought in the changing climate of the global economy. The need to educate engineering students on how to work in a globalized economy is well recognized within the engineering education community worldwide. The United States, however, is tardy in the acceptance of globalization. The U.S. construction industry has been slow to recognize the effects of globalization and many construction programs at universities across the United States are hindered as a result. If education is behind the current industry, in incorporating courses that adequately prepare students to compete and work in the global work place, their value as engineers is diminished.

The construction industry is unique in that design, construction and maintenance of the physical and naturally built environment on a global level requires not only technical information but also requires knowledge of local, regional, international codes and business culture. It is imperative that global aspects of construction, including ethical and cultural characteristics, are incorporated in the education and training process of construction engineers so that they are better prepared for their practice and are globally competent. This paper will discuss existing current Global Construction Programs and courses and also will provide a hypothetical and specific framework of incorporating global course content of construction in construction engineering education that will empower students in a global market. As a result, future engineers will have utilized proper educational resources in order to better serve the field of construction on a global level. This allows students to become a more valuable commodity to seeking employers.

**Key words: Construction engineering, Globalization, Undergraduate education Ethics, Culture**

## **Introduction:**

Globalization is a popular buzzword amongst contemporary political and academic debates. It is a broad term that embodies factors such as expansionism, organization, and overall global consciousness [2]. According to Write [28] globalization is a phenomenon that requires a proper education in order for humanity to better grasp its ideologies. As it involves social evolution on a global level, collective cooperation is a necessity, and therefore the weight of education becomes most apparent. Engineering Accreditation Commission (ABET) [1] emphasis the globalization in general criteria subpart h the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context[4]. Global consolidation is in fact a necessity towards future prosperities. However, for the design and construction industry, globalization is a trend that specifically means two things: increased opportunity and competition [32] .

While many might assume that only the largest corporations feel the effects of globalization, this is not the case. Although companies like Bechtel's, Kellogg Brown & Roots, or Foster Wheeler Ltd. may be international players in direct competition with foreign markets, domestic

companies shoulder an equal share of foreign competition [24]. LLC, a subsidiary of a Turner/DallasTexas based construction company was recently selected to manage a \$160 million USD renovation and upgrade project of 6 luxury hotels in the nation of Turkey through competitive bidding [33]. Many foreign companies underbid for domestic construction work and purchase others through coalitions, as such in the case of CINTRA, one of the largest private developers of transportation infrastructures in the world. Based in Madrid, Spain, the coalition formed with ZACHARY, a San Antonio-based Construction Company, work through competition and subcontracting work to that of companies like Technoserve Construction Co. Inc.[5,31,34]

Globalization allows companies a wider range of access in construction markets, which in turn allows for more direct competition. The largest contractors in the United States, for example, must compete alike against multi-billion dollar worldwide corporations based all over the world. This competition directly affects mid-sized and smaller, local firms who refuse to adjust towards the evolving market[22,27,30]. Establishing loyal customers becomes crucial when dealing with companies who can afford to undercut or produce more successful results.

### **Factors Affecting International Construction**

As argued in Gunhan and Arditi [11], globalization provides more possibilities and new opportunities to construction companies around the world. This is especially true in developing countries. A need for new infrastructure and buildings are welcomed by experienced and specialized contractors from industrial countries [11,12]. Companies in the US and European Union also can benefit by conducting business within them. It is fundamental to understand the social, ethical aspects of the intercultural relations and the understanding of opportunities, risks involved with international markets.

Over the last three decades globalization and an opening of new markets affected the construction market leaving companies looking for new international markets. Also, technological advances enabling economical activities in new areas, free trade, International Telecommunications Agreement (ITA), World Trade Organizations (WTO)-facilitated merging all markets into a global market and such as Uruguay Round in the General Agreement Tariffs and Trade (GATT) have fundamentally changed the structures of the construction industry [14].

International construction can be more risky than domestic construction due to difficulties such as client communication, understanding a new market and avoiding local politics, as well as supervising the diverse group of professionals who are confronted by the international construction business [15]. Moreover, the inability to understand the clients' requirement affects the project's overall success in international business [18]. The increasing misunderstanding or delay costs resulting from unfamiliar environment and different institutions such as regulations, norms, and cognitive-cultural beliefs of diverse participants are critical risk factors associated with overseas construction projects since disputes resulting from different cultures can diminish a project's profitability [14]. An International Expansion Decision Model can be used to help companies to assess if they are ready for international expansion [12]

## Impact of Globalization on the Construction Education

Construction is an essential sector to most economies. According to Crosthwaite and Connaughton [8] world Construction spending reached \$4.7 trillion (USD) in 2007. In 2007 the U.S construction market suffered whereas the rest of the world saw a growth of almost 4% [7,8]. Within the US nearly 7.3 million people are reliant on the industry; that's nearly 5% of the population and the same for most of the world's largest developed countries. The center for Construction Research and training reported around 15,042,000 employed by the Construction sector in 2005. See Table 1.

