Why So Many Nations Are Focused on Educating Engineering Innovators Today

by

Richard K. Miller[1] and Jamil Salmi[2]

Executive Summary. In recent years, the number of unsolicited institutional visits to Olin College has grown substantially. As a result, the College has established a "Collaboratory" to work with many like-minded institutions interested in substantive change through consultation and co-design. This growing interest seems to be fueled by global trends in economic development and innovation, with no end in sight. As a result, Olin appears well positioned to take a leadership role in catalyzing change in undergraduate and STEM education on a large scale.

Unsolicited Interest in Olin College. In the fall of 2009, Olin College established the "Initiative for Innovation in Engineering Education (I2E2)," an internal program designed to organize and manage the increasing number of unsolicited visits to Olin College and our emerging collaborations with some of these institutions. Since then, the number of visits and collaborations has continued to grow steadily. Olin College has now hosted unsolicited visits from more than 250 different institutions[3]. Nearly all of these institutions were represented by small teams of faculty and administrators, and a significant percentage of them sought opportunities to return to Olin for additional visits, while some asked Olin to send a team of faculty to visit them and provide at least one on-site workshop. At least ten of these institutions have initiated significant educational reform projects on their campuses as a direct result of the influence of Olin College. The University of Illinois at Urbana-Champaign has made substantial changes to the entire undergraduate program in engineering, affecting more than 1,500 incoming students each year, as a result of their visits. The University of Texas at El Paso has partnered with Olin to establish a new undergraduate engineering program, and the Insper Institute for Research and Teaching in Sao Paulo, Brazil, has partnered with Olin to establish an entirely new college of engineering. Both the UTEP and Insper projects are in the early stages of development. Singapore Polytechnic has created a number of new programs and is in the early stages of widespread institutional transformation inspired in significant part by Olin.

Last spring, Tony Wagner of Harvard published his latest book, entitled Creating Innovators: The Making of Young People Who Will Change the World. This book has been quite popular, and includes a substantial section on Olin College as a model program. As a result, the number of K-12 institutions that have shown an interest in Olin has grown significantly.

As Olin has learned to manage this interest and partner with a wide variety of institutions, the College has embraced the opportunity to play an influential role in improving education on other campuses. Recently, the I2E2 program was rebranded as the Olin College "Collaboratory" to emphasize our dedication to working with other institutions for the purpose of catalyzing innovation in engineering education on a large scale.

About 82% of the institutions that have visited Olin are from higher education, leaving 18% representing other types of institutions, as shown in Figure 1. They are either K-12 institutions, ministries of education or other government officials, foundations, corporations, donor agencies, or representatives of accreditation organizations from abroad.

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[3] An alphabetized list of institutional visits to Olin College is included in an appendix.

In addition, 68% of the institutions are from outside the U.S., as shown in Figure 2. It is interesting that the international institutions are broadly distributed across the globe, with the regional representation shown in Figure 3 below. It is noteworthy that developing countries are well represented among the visiting institutions.

Figure 1

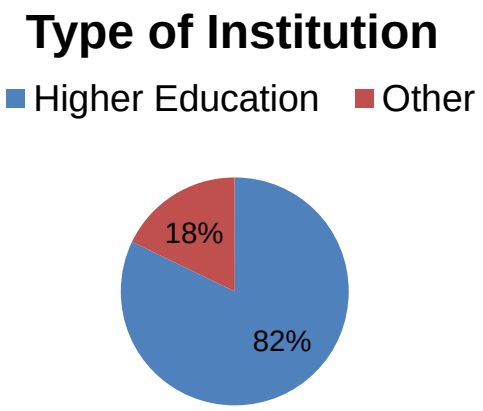


Figure 2

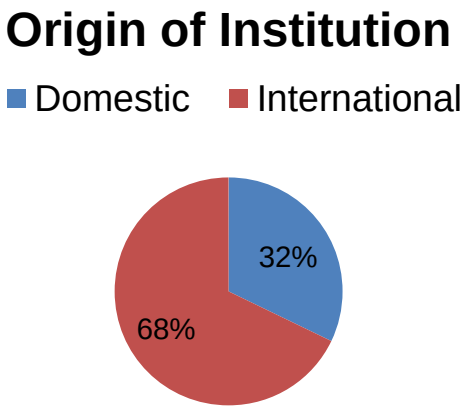
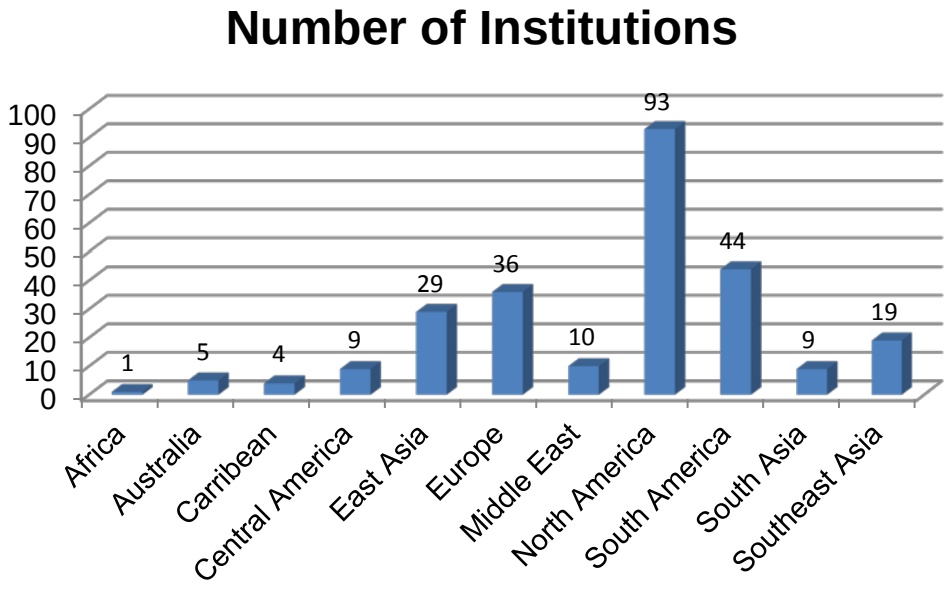


