

The GLF-CEM Key Performance Indicators Initiative

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The Trends Committee, in concert with a general need for the Global Leadership Forum for Construction Engineering Management (GLF-CEM) to consider global trends, was mandated to address one of the GLF-CEM's key objectives and purposes: To be at the forefront of developments in construction engineering and management and—through engagement with future leaders—ensure the global consideration of CEM-related issues within CEM educational programs, academic research, and industrial collaboration.

The purpose of the Trends Committee was to “report and articulate Construction/Built Environment industry¹, educational², and research trends that have the potential to or are already impacting Construction Engineering and Management and Construction Management graduate programs.”

Introduction

The first trends workshop that engaged the entire GLF-CEM membership took place in 2014 in Banff, Canada. Thirty-four issues were identified as potential markers for establishing trends against them. Those issues were broadly grouped together around four themes (Education, Industry, Research, and Funding). Several reports and presentations detailing the subsequent findings of the Trends Committee—which was led by several colleagues from the USA, Canada, South Africa, Hong Kong and the UK and lasted over 1 year—have since been

produced. The results of this work were presented in Weimar, Germany in 2015.

The adopted methodology included surveys to the GLF-CEM membership and other personal contacts. It was quickly established that the validity of the work was influenced by factors including sample size choices and representation, breadth of GLF-CEM membership, and available resources. The lack of an established baseline upon which to base any future measurements and trends was also evident. During 2015 to 2016, numerous conversations amongst the GLF-CEM membership regarding KPIs

¹Workforce and human capacity, project delivery, corporate strategy, technology and innovation, markets and demand drivers, and social and political influences, etc.

²Content offered, web-based learning, distance education, MOOCs, flipped classrooms, etc.

resulted in the creation of a joint workshop community who formally recognized the need for a global hub of KPIs in the areas of education, programs, research, and industry.

Committee Achievements

At the 2016 GLF-CEM forum in China, a special session on 'Trends and KPIs in CEM' was conducted in the form of a workshop chaired by Michail Kagioglou with presentations by Mohan Kumaraswamy (on ongoing KPI exercises in Hong Kong and India), Makarand (Mark) Hastak (on what has been done and is needed in USA), and Jan Wium (on the South African scenario and plans to develop KPIs); UK-specific examples were provided by Michail Kagioglou. A 'Global Hub' related to KPIs entitled, "Global Hub for Construction Performance Analysis and Improvement," was proposed. This project will begin by identifying specific KPIs for which data was easily available, and a sub-committee was formed to carry this work forward. This sub-committee, comprised of Michail Kagioglou, Mohan Kumaraswamy, Thomas Ng, Jan Wium, Geoffrey Shen, and Makarand (Mark) Hastak, has—as of December 2016—held five joint Skype meetings.

Current KPI Projects

United States

Pi-C (Purdue Index for Construction): The complex dynamics inherent to the context of decision-making in the construction industry requires more rigorous application of analytics. However, effective frameworks to facilitate such data-driven decision-making are noticeably lacking in the construction industry. To address this deficiency, the Purdue Index for Construction (<http://wpvcemweb01.itap.purdue.edu/CEM/Pi-C>) was developed at Purdue University to facilitate and promote data-driven decision-making in the construction industry. As a preliminary step, a hierarchical definition for health of the construction industry was defined based on the results of a literature review, survey, and interviews. The developed hierarchical definition was then used to propose a framework to benchmark, interpret, and analyze data associated with the status of the health of the industry. The proposed framework was tested with existing publicly-available data to

explore its effectiveness in improving decisions made in the form of policies or strategies. The results highlighted (i) the gap in the availability and frequency of data for analytics in the construction industry, (ii) the need for benchmarking the dynamics of the industry as a coupled system, and (iii) the potential for using analytics. Therefore, topics within the construction industry that require more rigorous data collection were systematically explored. Policy-makers and strategy developers can apply the proposed framework for data-driven decision-making using their preferred set of data as well as the data on trends. Researchers can use this framework to further explore the dynamics of the health of the construction industry on topics such as sustainable development or the diversity of the construction project area.

United Kingdom

Huddersfield University was involved in the GLF-CEM Trends Committee study that was focused on establishing a baseline for future measurements involving the areas of education, program, research, and industry. The UK has been very active in establishing KPIs for the construction sector, with Colleagues at Huddersfield University having been involved in this area for over 20 years. In particular, they have explored how construction performance should be measured and evaluated across a number of perspectives. Data collection, respective KPI reports, and the measures themselves have changed over a number of years. The data is publicly available (based on yearly analyses) through Constructing Excellence and Glenigan's, which, as of August 2016, has merged with BRE (Building Research Establishment). The data consists of three strands of Economic, Social, and Environmental measures in different sectors for various stakeholders and for particular products. Depending on when such measures were introduced, data for certain cases are available for over 15 years. Colleagues at Huddersfield have previously identified certain weaknesses in the way KPIs were interpreted and how meaningful they were. Current research aims to identify statistical correlations across the previous 15 to 20 years and to examine the possibility of establishing high-level measures that can determine industry

performance and hence, inform the global development of KPIs.