Table1. Number employed in 2005 in U.S construction Industry subsectors and Construction sector defined by the North American Industry Classification System (NAICS)

<b>NAICS CODE</b>	<b>Industry subsectors &amp; construction sector</b>	<b>Number employed in 2005</b>
236	Construction Buildings	1 782 200
237	Heavy & Civil Eng. Construction	974 800
238	Specialty Trade Construction	4 714 000
23	Construction sector	7 571 000

Source: The Center for Construction Research and Training (CPWR) (2007)

According to the research company HIS's Global Construction Outlook report, given in Figure 1, 4.9% of global expenditure was from the construction sector in year 2011. In the year 2011 construction spending in the US and Some European countries was lower than earlier expectations as a result of economic hardship. In 2012, Spain, Portugal, Greece, Ireland and Italy are expected to see reduced construction spending. IHS predicts that Panama would be the 2013 construction spending growth leader, with growth of nearly +13% over 2011 levels of forecast as expansion of the Panama Canal continues. Japan and New Zealand are also believed to see strong spending growth as reconstruction efforts in the wake of the earthquake damage in these countries drives spending. IHS also predicts that China will remain one of the fastest growth markets in 2012 and assess the Middle East as strong region for growth. [35]

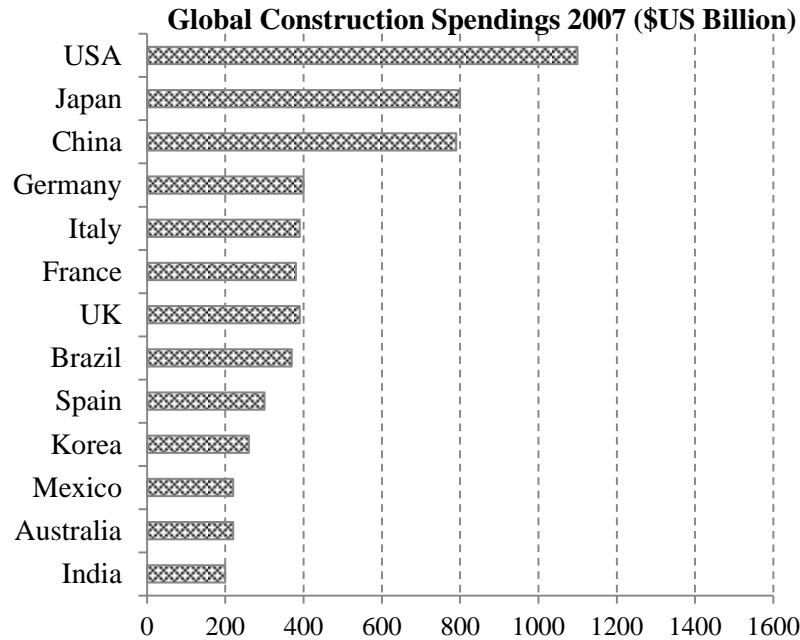


Figure 2. Global Construction Expenditures per Countries (Adapted from World Construction 2007-2009)[8]