Figure 3



It is remarkable that Olin College has received such international attention beginning only a few years after the graduation of the inaugural class in 2006. In addition, nearly all of the visiting institutions are seriously interested in educational innovation, and a substantial number of them are prepared to make significant investments to initiate change. This raises questions about the underlying causes for this interest in Olin as well as the opportunities and challenges this brings.

Global Trends in Economic Development. In recent years, the economies of certain countries have grown much faster than the global average. Among many others, Brazil, Russia, India, and China—the

so-called BRIC countries—have each emerged with new momentum in economic development that marks a significant change from the recent past. In each country, these macroeconomic developments have been accompanied by significant social and political changes, revealing several patterns across nations.

Fundamental among these changes is the emergence of a new middle class. This change, in particular, has many social and economic consequences. For example, the new middle class is enabled by the improving economic environment to consider and plan for the future of their children in ways that were not possible before. As a result, near the top of the economic priority list of the new middle class is a good education for their children. In these countries, where the early signs of economic opportunity and business success are becoming visible to the masses, widespread stories are emerging of life-changing success achieved by a few who were extraordinarily hard working and also fortunate enough to obtain a good education.

Of course, many other changes also accompany the improvement in economic opportunity, such as the increasing opportunity to own consumer goods (such as a cell phone), to travel, and (to some extent) to shape one's own destiny by personal effort together with a measure of good fortune. In some regions, a spirit of entrepreneurism is palpable with a growing expectation that a better life is possible for the next generation. However, along with the welcome economic development, come some not so welcome new challenges, such as large-scale environmental problems, inequality, corruption and lack of appreciation for intellectual property laws, among many others[4].

The Role of Higher Education. As just explained, new middle class families have a special interest in providing a good education for their children. As a result, a recent increase in demand for access to quality education is common in these countries. Many governments are scrambling to expand the capacity of their educational systems to accommodate the increasing public demand for education. For example, in recent years, several thousand new universities have been established in India[5]. The demand for engineering education in India in recent years is truly extraordinary. As of May 2012, India had a total of 3,393 colleges of engineering[6], largely as a result of recent expansion. (By comparison, the U.S. has a total of 525 institutions that offer 4-year accredited programs in either engineering or engineering technology.) As a result, "*The proliferation of engineering colleges in the country* [India] *without the requisite facilities and competent faculty is a matter of concern, as hardly 12 per cent of engineering graduates are found readily employable*[7]". Furthermore, "*the 'fast proliferation' of engineering colleges is causing the quality of education in the field to go down, as these institutions are started as 'business ventures with political patronage'*" [8].

China has sustained an aggressive university building program in which a new major university is started every few months for the last several years. Singapore recently added a fourth national university (SUTD) since many of their high school students were forced to go abroad to attend college due to lack of space at existing universities.

Consequently, the governments in many developing countries are responding to the demand by planning and building new schools, revitalizing old ones, and encouraging private providers to increase their presence. This presents a number of strategic challenges and opportunities. For example, how many schools are needed, at what level, and with what curriculum? How will the graduates of these new

