Industry and ET Education Collaborations From A Construction Engineering Perspective

Wafeek Samuel Wahby, Ph.D., B.Th.

Professor, Industrial Technology Program Coordinator
Eastern Illinois University, Charleston, Illinois

Abstract

The preparation of ET graduates who can make a smooth transition from their academic training into the work force with confidence and maximum productivity in areas of education, research, and business can be achieved through well defined, carefully designed, and appropriately implemented academia-industry collaboration. The design and construction industry is one of the largest industries and a major element in shaping the economy, locally and globally. The ever-increasing need for collaboration between academia and industry has never been more indispensable as it is now.

The 21st Century shall witness even more innovative applications within the construction industry that require the introduction of new building materials, equipment, and methods, as well as qualified and adequately trained personnel. The technological progress in the construction industry depends on two elements, namely: innovation and resources. Resources are introduced as MPLEM -- an acronym that stands for Money, People, Land, Equipment, and Materials. Generally, academia leads most of the research and development, and industry leads the application of most academia's findings. Inevitably, joint ventures between both result in better engineers, materials and equipment which benefit both engineering education and the construction industry.

When discussing intellectual property issues, important details need to be visited such as who pays for the research work, the degree of secrecy in research, who owns the outcome, who files for a patent, who gets rights to the outcome, and what are the conditions to get those rights.

Positive change comes through those who are willing to work together and take risks–and technological leadership in the construction industry is no exception. Industry's private and public sectors, government agencies, and academia need to come together and find better ways to collaborate in working for the common cause of technology innovation and commercialization. Together, they can achieve more than if they worked apart from each other. The intelligent industry/academia collaboration through innovation will take both parties further than any of them has ever been before, or thought they can ever be.

Introduction

The need for collaboration between academia and the design and construction industry (DCI) is ever increasing. The 21st Century shall witness even more innovative applications within the design and construction industry that require the introduction of new building materials, equipment and methods, as well as qualified and well-trained personnel [1].

Important questions may be raised here, such as: Why collaborate and what are the collaboration benefits? How would we start -- and then operate -- a collaboration? and, What makes a collaboration successful? The discussion of these and similar questions will shed light on the process of collaboration, the benefits of collaboration, the successful collaboration programming/administration, and lessons learned. This would help those in the construction technology education and training community organizations that are interested in forming a new collaboration or in improving an existing collaboration.

The remaining part of this paper is divided into the following subsections: Academia; Industry; New Materials, Processes, and Equipment; Collaboration; Academia/Industry Collaboration: Why? Intellectual Property Issues, Educational Examples of Actual Collaboration and Conclusion.

Academia

Members of academia are often first aware of new, developing technologies. From graduate projects and laboratory testing, they can see new innovations before anyone else does. Academic leaders can also see, based on their research and hands-on work, which areas of industry research need the most attention. That strategic position of academic leaders enables them to design educational programs for the future that leverage research dollars through collaborative projects with federal, state, and industry funding.

Generally, universities and their laboratories work to find new solutions to rebuild infrastructure, and enhance the environment [2]. Academic leaders are an essential part of helping these new technologies move into practice and reach society in a safe, expeditious manner. Academia and its work also provide opportunities for a dialogue with industry. This two-way information exchange has immeasurably positive effects on what DCI can achieve.

While academia may not be part of the work force that the public observes on a construction site, academic leaders are a vital and important element of the DCI. As the DCI is now taking its first steps into the new millennium, academia will continue to make its imprint as it contributes to infrastructure and the DCI other projects.

Industry

The DCI is one of the largest industries and a major element in shaping the economy, locally and globally. In the United States alone, the DCI employs a workforce of over six million and comprises roughly 13 % of the current Gross Domestic Product (GDP) [3]. The DCI stands or falls

on five resources, namely: money, people, land, equipment, and materials (MPLEM). The absence of any one of those equally essential resources brings the DCI to a halt.

Innovation within the DCI for infrastructure applications has the ability to carry benefits to the public such as: improved quality of life, productivity, better environmental protection or sustainability, superior safety and health, infrastructure of enhanced quality at an overall cost savings, and competitiveness of the society, locally and globally. The infrastructure needs are substantial, and there are compelling opportunities for collaboration between the DCI and academia.