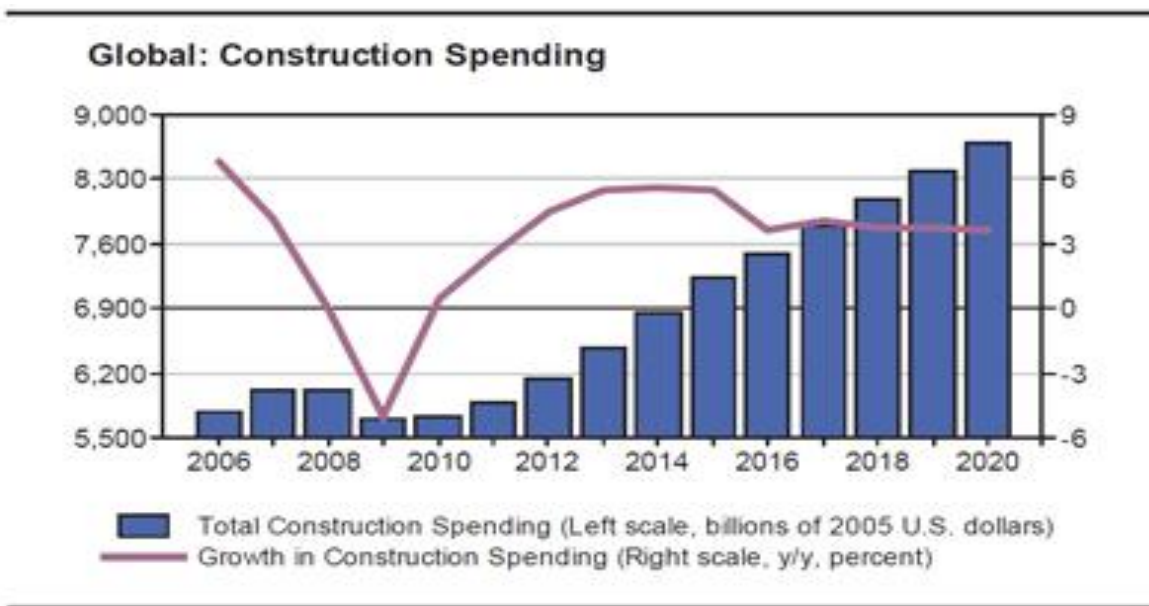


Figure1. Global Construction Spending. Source IHS Global Insight

The construction engineering industry will surely benefit from a curriculum that properly trains professionals to overcome and manage the new challenges of the century, especially those posited by globalization. This curriculum must incorporate those global aspects of construction, including ethical and cultural characteristics. Previous data and information provided reveals that most of the Construction jobs will be available outside of the US. Most new graduates will be

competing in foreign markets; therefore, it is imperative they be equipped with social skills including foreign language, ethical and cultural characteristics of global aspects of the construction engineering discipline. It is also crucial that a student is allowed to refine hard skills so that they are better prepared for their practice and global competence, thus making them an overall attractive and qualified candidate for employment.

Around the world, many universities approach global education for students from different viewpoints. Hayward and Morace [13] built a interdisciplinary teaching and research principle at the Ecole Supérieure de Commerce, Bretagne Brest, and the Telecom Bretagne in Brittany, France proposing a combination of “integrity” and a “third place” for language and intercultural learning [7,17] using a diversity approach[28]. In this study they set up an intercultural, international team of lecturers-researchers from differing disciplines, such as linguistics and management, using different languages and in different countries with an overall objective of developing the intercultural competencies of multicultural classes for each aforementioned university. They concluded that intercultural groups of students and lecturers combined with the management and communication in different languages, management and engineering schools, used a more active approach for projects based in learning. Professors with research experience in an international context could enrich their teaching practice with the insight gained from their contact with other cultures[13]. This study showed that intercultural and international training of professors could help them to adapt to the needs, learning and working methodology of foreign students and build foundations for domestic students’ interaction with other cultures resulting in a stronger formation of intercultural synergistic teams [6, 25, 26].

Global development was introduced in the service learning form in Smith College's new Picker Engineering Program discussed by Riley and Bloomgarden [24]. Kirby and Salama [16] reported that Civil Engineering at the University of Alabama at Birmingham has a collaborative program with Misr University in Cairo, Egypt to provide unique educational experiences in multicultural setting to both American and Middle Eastern students, with a strong emphasis on overseas construction management certification programs. The program is an online, blended instructional format that facilitates interactions among faculty and students. UAB faculties are available on the MUST campus for one month during each summer to provide course instruction and to support ongoing student research projects [16]

The study of Sunthonkanokpong,[29] at the King Mongkut’s Institute of Technology Bangkok, Thailand showed that there is a great need in establishing engineering education with a global vision. Engineering students should be educated from a global perspective of their field so that they successfully master essential attributes and the problem solving skills at strong levels to meet the demands of an evolving worldly market. Situations including, but not limited to, energy problems, population growth, pollution, climate change problems, water scarcity and maintaining technical currency. These study results comply with the Benson et al. [3,20]

Several Other US universities established collaboration with international counterparts in the form of faculty exchange student exchange or established short term faculty –led study abroad

programs. Most schools offer scholarships for their students and provide services to aid internship opportunities. Such support garners interest in the field of engineering, as well as provides a means to an end for those students who aspire to experience cultural variety in their career(s).