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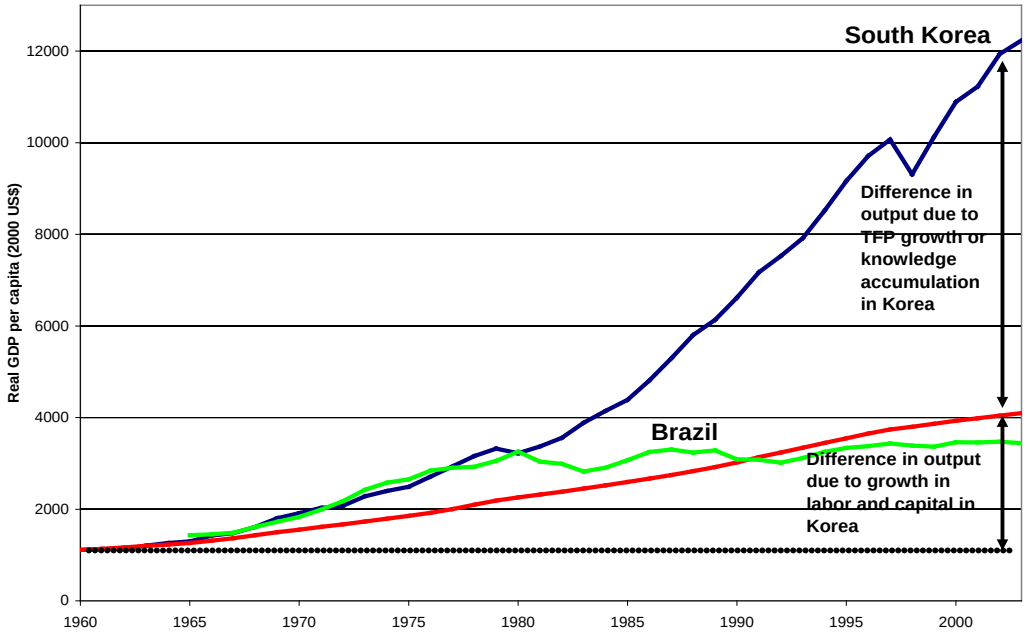
4 Kynge, James, (2007), China Shakes the World: A Titan's Rise and Troubled Future—and the Challenge for America, Mariner Books.
5 Anandakrishnan, M., "Time to end proliferation of engineering colleges," The New Indian Express, 5 May 2013.
6 Rao, Geetha, "Engineering tops as most favoured discipline," 28 May 2012, The Times of India.
7 The Hindu Business Line, "Proliferation of engineering colleges is a matter of concern," 6 August 2012.
8 Press Trust of India, CNN IBNLive India, "Sreedharan laments poor quality of engineering education," 7 August 2012.

schools contribute to the continued advancement and development of the nation? How will these decisions on educational planning influence the standard of living for the next generation?

History shows that education in general, and higher education, in particular, are correlated with many positive effects on the national level. For example, Figure 4, which compares the economic evolution of Brazil and the Republic of Korea between 1958 and 2000, illustrates the significant difference a knowledge-based development strategy made for two countries with a similar per capita GDP in 1958. The graph, based on the standard Solow method of accounting for economic growth, represents a stylized attempt to estimate the relative contribution of two types of factors: tangible factors such as the accumulation of physical capital and additional years of schooling in the labor force, and other factors linked to the use of knowledge such as educational quality, the strength of institutions, the ease of communicating and disseminating technical information, and management and organizational skills[9]. Empirical measures are applied to assess the extent to which growth is attributable to increased inputs (more labor and capital) or to the use of inputs in a more productive way (total factor productivity). In this model, the difference in economic growth between Brazil and Korea is a telling example of a situation where it is total factor productivity (TFP), which explains the bulk in the differences in economic growth.

Figure 4 - Knowledge as a Key Factor in Income Differences between Brazil and the Republic of Korea (1956–2000)[10]



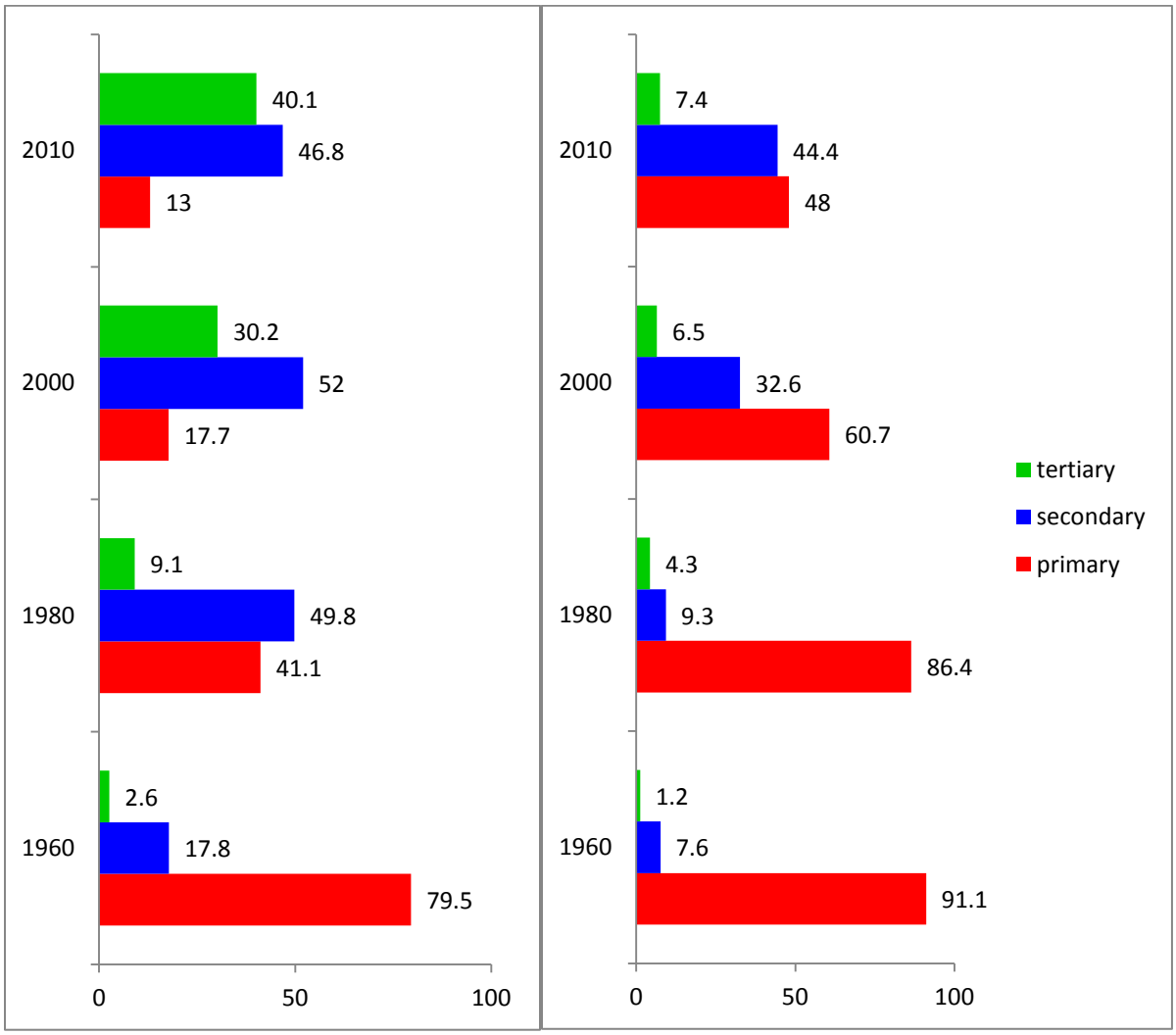
To complement this picture, it is useful to compare the evolution of educational attainment in both countries. Figure 5 shows the contrast between Korea, where the proportion of adults with a tertiary education qualification grew dramatically, and Brazil where investment in secondary and tertiary education was much less significant. While it is impossible to demonstrate a strictly causal relationship between educational attainment and economic growth in both cases, the 2008 study of Brazil prepared by Rodriguez *et al* clearly indicates that innovation and productivity growth have been heavily constrained by