While the DCI can sometimes be viewed as "low-tech" -- an industry that is not advancing into the new century/millennium with the strength of futuristic technology -- systems being developed at home and around the world are beginning to change the public's "traditional" perception of construction through discoveries and technological advancements.

As the DCI moves into the future, while new infrastructure is added to meet growing needs, and old or deteriorating infrastructure is renewed or replaced, it is imperative that DCI realizes that any one group operating in isolation cannot work effectively toward meeting those needs. Collaboration with other team members is extremely important.

New Materials, Processes, and Equipment

New materials, processes, and equipment may be the most technologically advanced, fastest growing area of the DCI [4]. From ancient civilizations to modern day infrastructure, DCI played an essential role in the progress and the well being of societies -- with innovative, advanced materials, processes, and equipment being both its tools and final product into the future.

That said, many would frequently view certain industries such as telecommunications, computers, automotive, and aerospace as cutting-edge and ultramodern, while take for granted any innovations in the DCI, be it in buildings, bridges, roads, or any other project. In spite of this, the fact of the matter is that DCI and its collaborators are currently developing a multitude of new, state-of-the-art materials, processes, and equipment – with even newer items added to the already long list every day [5].

These new materials, processes, and equipment are strong indicators of the technological progress that DCI is making. As these innovations infiltrate the marketplace and make their way into everyday usage, innovations that are even more superior will continue to be developed.

Although these advancements often go unheralded by the public at large, they invariably expect the infrastructure to perform better -- now and into the future [6]. Meanwhile, the DCI must ensure that advanced materials research and innovation implementation continue to move the industry forward at the speed of other high-tech fields.

Collaboration

For innovative design and construction technologies to succeed and move into practice more quickly, collaboration between DCI and all sectors of the economy, particularly academia, is crucial. This collaboration is necessary to accomplish tasks that neither DCI nor any single sector can realize alone.

The DCI can foster the development of the innovative technology solutions by working to create consortia, bringing together groups that can effectively collaborate to create results [7]. By combining the efforts of industry, academe, governmental and non-governmental organizations, and the public sector, the industry can better use society's available resources. The combination of these different sectors' collective expertise, insights, and capabilities increase the likelihood of revealing the most innovative solution to any technology dilemma.

Collaborative industry and academia programs would identify technical solutions and accelerate the introduction of new products into the marketplace. These programs can work together to move innovation into practice in different ways; some support such advancement through funding, others oversee cooperative programs. The common factor in each joint program, however, is that all parties involved must have genuine interest in advancing infrastructure and making life better through innovative technology.

The collaborating organizations may even be diverse in size, focus, and expertise. However, when they are linked by a common conviction they can work together towards improving construction site productivity and reducing the time to construct facilities. When many minds come together in the spirit of cooperation to create solutions, effective, long-term, innovative outcomes are shaped that benefit the entire DCI and its future. With DCI/academic collaboration, technology has the power and thrust to go further than it ever could before.

Academia/Industry Collaboration: Why?

As it has been in the past, positive change still comes through those who are willing to work together and take risks. Technological leadership in the construction industry is no exception. It has also come from the collaboration and the hard work of risk takers.

Universities and industry organizations have traditionally maintained *informal* ways of working together, including student internships, faculty exchanges, and industry capstone projects to complete a degree program.

A more recent phenomenon is the *formal* collaboration between a university (or group of universities) and an industry organization (or group of organizations). The purpose of these formal collaborations is to meet the construction technology education and training needs of undergraduate and graduate/adult learners through joint ventures such as higher education programs, graduate programs (degree and certificate) and professional development activities (customized classes, seminars, training workshops, forums, and conferences). These activities are typically held on-location, either at the university or industry site, although individual circumstances may vary.

There are many reasons for forming industry/university collaboration. These reasons may

include fulfilling an organization's education mission, accessing education and training resources, gaining competitive advantage, addressing business growth, achieving cost savings, enhancing organizational reputation, increasing revenue, accessing research and tool resources, and providing a staffing source.

For the DCI to effectively meet its lofty goals and continue its progress, private and public industry, government agencies, and academia need to continue to come together and find even better ways to collaborate in working for the common cause of technology innovation and commercialization -- the primary solution that will push the design and construction industry to the innovation forefront of the future. The intelligent DCI/academia collaboration through innovation will take both further than any of them has ever been before.