India

An Action Team on KPIs has developed a family of KPIs under the 'Ci3 India' – Construction Industry Improvement Initiative, India that was launched through IIT Madras with a Regional Building Clients Roundtable in October 2015. As of October 2016, three additional Roundtables have been held in Mumbai and Chennai bringing together top-tier building industry clients to improve industrial practices and performance levels. Five Action Teams that were established following the Mumbai Roundtable in February 2016 have progressed on specific fronts, with Action Team 1 on KPIs having recently issued the final draft of a family of KPIs for feedback from others in Ci3 India.

The 'Suggested KPIs' for Building Clients in India would allow organizations to choose from this suite of KPIs: (i) from three different groups (e.g., design phase, construction phase, or business outcomes); and (ii) at three different levels (e.g., project/organization level, benchmarking club level, or industry level). They could use chosen KPIs to benchmark internally over time, across their projects, and/or with other organizations. They could also modify these for internal use only or agree to modify jointly if benchmarking. There are two additional columns of the KPIs template that must be populated in the next stage of development: (i) to design realistic 'weighting indicators' that will help allow for special conditions by adjusting a 'typical KPI value' accordingly and (ii) to collect data for and determine typical (i.e., average) value ranges under 'normal' conditions.

South Africa

The Chair in Construction Engineering and Management at Stellenbosch University in South Africa participates in the GLF-CEM initiative to compare KPIs from different countries. Although several KPIs have been identified for comparison, not all of these are readily available from public sources. Therefore, a contribution to the initiative will be made for those indicators that are in the public domain in South Africa.

Nevertheless, the Chair is also commencing with its own study to build a database of project information that will address a specific local need. It has been found that one of the more prominent risks encountered by construction organizations on projects is the quality of project documentation prepared by clients and consultants. Several reasons are cited by industry players, but the study aims to gather sufficient evidence to justifiably identify key indicators. For this reason, a program will be launched to capture project information from large public clients who are regularly involved in infrastructure projects. Typical information would include, but not be limited to, the planned and final project cost and duration, consultant fees, number of changes (or variations), number of drawings, and the qualifications and experience of project team members. It is expected that once it has been proven that such data can be captured successfully, the initiative can be expanded to also capture other key indicators. The project will commence in the first half of 2017.

Hong Kong

A contract research study has been initiated by the Construction Industry Council of Hong Kong to develop a set of KPIs to benchmark the performance of the local construction industry against that of other advanced economies. While the culture and requirements of the construction industry may vary between countries, the first task of this study is to identify a list of KPIs that is considered important to various constituencies. The KPIs evolve around four broad categories, namely: productivity, manpower, safety, and the environment. With that, the definition and measurement method for each KPI have been delineated.

Based on the identified KPIs and measurement methods, the research team has collected data from relevant sources for trend analyses and international benchmarking. This will enable policy makers and construction stakeholders to identify the strengths and weaknesses of the Hong Kong construction industry during the boom and bust periods and after new regulations or initiatives have been instituted.

At the current stage of the study, the analysis in Hong Kong is primarily focused on construction

performance at the industrial level—although the sectoral performance will also be a subject of this investigation in the subsequent stage. In addition, the results of this study will complement other investigations being carried out by other members at the project and organizational levels.

Next Steps/Conclusions

Based on these efforts, the committee has shortlisted the following KPIs under each of the sub-categories (Table 1). These KPIs were specifically selected because the required data is publicly available in each country (e.g., Hong Kong, India, South Africa, UK, and USA). The committee is of the opinion that, for the longevity of this effort, the required data should be publicly available to all participating GLF-CEM members in their respective countries.

We would encourage all members to identify similar data sources for the suggested KPIs within their countries. In doing so, this initiative could be spread to as many member countries as possible. Please contact any of the committee members with your interest.

Interested in participating?

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Table 1. Selected KPIs

	Industry	Program	Education	Research
Data Availability	Yes	Yes	In Progress	In Progress
Data Selection	1. Productivity ³ 2. Safety ⁴	1. No. student applications (CEM or Eng.) ⁵ 2. Employment rate of students by country ⁵	To be determined.	To be determined.

³Data available at the U.S Department of Labor, U.S. Bureau of Labor Statistics, Bureau of Economic Research (BER), and South African Forum of Civil Engineering Contractors

⁴Data available at U.S. Bureau of Labor Statistics, United Nations Statistics Division

⁵Data available at CEM Department in University of Hong Kong, Purdue University, IIT Madras, Stellenbosch University, and Hong Kong Polytechnic University