[9] Solow, R. M. (2001). "What have we learned from a decade of empirical research on growth? Applying growth theory across countries." World Bank Economic Review 15 (2): pp. 283–88.

[10] Rodriguez, A., with C. Dahlman and J. Salmi (2008). Knowledge and Innovation for Competitiveness in Brazil. Washington DC: the World Bank.

the low proportion of adults with tertiary-level qualifications and the lack of linkages between universities and the productive sectors.

Figure 5 – Evolution of the Educational Attainment of the Labour Force in South Korea and Brazil (1960 – 2010)[11]



South Korea **Brazil**

Generally speaking, the success of East Asian economies illustrates the symbiotic relationship among tertiary education, innovation, and growth through the production of research and skills. Recent studies have shown the positive links between economic growth and tertiary education as measured by the tertiary gross enrollment ratio, science test scores, levels of R&D investment, and the number of scientists and engineers relative to a country's population. Firm innovation surveys undertaken in Indonesia, the Philippines and Thailand, for example, showed that the active innovators are those with higher levels of R&D expenditures, more highly qualified staff, and located in more R&D-intensive industries[12].

[11] Lee and Barrow (2012), *Educational Attainment Dataset*. (Available online at www.barrolee.com.)
[12] World Bank (2011).

Recently, the Prime Minister of the Canadian Province of Ontario traveled to Minnesota and gave a speech in which he observed that "in today's world all countries are alike, you can borrow your capital, you can copy technology, you can buy raw materials. There is only one thing left to make a difference and that is talent". And that is why the Province of Ontario advertises itself by saying "We have three major advantages to attract foreign investments. Our tax rate is very low, we co-finance research expenditures and 63% of our adult population has a tertiary education".

Another story to illustrate the importance of knowledge comes from the Scandinavian countries. In northern Finland, 300 miles north of Helsinki, there was a small city named Oulu in the middle of the forest. The main company there used to cut trees; making paper and cardboard. But, back in the 1970s, the CEO of that company started to get worried about the future of his industry and so he challenged the government – 'If you establish a polytechnic university in Oulu, I commit to investing in modern labs and to bring more private sector investors.' Academics in Helsinki were not so keen to move to this small city in the middle of nowhere, but the government took up the challenge and established a university in Oulu and today the City of Oulu and the University of Oulu share a single website – because their development has been so closely interlinked. Which company had a CEO with such a far-fetching vision? It was Nokia which moved from being a company producing paper, cardboard and cables to becoming a world leader in electronics, contributing 20% of Finland's balance of payments and two-thirds of the country's R&D funding.

When examined more closely, the trend toward increasing levels of formal education is also accompanied by an increase in the demand for highly skilled workers and a decrease in the demand for manual labor. This shift toward a "knowledge-based economy" is often referenced in the literature on trends in global economic development. Statistics from the OECD show that, in all member countries and for both male and female, the gap in earnings between the tertiary and the lower levels of education has grown even though the supply of graduates has increased, reflecting the higher demand for college and university graduates. Similar statistics are available for a number of developing countries such as India, the Philippines, Brazil, Mexico and Argentina.

