



Construction Industry Institute®

Globalization: Building a Successful Global Engineering and Construction Company

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GLOBALIZATION: BUILDING A SUCCESSFUL GLOBAL
ENGINEERING AND CONSTRUCTION COMPANY

by

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A Report to
Construction Industry Institute
The University of Texas at Austin

Under the Guidance of
CII Research Team 263
Globalization

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Executive Summary

The globalization of engineering and construction services is a component of a much broader trend in the globalization of services, which has far-reaching impacts on work practices, workforce, economy and society. In the engineering and construction industry, discussions of globalization have centered largely on two main topics: (1) *offshore outsourcing* [U.S. organizations securing services from offshore service providers such as low cost engineering centers] and (2) *global project scope* [the increasing size and complexity of projects requiring participation of engineers, contractors, and suppliers from multiple countries]. Yet a third important globalization trend, *market issues* [U.S. organizations expanding into other countries and international organizations increasingly competing with U.S. organizations domestically], deserves further investigation. The situation in industry today is that trade liberalization is increasing and cost differentials between advanced and developing countries are declining. Market issues are creating a new globalization dynamic making it difficult for engineering and construction organizations to maintain and grow market share domestically and abroad. In the period from 2002 to 2010 the number of U.S. companies on the ENR list of contractors performing the most work outside their domestic market dropped from 36% to 9%. The U.S. engineering and construction industry needs to develop a new understanding of how engineering and construction organizations can evolve beyond users of global resources to ventures that effectively operate in, and integrate into, a global market to reverse this trend.

The CII Globalization Project Team 263 was established to develop a comprehensive understanding of, to synthesize, and to prioritize the key drivers and critical success factors for engineering and construction organizations to become truly global. The purpose of this effort was to increase the success of owners and engineering and construction organizations in the

global context. To achieve this purpose, the research team collected case study data utilizing open-ended interviews to identify globalizing dimensions and attributes. The team then utilized the Analytic Hierarchy Process (AHP) to rank and weight the attributes. This led to the development of an implementation tool to enable engineering and construction organizations to evaluate their globalizing progress, to identify and evaluate globalizing tactics to become more global, and to prioritize and plan the implementation of these globalizing tactics. The implementation tool created is titled the Globalizing Self-Assessment Tool (G-SAT). While principally designed for use by engineering and construction companies seeking to understand and improve their globalizing efforts, the G-SAT may be used by engineering and construction companies, owners and suppliers.

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1.0 Introduction

For the last several decades, distinct changes have occurred in the engineering and construction industry due to the effects of globalization. Enlarged project scope, emerging market opportunities, and access to low cost, high quality engineering and construction services from offshore countries provide new opportunities and challenges to the engineering and construction industry. Many U.S. companies with their experience and highly developed technological background have been benefiting from the opportunities of globalization. However, the global construction market is getting highly competitive and the market share of leading U.S. companies is declining.

According to Oxford Economics, the 2009 global construction market value is estimated at \$7.5 trillion and it is estimated to be \$12.5 trillion (in 2009 dollars) by 2020, a projected 70% growth. While the U.S. is currently the largest construction market, Oxford Economics claims that BRIC countries (Brazil, Russia, India and China) will overtake the developed countries in the following decade. Construction market growth is estimated at 125% in the Asia Pacific region. As presented in Figure 1, China is projected to increase its global market share from 13.7% to 19.1% by 2020. On the other hand, the U.S. market share is projected to drop from 17.4% to 16.9% over the same period. Engineering News Record (ENR) also supports the Oxford Economics predicted trends; in the period 2002-2010, the percentage of U.S. companies on the ENR Top 225 list of contractors performing the most work outside their domestic market dropped from 36% to 9%. The U.S. currently represents the largest global construction market; therefore some might argue that U.S. engineering and construction organizations are disadvantaged in this ranking due to the substantial domestic market sizing. Yet over the same

period (from 2002 to 2010), the percentage of U.S. companies on the ENR Top 225 list of the largest global contractors dropped from 60% to 30%. At the same time, the global construction market has been growing and is projected to continue to grow. It is in light of these trends that CII Research Team 263 was formed with the goal of understanding and taking aims to mitigate market share decline of U.S. engineering and construction companies. In executing this mandate, CII Research Team 263 created a tool—the Globalizing Self-Assessment Tool (G-SAT)—which engineering and construction companies may employ to evaluate their own globalizing performance, evaluate and track changes in their globalizing performance over time, compare their results with globalizing performance data provided in this report, and receive tactical guidance to improve their globalizing performance.

