Identification of the Use of Impact of Performance Information Within the Construction Industry

Prepared By Task Group 61 / Working Commission 117
Performance Measurement in Construction
IDENTIFICATION OF THE USE AND IMPACT OF PERFORMANCE INFORMATION WITHIN THE
CONSTRUCTION INDUSTRY

by

CIB TG61

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A Report on the Findings of:
The International Council for Research and Innovation in Building Construction
Task Group 61

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**Executive Summary**

After an extensive review of the use and impact of performance information in construction, this document was created to serve as a report of the findings. The research put into this effort included both surveying and an extensive literature review. The survey overwhelmingly identified that there is lack of performance information being used within the construction industry and that there is need for the use of performance information within the industry. The literature review employed nine separate academic search engines (EI Compendex, ABI/Inform, Emerald Journals, Scholar.Google, Iliad interlibrary service, ProQuest, ScienceDirect, ASCE Library, and Informaworld) and more than 200 separate combinations of search terms in order to maximize the area canvassed by the literature search. The eight search engines, excluding Scholar.Google, spanned more than 7,000 journals and more than 55 countries. The nine search engines were chosen based on the fact that they covered construction, engineering, architectural, and business management fields.

More than 15 million articles were returned by the search engines. Titles and descriptions were read for the returned articles in order to determine if they were relevant to the use and impact of performance information within the construction industry. More than 4,500 of the articles returned by the search engines had at a minimum their abstract read in order to determine relevance. A total of 16 articles were identified in which performance information had been implemented in order to create sustainable performance increases. There were also 42 articles identified in
which at least a case study into the use of performance information was conducted. An additional 79 articles identified the need for performance information.

In response to the lack of performance information being used within the construction industry worldwide The International Council for Research and Innovation in Building Construction (CIB) Task Group 61 has created The Journal for the Advancement of Performance Information and Value. The journal is tied to a living database and interactive interface that were designed to be used by all of journal’s subscribers. The combination of the Journal and the database will allow for the dissemination of the implementation of performance information in the construction industry and greater collaboration amongst industry representatives and researchers to increase the performance of the construction industry.
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Section 1 - Introduction

The construction industry is under increasing pressure to improve its practices (Hill 1992), and is suffering from a lack of performance. "Performance management is a growing concept in construction and this is evidenced by the numerous methodologies and approaches to measuring that have recently been introduced (Lee 2000)." Within the construction industry the objective of performance information is to impact and improve construction performance (Kashiwagi 2008). Performance information has been defined as "the set of metrics used to quantify both the efficiency and effectiveness of actions (Neely 1995)." Key metrics that apply to performance information in the construction industry correspond to cost, schedule, and customer satisfaction. Simply quantifying the effectiveness of a contractor or project is not effective. The data that is collected and measured must be able to affect change in either the client organization, the contractor, or in the project itself in order for it to be effective.

In various literature sources, the terms performance information, performance measurements, performance metrics, and benchmarking are often used interchangeably. Depending on what region of the globe a study was conducted in, the term "benchmarking" has often been used in place of the term "performance information." According to the Construction Task Force, benchmarking can be used as reference points to measure change (Martin 2004). The Construction Task Force further defines benchmarking in a management sense, "the continuous process of measuring..."
Section 1 - Introduction

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products, services and practices against those recognized as industry leaders to promote the improvement of performance (Martin 2004).” For the purposes of this report, performance information is considered to be any information that can be collected and utilized to measure the performance of a client organization, designer, contractor, facility manager or specific construction projects.

Objectives and Developments

The International Council for Research and Innovation in Building Construction (CIB) commissioned Task Group 61 (TG61) in 2006. TG61 was charged with capturing the use and impact of performance information from around the globe. TG61 determined that the best way to canvas the use of performance information within the global construction industry was to identify any regional experts using performance information as well as any regional systems which incorporate the use of performance information. The next step would be to identify any recorded impact that the identified researchers or systems were experiencing or had experienced. This report serves to present the findings of TG61. This report is made up of five parts, with Part I outlining the report objectives and TG61 developments. Part II will provide a review of the research that went into the creation of this document. Part III of the report will identify international experts in the use of performance information in construction and provide summaries of the existing systems that utilize performance information within the construction industry. Also included in Part III is an analysis of the impact the identified systems have. Part IV outlines the new efforts of TG61, future research, and future deliverables. The conclusion will be contained in Part IV of the document.
Section 2 - Research Review