Research support for this observation is provided by the recent work of Levy and Murnane on the skills requirements for the tasks performed in US firms showing the types of skills for which there is less demand (or which have been taken over by computers and intelligent machines) and those for which there has been increased demand[13]. In their path-breaking study, the authors divided the tasks performed in firms into five broad categories:

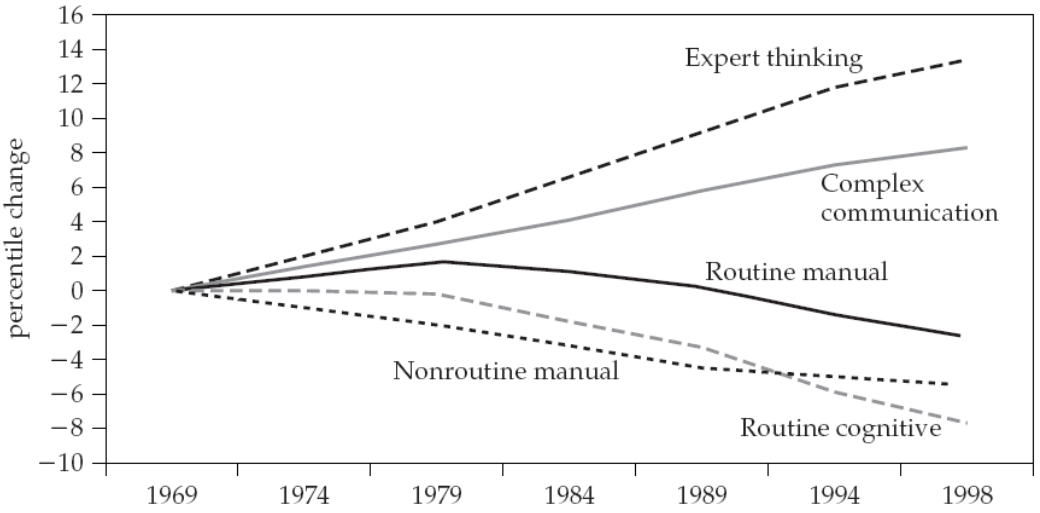
- Expert thinking: solving problems for which there are no rule-based solutions, such as diagnosing the illness of a patient whose symptoms are out of the ordinary;
- Complex communication: interacting with others to acquire information, to explain it, or to persuade others of its implications for action; for example, a manager motivating the people whose work he/ she supervises;
- Routine cognitive tasks: mental tasks that are well described by logical rules, such as maintaining expense reports;
- Routine manual tasks: physical tasks that can be well described using rules, such as installing windshields on new vehicles in automobile assembly plants; and
- Non-routine manual tasks: physical tasks that cannot be well described as following a set of "if-then-do" rules and that are difficult to computerize because they require optical recognition and fine muscle control; for example, driving a truck.

Figure 6 below shows trends for each type of task. Tasks requiring expert thinking and complex communication grew steadily and consistently during the 1970s, 1980s, and 1990s. The share of the labor force employed in occupations that emphasize routine cognitive or routine manual tasks remained

[13] Levy, Frank, and Richard Murnane (2005). The New Division of Labor: How Computers Are Creating the Next Job Market. Princeton University Press.

stable in the 1970s and then declined over the next two decades. Finally, the share of the labor force working in occupations that emphasize non-routine manual tasks declined throughout the period.

Figure 6 - Economy-wide Measures of Routine and Non Routine Task Inputs United States, 1969–98[14]



Note: Each trend reflects changes in the numbers of people employed in occupations emphasizing that task. To facilitate comparison, the importance of each task in the US economy is set to zero in 1969, the baseline year. The value in each subsequent year represents the percentile change in the importance of each type of task in the economy.

Why Engineering is of Special Importance. As governments consider how best to invest in higher education to raise the standard of living, these correlations and trends have had considerable influence. First, the fields of business and engineering seem to be of primary interest when conceiving new academic institutions. This is often intended to accelerate the development of the physical resources and infrastructure of the country and also boost the creation of globally competitive new jobs for the knowledge-based economy. It is not unusual for the planners of these new institutions to defer (sometimes indefinitely) the development of the liberal arts and social sciences to support the business and engineering disciplines. Instead, there frequently is an interest in moving on to advanced graduate education in the sciences and engineering, and in medicine and law.

Some recent examples include the decision in India to build eight new campuses of the Indian Institute of Technology, a highly selective engineering institution that has had extraordinary impact in the last 50 years. Singapore recently established the Singapore University for Technology and Design. Saudi Arabia established the King Abdullah University of Science and Technology (KAUST), a remarkable new institution that does not offer tenure, has no academic departments, charges no tuition, and provides only graduate degrees in the sciences and engineering—in partnership with many of the world's best universities. (KAUST recently recruited Dr. Jean Lou Chameau away from Caltech to serve as its president.) Abu Dhabi recently established the Khalifa University of Science, Technology and Research, with special subsidy from the government. Kazakhstan recently established Nazarbayev University in Astana, named for the country's president and intended to be the nation's flagship research university, starting with science, engineering, and education as the disciplines first to be developed.

[14] Ibid, p. 50, figure 3.5.