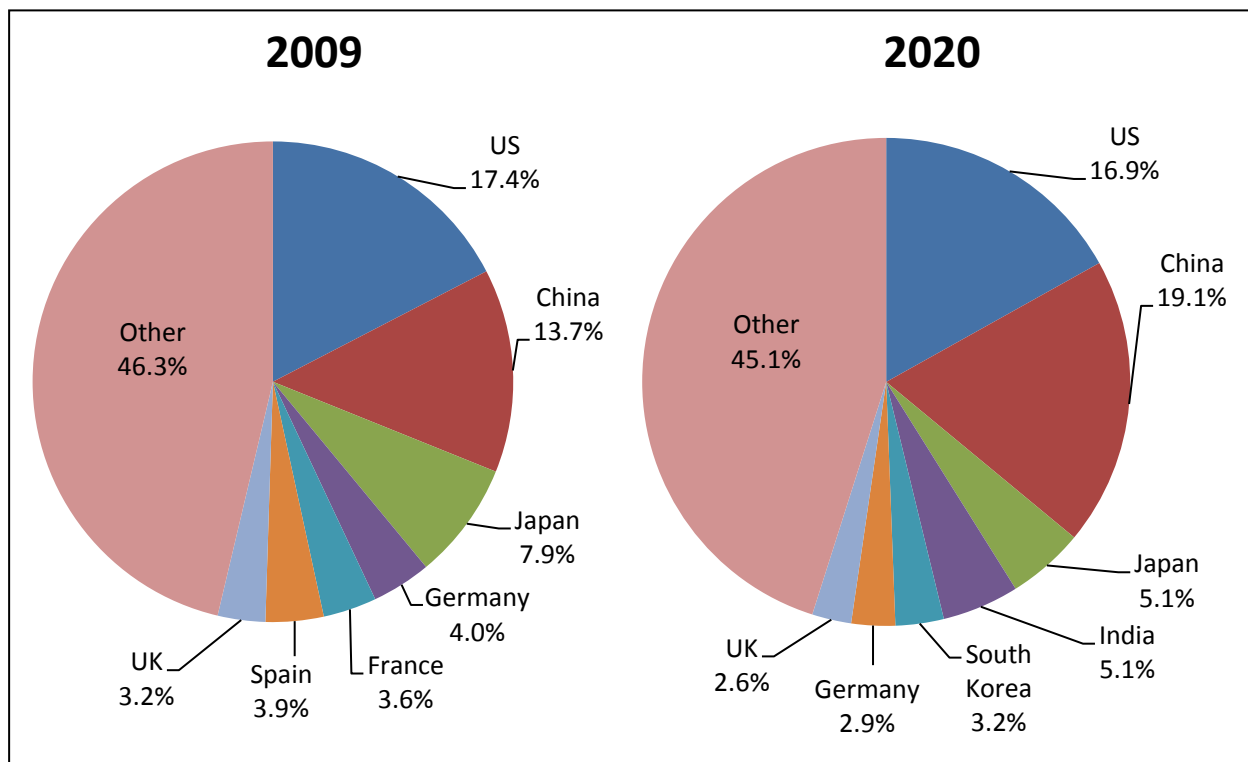


Figure 1 Construction Industry Market Share

1.1 Purpose and Scope

The primary purpose of CII Research Team (RT) 263 was to develop a comprehensive understanding of the key drivers and critical success factors for engineering and construction firms to become truly global and increase the success of owners and engineering and construction organizations in the global context. Therefore, the scope of this study was focused on developing a globalizing self-assessment tool for engineering and construction organizations, however, it may also be used by suppliers, owners and other organizations involved in capital project delivery. To carry out this research, the team initially needed to define the meaning of globalizing in terms of capital project delivery for CII member companies. The working definition of “globalizing” developed by CII RT 263 is as follows:

“Globalizing is the process of transformation of local or regional organizations into global ones that have bidirectional value flows. For engineering and construction organizations to globalize effectively they must evolve beyond users of global resources into ventures that effectively operate in and integrate into a global market.”