### **New Challenges for Construction Education**

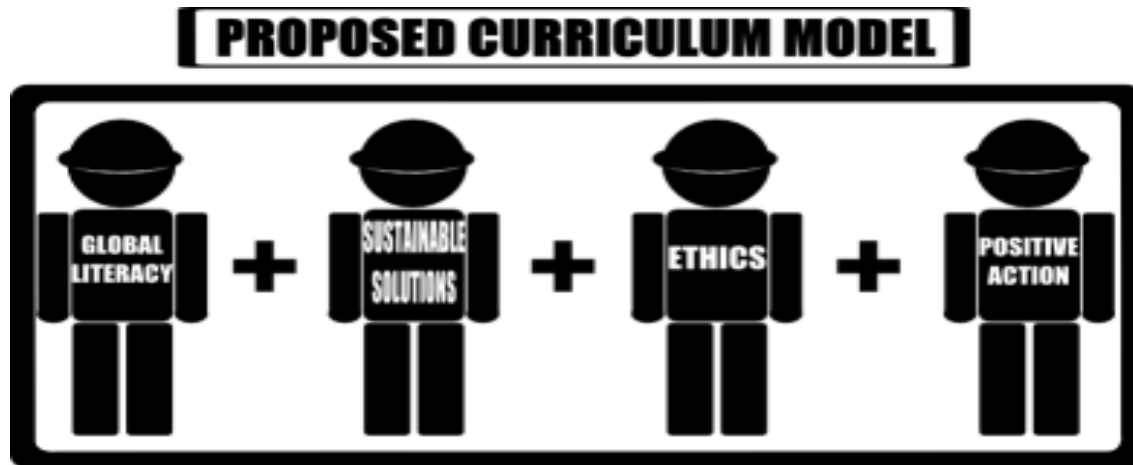
The education of construction engineering is traditionally designed to train students for technical information in construction and building, structural management. Admittedly, there is no hesitation about the importance of teaching core engineering and analytical skills to our students. On the contrary, it is pertinent to educate them as creative thinkers and creative problem solvers [34]. Therefore we can say that because of the challenges of globalization and also other complex intractable problems, such as environmental degradation, climate change, sustainability and economical crisis, the need for construction engineering graduates to become more adept in the following areas is critical:

- Technically adept, creative thinker, analytical problem solver, broadly knowledgeable
- Lifelong learner, culturally and ethically aware
- Communicate multiculturally and demonstrate such skills
- Able to deal with multidisciplinary problems
- Able to manage uncertainties
- Exhibit leadership skills among multidisciplinary and intercultural teams
- Exhibit entrepreneurial spirit
- Know foreign language
- Know how to translate research to market
- Exercise ethics that express professionalism, flexibility, and mobility
- Literate in Global competence and cross-cultural sensitivity.

In 2004, the National Academy of Engineering published a report entitled the engineer of 2020: *Visions of Engineering in the New Century*, stating in the executive summary that “Engineers must adopt to new trends, and educate the next generation of students to arm them with the tools needed for the world as it will be, not as it today”[21].

### **Conceptual Framework:**

In order to promote global sustainable ethical construction education, universities must invest in long-term programs. The curriculum must be restructured to teach global literacy, cultural diversity and sustainability, and environmental and cultural ethics, as well as encourage at least a full semester in international experience for a substantial number of students [9]. See Figure 2 for a suggested model by the authors.



**Figure 3. Efficient global curriculum model (Source Darwish et. al [10])**

### **Discussions and Conclusion:**

Globalization has spread in developing and developed countries alike mandating the necessity for countries to rethink their economic policies, industries, and their business strategies. The construction industry, which is one of the largest contributors to the world economy, has been greatly impacted by globalization. Tomorrow’s construction engineering graduates will do business in a global economy amidst the backdrop of a global setting. There is even the future likelihood of working in a global cyber-economy. It is our job to determine how to educate them to cope with these challenges in the globalization era. As educators, we must determine the curriculum changes that will best suit future generations of construction engineering needs so future professionals can utilize proper educational resources better suited to global construction engineering—a most important and valuable commodity to employers. Suggested curricula must include the 11 points previously mentioned and, most importantly, must prepare students for global leadership roles that require international construction opportunities.

The authors suggest a global construction engineering model which includes global literacy, sustainable development, cross cultural communications; ethics and positive actions in engineering curriculum so that engineering educators and education can better adopt contemporary global teaching methodologies. Such efforts will lead to better environments in which to improve teaching and learning their craft. If educators wish for their graduates to be successful in the global construction marketplace, they will need to attain those skills and knowledge that will not only provide a deeper understanding and appreciation for different cultures but also how to effectively and efficiently work with individuals in different countries.

The achievements of the needed skills and knowledge must be fostered in construction engineering curricula. Educators must instill in their students a true sense of global perspective, which requires better self-assessment of their applicable trade beyond the realm of the classroom or their environmental conditioning. In order to be worthwhile, educational, as well as engineering practices applied worldwide every day must expand their scope to include universal concerns.



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