Furthermore, global competition for talent and resources often motivates governments to make special investments in efforts to create a "world class" university. The establishment of a world class university is often seen as a short cut to achieving global competitiveness in many dimensions. While there is no universally accepted definition of a world class university, the proliferation in recent years of international rankings (or league tables) has sharpened the interest and appetite for such recognition. Among the most widely cited such rankings is the Shanghai ranking (Academic Ranking of World Universities) and the Times Higher Education (THE) ranking that comes out annually from London[15]. Thirty-five out of the top 50 universities in the Shanghai rankings are U.S. institutions. In the THE rankings, the current top ten universities are:

1. California Institute of Technology
2. Harvard University
   Oxford University
4. Stanford University
5. Massachusetts Institute of Technology
6. Princeton University
7. Cambridge University
8. University of California, Berkeley
9. University of Chicago
10. Imperial College London

Seven of these are from the U.S. and three from the U.K. All of them are located in English-speaking countries.

However, the process used to construct these rankings depends on both peer recognition and also on evidence of academic achievement, principally publications and citations of research in the academic literature. Since the majority of recognized journals are published in English, and since most of the journal publications and peer-reviewed research funding is available in engineering and the sciences, it seems clear that these rankings contain a bias toward the engineering and science disciplines. It is noteworthy that the top university in these rankings is Caltech, which does not have a business school, a medical school, a law school, or an extensive faculty in the liberal arts.

With all of these influences, it is not surprising that many developing nations are very interested today in establishing a world class university with a focus on engineering and science. For example, the Russian government recently established the "5-100-2020" project, a national educational initiative intended to produce five Russian universities ranked in the top 100 of the THES ranking by the year 2020. A central focus of this initiative is the establishment of Skolkovo Institute of Science and Technology, a completely new institution outside Moscow, in partnership with MIT, intended to boost the region in technological innovation[16]. Malaysia has also established a similar "3-100-2020" project to produce three Malaysian universities in the top 100 by 2020[17]. Attaining a world class university—particularly one that is focused on innovation in technology and engineering—is seen as an imperative for many governments that aspire to improve the standard of living and global importance of their country.

The Opportunity for Global Impact. Given the growing international interest in Olin's efforts to innovate in undergraduate engineering education—even though Olin does not appear in the global university rankings—and the growing international drive for investment in higher education with a special interest in technological innovation, the opportunity for Olin to play an important role in catalyzing change is significant. While many other institutions are now becoming involved in educational experimentation, Olin

[15] Salmi, Jamil, (2009) The Challenge of Establishing World-Class Universities, Washington, DC: the World Bank.
[16] Saltykovsky, Dmitry, (28 August 2013) "Skolkovo: Tech city that aims to restore nation's pride," BBC Future. (Available online)
[17] Toward a World-Class University, Ural Federal University, (July 15, 2013). (Obtained from the website: http://urfu.ru/en/home/press/news/article/towards-a-world-class-university/).

has received and continues to receive special recognition for our unique comprehensive approach, deliberate institutional mission aimed at continual educational innovation, strong commitment to collaboration and co-design rather than dissemination, and the exceptional results demonstrated in the capabilities and self-efficacy of our graduates. Olin was recognized earlier this year with the 2013 Bernard M. Gordon Prize for Innovation in Engineering and Technology Education by the U.S. National Academy of Engineering. In addition, Olin will be highlighted in the next several months, in several feature-length documentary films that identify particularly successful new and innovative models in higher education. The opportunity to catalyze change on a large scale and to lead a "movement," or even a revolution, in undergraduate education is quite real. Olin is positioned well to fulfill its original purpose, as stated in the Founding Precepts to the institution: "*to become an important and constant contributor to the advancement of engineering education in America and throughout the world*."

Questions for Discussion.

1. How should we address potential concerns that when American universities engage with partners abroad, it may ultimately lead to degradation in the economic competitiveness of the U.S.?

2. How should we address potential concerns about the ethics of working with partners in foreign lands that do not embrace our principles?

3. How can Olin College maximize its global impact and also benefit from the growing global interest in innovation in engineering education?

Olin College OF ENGINEERING Collaboratory

Olin, through I2E2/Collaboratory, has received representatives from the following institutions, organizations and corporations. Interactions may include on-campus visits or workshops.

Institution/Organization	Country
Aalborg University	Denmark
Academy of Singapore Teachers	Singapore
Accreditation Board for Engineering Education of Korea (ABEEK)	Korea
Adolfo Ibanez	Chile
Ahmedabad University (Gujarat)	India
Amherst College	USA (MA)
Anbar University	Iraq
Ashesi University	Ghana
Autodesk	USA
Avon Public Schools	USA (MA)
Bakrie University	Indonesia
Bard College at Simon's Rock	USA (MA)
Blue Valley Schools	USA (KS)
BML Mungal University	India
Bridgewater State University	USA (MA)
Brookwood School	USA (MA)
California State University/Bakersfield	USA (CA)
Carreras Profesionales en Ingenieria y Technologia (TECSUP)	Peru
Castle View High School	USA (CO)
Centre d'Innovation et de Recherche en Pédagogie de Paris	France
Centro Universitário Augusto Motta (UNISUAM)	Brazil
Centro Universitário Salesiano de São Paulo (UNISAL)	Brazil
Centro Universitário Toledo (UNITOLEDO)	Brazil
Chalmers University of Technology	Sweden
Chiba University	Japan
Choate Rosemary Hall	USA (CT)
Ciputra University in Surabaya	Indonesia
Creighton University	USA (NE)
Daejeon University	Korea
Dana Hall School	USA (MA)
Delft University of Technology	Netherlands
Denver School of Science & Technology	USA (CO)
Dongseo University	Korea
Ecole Supérieure de Commerce de Paris	France
Embassy of Sweden	Sweden
Embraer S.A. - Brazil	Brazil
Engineering Academy of Japan	Japan