1.2 Research Goal and Objectives

The primary goal of this research was to develop a user friendly globalizing self-assessment tool to assist engineering and construction companies in developing and prioritizing their globalizing tactics and strategies. In addition to this primary goal, the following objectives were also pursued:

- To identify the globalizing key drivers and critical success factors from non-engineering and construction successful global companies;
- To synthesize acquired knowledge from non-engineering and construction industries in order to understand the key drivers and critical success factors specific to engineering and construction companies;
- To prioritize each key driver and critical success factor according to engineering and construction market conditions;
- To develop a globalizing maturity scale-based continuum and associated metric to track an engineering and construction company's globalizing progress; and
- To develop a user-friendly Microsoft Excel-based tool and to ensure the tool's validity.

The G-SAT not only provides a metric through which companies can be compared in terms of globalizing, it is also an evaluation framework that CII member companies can use to aid in both identifying strategies for globalizing and in the selection of appropriate tactics to achieve globalizing objectives.

1.3 Research Approach

There is limited research focused on strategies for quantifying the globalizing performance of companies. Moreover, no research exists on quantifying the globalizing performance specific to engineering and construction organizations. To fill this crucial gap in the construction literature, CII Research Team 263 developed a metric and associated tool to strategically manage globalizing progress. The team adopted the research approach outlined in Figure 2 to achieve the research goal and objectives. A summary of each step follows, and additional details regarding the research process are included in Chapter 3.

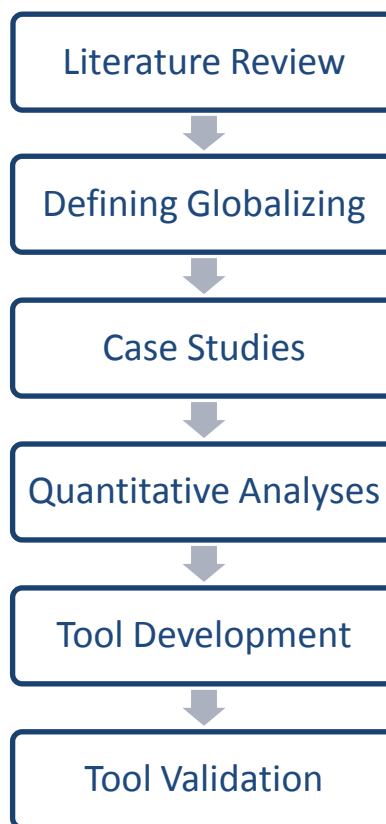


Figure 2 RT 263 research approach

1. Literature Review: Reviewed past CII research along with other relevant research.
2. Defining Globalization: Defined globalizing within the context of the engineering and construction industry and within the scope of this research.
3. Case Studies: Collected data on case studies of the globalizing experiences and histories of both non-engineering and construction companies and engineering and construction companies.
4. Quantitative Analyses: Synthesized case study findings into key drivers and key attributes and then utilized an Analytical Hierarchy Process to quantitatively prioritize the key attributes.
5. Tool Development: Developed a Globalizing Self-Assessment Tool (G-SAT) in Microsoft Excel.
6. Tool Validation: Collected empirical data from companies using the G-SAT tool to validate the tool.

1.4 Organization of the Research Report

This research report consists of eight chapters followed by two appendices of case study data results and tool survey questions. Following this initial introductory chapter, background information is presented in Chapter 2 regarding current market issues and conditions in the engineering and construction industry. Chapter 3 explains the research methodology in detail including data collection and analysis methods. Chapter 4 provides a description of the G-SAT tool and a discussion of its development in a Microsoft Excel environment. Chapter 5 explains how the G-SAT can be implemented by engineering and construction companies. Since a similar tool does not exist for quantifying the globalizing performance of companies in the

engineering and construction industry, the team established the internal validity of the tool by collecting and analyzing empirical data from companies. This validation process is described in detail in Chapter 6. A discussion of the research conclusions is included in Chapter 7. Finally, a set of recommendations is presented in Chapter 8.

2.0 Background

Globalization and its long-term effects have attracted the attention of corporations as well as scholarly researchers. However, discussions of industry globalization lack quantitative metrics that would enable concrete discussions and enable organizations to track, manage, benchmark and predict their globalizing status or progress. This inadequacy is based largely on a lack of empirical data to support claims made about an organization's globalizing performance. Since the industry lacks metrics for globalizing, comparing one company to another or the same company at two points in time in terms of globalization is problematic. In other words, without a metric as the basis of comparison, it is impracticable to benchmark firms regarding their globalizing performance.