Intellectual Property Issues

When discussing intellectual property issues, important details need to be visited such as who pays for the research work, the degree of secrecy in research, who owns the outcome, who files for a patent, who gets rights to the outcome, and what are the conditions to get those rights. Even the patent system itself may need to be discussed to see whether and to what extent it is detrimental or beneficial to the overall good of the research because of the various secrecy requirements. Of course, if a patent is sought, the requirements of patent law must be satisfied in all cases [8].

Patent law may be visualized as a tripod that carries a valuable object, with that valuable object being the patentable subject matter. The three legs of the tripod represent the three conditions required to obtain a patent. The first leg is *the utility and enablement requirement*, which means that enough evidence must be presented to the patent office to convince them a subject matter does what is claimed and works for its intended purpose. The second leg is *novelty*, which requires that no one else has done it before by way of publication or public use. The third leg is *non-obviousness*, which means that what has been done is sufficiently different from what has been done before.

A written contract must be prepared, signed, and dated all under legal supervision. When matters are clearly stated to all parties involved in a collaboration, as early as possible in the process, chances are that the collaboration will go smoothly and profitably for each one.

Educational Examples of Actual Collaboration

The School of Technology at Eastern Illinois University is a firm believer in collaboration between academia and industry. Some of the ways successfully adopted include internships, Co-Op, and job shadowing programs where students join the DCI for a certain period of time for training. Students perception of the DCI was enhanced and many of them landed in jobs with some of those firms upon graduation. Similarly, inviting DCI experts as guest speakers to classes and holding seminars, workshops, and panel discussions proved to be very effective educational opportunities.

A very successful example of educational collaboration is developing research programs that try to solve real life problems in the DCI at the school's laboratories. The triad collaboration typically includes: students/professors representing academia, a particular partner representing the DCI, and a funding agency to support the research work. Publishing the results of research in professional literature and presenting them in national and international professional conferences is a powerful way for disseminating information and fulfilling the mission of both academia and DCI.

Conclusion

The challenges expected during the 21st Century in the DCI necessitate more collaboration between academia and DCI to arrive at better construction materials, equipment, and personnel. The preparation of ET graduates who can make a smooth transition from their academic training into the work force with confidence and maximum productivity in areas of education, research, and business can be achieved through well defined, carefully designed, and appropriately implemented academia-industry collaboration. Together, academia and DCI can and should achieve a much greater and faster progress of the DCI and education than can be achieved when they operate apart from each other.

References:

1. "University And Technology Advances, The Role of International Collaboration," Proceedings, in English, Facoltà di Ingegneria, Università dell'Aquila, Poggio di Roio, 67040 L'Aquila, Italy, March 27, 2000.
2. "Consortia: Moving Research into Practice," Celebrating Innovation Monthly, The Civil Engineering Research Foundation (CERF), Washington D.C., April 1999
3. "Government and Industry: Working Together for the Public," Celebrating Innovation Monthly, The Civil Engineering Research Foundation (CERF), Washington D.C., March 1999.
4. "New Materials: What They Mean to Industry Advancement", Celebrating Innovation Monthly, The Civil Engineering Research Foundation (CERF), Washington D.C. January 1999.
5. "How Do Advancing Global Innovations Affect The Entire Industry?" Celebrating Innovation Monthly, The Civil Engineering Research Foundation (CERF), Washington D.C., December 1998.
6. "Academia - Infrastructure's Unheralded Hero," Celebrating Innovation Monthly, The Civil Engineering Research Foundation (CERF), Washington D.C., November 1998.
7. "What can research and innovation accomplish for the public?" Celebrating Innovation Monthly, The Civil Engineering Research Foundation (CERF), Washington D.C., October 1998.
8. "Industry/University Collaborations: Different Perspectives Heighten Mutual Opportunities," A Survey, Software Engineering Institute (SEI), 1998.

WAFEEK SAMUEL WAHBY

Dr. Wafeek Samuel Wahby is a professor of civil/structural engineering and the Coordinator of the Industrial Technology Program, School of Technology, Eastern Illinois University, Charleston, Illinois. He is the chair of ACI sub-committee on Polymer Concrete Structural Design and Analysis, and chair of the Construction Focus Group of the National Association of Industrial Technology (NAIT). Dr. Wahby offered special technologically focused study abroad courses in China and in Egypt. He is planning another course in Brazil.