Institution/Organization	Country
Engineers Without Borders/Australia	Australia
Escuela Superior de Economia y Negocios (ESEN)	El Salvador
Escuela Superior Politécnica del Litoral	Ecuador
FIAP	Brazil
Gifu University	Japan
Grand Valley State University	USA (MI)
Green Enterprise Institute	USA (MA)
Greenwich Academy	USA (CT)
Group T University	Belgium
Habib University Foundation	Pakistan
Hanyang University	Korea
Harvard Kennedy School	USA (MA)
Harvard Graduate School of Education	USA (MA)
Harvard University	USA (MA)
Harvard-Westlake School	USA (CA)
Harvey Mudd College	USA (CA)
Higher School of Economics	Russia
Holliston Middle School	USA (MA)
Indian Institute of Technology at Gandhinagar (IIT)	India
Indian Institute of Technology at Madras (IIT)	India
Indian Institute of Technology at Mandi (IIT)	India
Indiana University	USA (IN)
Insper Instituto de Ensino e Pesquisa	Brazil
Instituto Superior Técnico, Technical University of Lisbon	Portugal
Instituto Tecnológico de Aeronáutica (ITA)	Brazil
Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM)	Mexico
Interuniversity Microelectronics Centre (IMEC)	Belgium
ITESM Tecnológico de Monterrey Campus Chihuahua	México
ITESM Tecnológico de Monterrey Campus Cuernavaca	México
ITESM Tecnológico de Monterrey Campus Cumbres	México
ITESM Tecnológico de Monterrey Campus Estado de México	México
ITESM Tecnológico de Monterrey Campus Guadalajara	México
ITESM Tecnológico de Monterrey Campus Monterrey City	México
ITESM Tecnológico de Monterrey Virtual University	México
Japan University Accreditation Association	Japan
K-20 Solutions	Saudi Arabia
Karnatak Law Society's Gogte Institute of Technology (GIT)	India
Kauffman Foundation	USA (MO)
Kent School	USA (CT)
Khalifa University of Science, Technology, and Research (KUSTAR)	UAE
King Mongkut's University of Technology Thonburi (KMUTT)	Thailand
King Saud University	Saudi Arabia
Konkuk University	Korea
Korea Association for Innovative Engineering Education	Korea
Korea University of Technology and Education (KUT)	Korea
Korean Research Institute for Vocational Education and Training (KRIVET)	Korea

Institution/Organization	Country
KTH Royal Institute of Technology	Sweden
Kyushu University	Japan
LASPAU: Academic and Professional Programs for the Americas	USA (MA)
Lawrence Technological University	USA (MI)
Louisiana Tech University	USA (LA)
Lucerne University of Applied Sciences	Switzerland
Maastricht University	Netherlands
Maimonides School	USA (MA)
Mainichi Shimbun Newspaper	Japan
Malaysian Ministry of Higher Education	Malaysia
Manipal International University	Malaysia
Massachusetts Institute of Technology (MIT)	USA (MA)
MassBay Community College	USA (MA)
Memorial University of Newfoundland	Newfoundland
Michigan Technological University	USA (MI)
Minerva Project	USA (CA)
Ministry of Knowledge Economy & National IT Promotion Agency of Korea	Korea
Minnesota State University, Mankato	USA (MN)
Modi Academic International Institute (MAII)	India
Moscow Institute of Physics and Technology	Russia
Moscow National Nuclear University	Russia
Nagoya University	Japan
Nanyang Technological University	Singapore
National Healthcare Group	Singapore
National University of Science and Technology (MISIS)	Russia
National University of Singapore (NUS)	Singapore
Needham High School	USA
Ngee Ann Polytechnic	Singapore
NHN Institute for the Next Network (NHN NEXT)	Korea
Niigata University	Japan
Normandale Community College	USA (MN)
Northeastern University	USA (MA)
Northwestern University	USA (IL)
Nueva School	USA (CA)
Osaka University	Japan
Oxford Brookes University	UK
Pacific Lutheran University	USA (WA)
Petroleum Institute	UAE
Pontifica Universidad Catolica	Chile
Pontificia Universidad Javeriana	Colombia
Purdue University	USA (IN)
Qiming College of Huazhong Institute of Science and Technology	China
Rensselaer Polytechnic Institute (RPI)	USA (NY)
Rice Center for Engineering Leadership	USA (TX)
Roger Van Overstraeten (RVO) Society	Belgium
Rose-Hulman Institute of Technology	USA (IN)