While attempts to quantify globalization have gained attention in recent years for empirical inquiry, researchers have neglected the study of globalization as it applies specifically to the engineering and construction industry. In this industry, the discussions to date on the topic of industry globalization have centered on three main topics: 1) market issues, 2) offshoring, and 3) project scope.

2.1 Market Issues in the Engineering and Construction Industry

Many issues have emerged regarding the impact of globalization on the engineering and construction industry. While globalization has created many opportunities for firms, it also triggers challenges such as cultural and linguistic difficulties (Chan and Tse 2003), changes in law and regulations (Zhi 1995), economic instability (e.g., inflation and currency fluctuations), and interest rate increases (Gunhan and Arditi 2005). In short, to be successful in a foreign

market, all economic, political, legal and cultural aspects of the project must be well understood so that resulting challenges can be effectively addressed. For U.S. engineering and construction organizations, two market issues are particularly significant. First, many U.S. firms expand into other countries and in order to be successful, they must address all of the aforementioned challenges caused by globalization. Second, companies who choose to stay in domestic markets must compete with both national and international firms operating in the U.S.

To date, research has established a number of motivating factors that lead firms to expand their operations into the often challenging global engineering and construction market. For instance, many firms consider international projects to ensure their financial security (Han et al 2007). Highly specialized firms also consider international projects to provide an opportunity to capitalize on their experience gained from highly sophisticated construction projects and adaptation to technological innovations (Han et al 2007). In this sense, the rising construction demand in developing countries provides opportunities to U.S. construction organizations. A firm's knowledge, ability to adopt innovative technology, and their experience in various types of construction projects provides these firms with an advantage over their competitors.

According to Kini (2000), engineering and construction companies that aim to be successful in the global engineering and construction market cannot afford to conduct business as they have in the past. Companies must adapt according to the circumstances and expectations of a global market. Their organizational structure must satisfy their customers' needs anywhere in the world quickly and efficiently. Their information technology and systems must transmit data quickly and accurately. Their personnel must think globally as they work with suppliers from all over the world to cooperatively reduce costs and optimize schedules. They must use the

local sources to the project's best advantage and must provide high quality, low cost, and more efficient engineering and construction schedules to their customers (Kini, 2000).

2.2 Offshoring

The practice of moving domestic operations to foreign countries is referred to as offshoring (Lewin and Fong, 2005). In the second half of the 20th century, global outsourcing has become an important initiative for U.S. firms in order to establish two main goals. First, firms gain access to emerging markets. Second, when U.S. firms operate in comparatively low-wage countries, this scenario has allowed U.S. firms to align their cost structures with their global competitors (Lewin and Fong, 2005). In 2004, the Duke University Center for International Business Education and Research (CIBER) began researching global offshoring. CIBER cooperated with Archstone Consulting and formed a project team to analyze firm-level data. In 2005, the project team released the results a survey. According to the survey results, some key findings relating the offshoring are as follows:

- 93% of respondents strongly agree that “Taking out Cost” is the main reason for U.S. firms to offshore.
- “Competitive Pressure”, which is strongly related to cost savings, is cited by 69% of firms as the second significant driver.
- Among the sub-sample of firms that do not consider offshoring, 60% of firms indicate that they would change their strategy if savings were greater than 30%.
- Somewhat surprisingly, 54% of the respondents strongly agree that access to qualified personnel, either at the entry level and/or at skilled levels, is also a significant driver.

- The percentages of business processes offshored are as follows: information technology 66%, finance 60%, call center 54%, engineering services 44%, research 32% and finally both HR and procurement 24%.
- The percentage increases of offshoring in industries like information technology, engineering, research and human resources suggest a trend toward more complex, higher value-added business processes.
- In offshored engineering services, the cost savings of more than half of the firms is greater than 40%.

According to Bryant (2006), the global outsourcing trend started in the 1960s in the U.S., with assembly plants locating in Mexico. This “twin plant” or *maquiladro* model exists when one labor intensive plant is located in Mexico while another capital intensive plant is located in the U.S. The input that had been designed and manufactured in the U.S. is then shipped to Mexico for assembly while the end product is imported back to the U.S. Both countries benefit from this process. For instance, this model promotes a natural trans-border economic exchange process that strengthens the border economies of both countries (Herzog 1991). In order to find cheaper labor, the U.S. began to forge relationships with border countries such as Mexico and moved toward large-scale businesses far away from the U.S. border in countries like India and China. Today, U.S. firms offshore not only manufacturing facilities (as they did in the 1960s with Mexico), but they also offshore information system development and other business processes such as engineering services (Lewin and Fong, 2005) to firms from around the world. Currently, India has become the dominant location for offshoring business processes as 67% of

all functional implementations are currently located in India. The Philippines and China are a distant second and third at 7% and 6% respectively (Lewin and Fong, 2005).

In spite of the many key drivers that make offshoring attractive to companies, there are also many arguments against global outsourcing, including; safety, legal issues, poor service and material quality, political instability and different insurance practices between countries. According to Bryant (2006), there is always a learning curve in terms of offshoring and reaching a firm's expected service level is the key to benefit from outsourcing. Reaching acceptable service levels involves establishing communication standards, having pre-established procedures for the work, and having the right people managing the relationships between onshore and offshore groups (Bryant 2006). Bryant also emphasized the difficulty of performing outsourcing on a project-only basis and suggested that developing a relationship with the offshore group is a critical step in order to reach the expected service levels and saving targets. In the engineering and construction industry, developing long-term relationships based on trust and cooperating with a single offshore company may lead to a hold-up problem in which one organization becomes dependent on another and bid prices become less competitive (Unsal and Taylor 2009). Therefore, developing long-term relations and cooperating with the same organization on multiple projects may also create inefficiencies in which a subcontractor can gain bargaining power during the bidding process since long term cooperation decreases the transaction cost between parties. In short, the consequences of establishing long-term business relations with offshore companies must also be considered.

2.3 Project Scope

The increasing size and complexity of projects is requiring increasing participation of engineers, contractors, and suppliers from multiple countries. Undertaking a large and technically complex project, especially in a new international market, involves various high level risks such as safety, political instability, and legal issues. To reduce exposure to these risks, cooperating with overseas companies can mitigate risks by sharing financial responsibility and work load. As the project scope and complexity increase, the involvement of a larger number of industry specialists may be required. There has been an increase in the number of participants (and participating organizations) in large scale projects. This increase in the number of participants can be exacerbated depending on the location of the project or type of global collaboration that is required. Moreover, some nationalities have certain specialty areas. For example, the U.S. has historically provided expertise in green buildings and high-rise steel structures, while Japan is typically associated with tunnel construction and earthquake-resistant buildings. Therefore, in many large-scale projects, it is strategically beneficial to collaborate with companies from certain countries to utilize their experience and specialized expertise.

2.4 Quantifying of the Globalizing Performance in Construction Industry

Globalization is impacting the engineering and construction industry in significant ways, as noted in current literature (Nayak and Taylor 2009, Messner et al. 2007, Ozorhon et al. 2008, Raftery et al. 1998) In the last few decades, CII has also paid close attention to the impact of globalization on industry by establishing research teams tasked with investigating topics such as Effective Use of the Global Engineering Workforce (2004-05) by Research Team 211, Global

Project Control and Management Systems (2006–09) by Research Team 244, and Global Procurement & Materials Management Best Practice Refresh (2007–09) by Research Team 257. CII attaches importance to global issues not only through research teams but also through the development of communities of practice such as the CII Globalization Community of Practice (GCOP), which has been in operation since 2007. The goal of the GCOP is to provide a forum for information exchange between CII member companies regarding business activities in various international locations.

In the last few decades, the measurement of globalization has become a popular topic for government agencies, academics and industry. Government agencies such as the World Bank, United Nations, and many other institutions and non-governmental organizations need to measure the globalization level of countries in order to examine the potential correlations with countries' social, economic and political statuses. In the existing literature, there are two widely accepted globalization indices which were developed to fulfill this necessity. A global management consulting firm, A.T. Kearney, and the magazine *Foreign Policy* introduced the A.T. Kearney / Foreign Policy Magazine globalization index in 2001. This index is based on political engagement, technology, personal contact and economic integration. In the following year, the KOF Swiss Economic Institute developed the KOF Index of Globalization, which measures globalization on economic, social, and political dimensions.