Institution/Organization	Country
Rotterdam School of Management, Erasmus University	Belgium
Royal Melbourne Institute of Technology (RMIT)	Australia
Sahmyook University	Korea
Saigon Industry Corporation	Vietnam
Samara State Aerospace University	Russia
Saudi Arabian General Investment Authority (SAGIA)	Saudi Arabia
School Improvement Network	USA (UT)
Science and Technology Policy Institute (STEPI)	Korea
Seattle Academy	USA (WA)
Seoul National University	Korea
Shady Hill School	USA (MA)
Shikshantar: The Peoples' Institute for Rethinking Education & Development	India
Singapore Polytechnic	Singapore
Singapore University of Technology and Design (SUTD)	Singapore
Skolkovo Institute of Science and Technology	Russia
Southern Methodist University	USA (TX)
Southwestern University	USA (TX)
St. Cloud State University	USA (MN)
St. Louis University	USA (MO)
St. Paul's School	USA (NH)
St. Petersburg National Research University of Information Technologies	Russia
St. Thomas More High School	USA (WI)
Stanford University	USA (CA)
State University of New York/Binghamton	USA (NY)
Sungkyunkwan University (SKKU)	Korea
Swaraj University	India
Taibah University	Saudi Arabia
Tarumanagara University	Indonesia
Technical University of Denmark (DTU)	Denmark
Technical University of Lisbon	Portugal
Technological University of Panama	Panama
Telecom Paris Tech	France
Tennessee State University	USA (TN)
Texas State University	USA (TX)
The Webb Schools	USA (CA)
TIES: Teaching Institute for Excellence in STEM	USA (OH)
Tillväxtanalys/Swedish Agency for Growth Policy Analysis	Sweden
Tokyo Institute of Technology	Japan
Tomsk Polytechnic University	Russia
Toyota Technological Institute	Japan
Universidad Adolfo Ibanez	Chile
Universidad Andrés Bello	Chile
Universidad Autónoma de Santo Domingo	Dominican Republic
Universidad Católica de Chile	Chile
Universidad Católica de la Santísima Concepción	Chile
Universidad Católica de Temuco	Chile
Universidad Catolica de Valparaiso	Chile
Universidad Catolica del Norte	Chile

Institution/Organization	Country
Universidad Central	Colombia
Universidad de Caldas	Colombia
Universidad de Chile	Chile
Universidad de Costa Rica	Costa Rica
Universidad de El Salvador	El Salvador
Universidad de La Frontera	Chile
Universidad de los Andes	Colombia
Universidad de Los Lagos	Chile
Universidad de Playa Ancha	Chile
Universidad de Talca	Chile
Universidad de Tarapacá	Chile
Universidad del Norte	Colombia
Universidad del Valle de Guatemala (UVG)	Guatemala
Universidad Diego Portales (10 different schools)	Chile
Universidad Francisco Marroquín (UFM)	Guatemala
Universidad Iberoamericana	Dominican Republic
Universidad Icesi	Colombia
Universidad Juárez Autónoma de Tabasco	Mexico
Universidad Metropolitana de Ciencias de la Educación	Chile
Universidad Nacional	Costa Rica
Universidad Nacional Agraria La Molina	Peru
Universidad Nuestra Señora de La Paz	Bolivia
Universidad Pedagógica Nacional Francisco Morazán	Honduras
Universidad San Carlos de Guatemala	Guatemala
Universidad San Sebastián	Chile
Universidad Tecnológica de Bolívar	Colombia
Universidad Tecnológica de Pereira	Colombia
Universidade Estadual de Campinas (UNICAMP)	Brazil
Universidade Federal de Itajubá (UNIFEI)	Brazil
Universidade Federal de Minas Gerais (UFMG)	Brazil
Universidade Federal do ABC (UFABC)	Brazil
Universidade Federal do Rio Grande do Sul (UFRGS)	Brazil
Universitat Pompeu Fabra (UPF)	Spain
Universiti Brunei Darussalam	Brunei
Universiti Teknologi Malaysia (UTM)	US/Malaysia
University of California/Davis	USA (CA)
University of Illinois at Urbana Champaign (UIUC)	USA (IL)
University of Kent	UK
University of Leuven	Belgium
University of Limerick	Ireland
University of Maine	USA (ME)
University of Manchester	UK
University of Massachusetts/Amherst	USA (MA)
University of Massachusetts/Dartmouth	USA (MA)
University of Massachusetts/Lowell	USA (MA)
University of Michigan	USA (MI)
University of Missouri	USA (MO)
University of New Haven	USA (CT)

Institution/Organization	Country
University of New South Wales	Australia
University of Oklahoma	USA (OK)
University of Pittsburgh	USA (PA)
University of Portland	USA (OR)
University of Queensland	Australia
University of São Paulo (USP)	Brazil
University of Technology, Jamaica	Jamaica
University of Texas at El Paso (UTEP)	USA (TX)
University of the West Indies, St. Augustine	Trinidad & Tobago
University of Tokyo	Japan
University of Tsukuba	Japan
University of Twente	Netherlands
University of Utrecht	Netherlands
University of Vienna, Prague	Czech Republic
University of Washington Bothell	USA (WA)
University of Wasit	Iraq
University Sains Malaysia	Malaysia
Van Hall Larenstein University of Applied Sciences	Netherlands
Vietnamese Embassy: Ministry of Science and Technology	Vietnam
Virginia Commonwealth University (VCU)	USA (VA)
Vrije Universiteit Amsterdam	Netherlands
Wayne State University	USA (MI)
Western New England College	USA (MA)
Wichita State University	USA (KS)
Wilkes University	USA (PA)
Worcester Polytechnic Institute (WPI)	USA (MA)
Yale University--Center for Engineering Innovation Design	USA (CT)
Yale-NUS College	Singapore
Yeungjin College	Korea