Efforts on measuring globalization are not limited to the country level. Researchers have started examining ways to measure globalization within and across industries. Research and empirical studies to date have investigated methods for comparing industries such as the information and communication technology industries (Chen and Lin, 2004) and chemical and manufacturing industries (Makhija et al 1997). Moreover, some industry globalization studies

have adopted a focus on measures of how global business networks within specific industries operate effectively (e.g. the electronics industry in Ernst 2004). Unfortunately, studies considering the engineering and construction industry, one of the largest industries in the world, are absent from the literature. CII Research Team 263 took a step to fill this critical gap in the literature and at the same time developed a practical strategic management tool for the globalizing performance of engineering and construction companies.

3.0 Methodology

The literature review presented in Chapter 2 provides a background of the current knowledge regarding the global engineering and construction industry and the lack of a practical management tool to quantify the globalizing status and performance of engineering and construction organizations. Based on information gained from the literature review and the RT 263 research objectives, the research team developed a research methodology employed in the development of a Globalizing Self-Assessment Tool (G-SAT). The team collected case study data and employed statistical testing procedures and decision making tools such as the Analytical Hierarchy Process (AHP). The sequential progression of the RT 263 methodology is summarized as follows:

- Literature Review: The team performed an extensive literature review of globalization including information gathered from CII's former research teams and literature that emerged from both industry and academic research in construction as well as other industries.
- Case Studies: The team collected case histories on non-engineering and construction organizations as well as engineering and construction organizations to gather knowledge on the key drivers and critical success factors for globalizing. This provided insight to specific issues and current approaches used by organizations to successfully globalize.
- Quantitative Analyses: Based on a refined set of key drivers and key attributes related to successful engineering and construction organization globalizing, the prioritized and weighted the key attributes utilizing an Analytical Hierarchy Process (AHP).
- Tool Development: The Globalizing Self-Assessment Tool (G-SAT), the team developed a strategic management tool to evaluate companies' globalizing progress, to

identify and evaluate globalizing tactics, and to prioritize, plan and monitor the implementation of these globalizing tactics.

- Tool Validation: Several data sets were collected from research team members and CII member company representatives at the CII Board of Advisors meeting in October 2009 to establish the internal validity of the G-SAT.

The first three phases of the methodology will be explained in greater detail in the following sub-sections. The Tool Development and Tool Validation phases are presented in Chapters 4.0 and 6.0, respectively.

3.1 Literature Review

Prior to the beginning of the research, the academic members in RT 263 had developed an extensive understanding of globalization research with a particular focus related to the engineering and construction industry. Some research team members were previously involved in CII research that focused on topics related to globalization. These previous research experiences were leveraged to ensure that all team members were working from the same knowledge base. The research team organized a knowledge-sharing meeting in which experienced team members reviewed and made presentations on topics of globalization to the rest of the research team members. These presentations covered the following topics:

- CII RT 181 – “Risk Assessment on International Projects”
- CII RT 211 – “Effective Use of the Global Engineering Work Force”
- CII RT 244 – “Global Project Controls & Management”

- National Academy of Engineering (NAE) Report Chapter – “Offshoring of Engineering Services in the Construction Industry”
- Globalization – Corporate Globalization Strategies and the 2008 KOF Index of Globalization
- Dimensions of National Cultures developed by Geert Hofstede in the 1970s
- National Science Foundation (NSF) Project – “Intercultural Knowledge System Dynamics in Complex Services Outsourcing”

CII RT 181, one of the early globalizing related research projects, examined risk assessment and risk management in international projects. They developed the International Project Risk Assessment (IPRA), which creates structural process to help identify, measure, and track risks from an early stage of project development through the opening and operation of the facility. Research Team 211 developed a framework to address the comprehensive issues involved in successful Global Virtual Engineering Teams through identifying best practices in the assignment of personnel to particular tasks, work processes, the selection of appropriate tools and technologies. They defined Global Virtual Engineering Team (GVET) as a group of geographically dispersed engineers that needs to overcome challenges related to differences in time and space orientations, as well as functional and organizational barriers. CII Research Team 244 worked on the Project Controls Team Learning and Development Program that involved an introduction to team learning and development in project controls, defining and developing a skills matrix, team learning and developmental program framework, sources of training, and finally career path.