The initial research conducted by TG61 into the understanding of performance information was via a literature search. The literature search exhausted all available search mechanisms and resources available to the researchers. In order to achieve useful results it was necessary to establish base search criteria. The criteria were developed with intentions of being simplistic in order to allow as wide of a sampling as possible. In order for the article to be indexed it was necessary for it to apply to the construction industry, facilities management, procurement of construction, or construction design and engineering. With simplicity in mind, the following criteria were developed to determine if an article should be indexed:

- Any research that identified the need for performance information to be used within the industry.
- Any research that proposed a system or metrics for measuring performance.
- Any research that had tracked performance measurements.
- Any research that had actually implemented the use of performance information to increase performance within the industry.

During the literature search it was discovered that there is far more technical information available within the construction industry than performance information. Technical information includes: specifications, cycle time analysis, labor hour analysis, machine hour analysis, general productivity analysis and modeling, material and resource consumption analysis, and safety modeling. Technical information requires
intensive tracking of many metrics that is not plausible on an industry wide scale.

Measuring a vast quantity of metrics does not necessarily add value, as was noted by Brown in 1994 “…measuring more things does not guarantee quality (Brown 1994).” This sentiment was also reflected by The International Review of Benchmarking in Construction, “Experience shows that it is better to concentrate on a relatively few, well-defined [metrics] than to attempt to produce a large set which may only confuse the user (Bakens 2005).”

Performance information is simple and tracks only metrics that are easily identifiable and easy to track. In order performance information to be effective it must require minimal resources and effort to produce. Simplicity and logic are the two keys to establishing a performance information system that can have an impact by increasing performance.

Both academic and non-academic search engines were used in order to ensure that the literature review would obtain as much relevant literature on the use of performance information within the construction industry as possible. If an article contained information from any of the bulleted points it was indexed and put through a further review. The articles that had dialogue regarding the use of performance information within the construction industry were cataloged and placed in a database. A second search followed once the search engines had been exhausted. The second search was conducted in order to locate any articles that were referenced in any previously indexed articles. This was repeated for each article until only circular references existed, with a circular reference being any article that had already been indexed. Four main academic search engines were employed for this task.
The first of the four search engines was the EI Compendex, which is a database and search engine with over 10 million records from more than 5,600 scholarly journals, trade magazines and conference proceedings. The EI Compendex contains academic writings dating from the present back to 1969. More than 650,000 records are added annually to the database and more than 5,600 academic journals and conference proceedings are indexed annually. The database is updated weekly with articles spanning 190 engineering disciplines in 55 different countries.

Emerald Journals is the second of the four main search engines used in this research effort. Emerald Journals is a searchable database. The more than 190 academic journals contained in the database span many industries, but all contain a management focus. The Emerald Journals database covers many of the previously mentioned industries which are relevant to this research effort. These industries include: facilities management, engineering management, and construction management.

The third academic search engine that was relied upon to conduct the bulk of the research effort was ABI/Inform. ABI/Inform searches articles from more than 1,100 English-language publications. These publications span the entire globe and focus on business and management. The relevant publications to this research effort that are indexed by ABI/Inform include the Journal of Facilities Management, Engineering News Record, Journal of Construction Engineering and Management, Cost Engineering, American Association of Civil Engineers International Transactions, International Journal of Project Management, Engineering, Construction, and Architectural Management.
A fourth search engine was employed in the initial literature search. This search engine was Scholar.Google. Scholar.Google provided mixed results. The search engine has no search parameters built in, thus it searches all writing that is available via the internet. During the initial search Scholar.Google provided such vast results that reviewing the results was impractical. The format for which the results were provided also made it difficult. The articles entire title was often not provided in the results and the articles were often not accessible via the links provided.

After exhausting the previously mentioned resources, an in depth search was conducted in order to locate the relevant articles that were identified as references in the articles returned by the search engines. Again, to find the referenced articles, the same four search engines were employed. This search also utilized several other search engines as well. The other search engines used included Illiad interlibrary service, ProQuest, ScienceDirect, ASCE Library, and Informaworld. Although Scholar.Google was not an effective tool for the initial literature review, it was incredibly effective at locating single articles that were searched for using bibliography listings. If the search engines were unable to provide access to an article then direct searches for the referenced articles were conducted. Direct searches consisted of going directly to the source publications of the articles referenced. Both hard copies and electronic copies of articles were located using this process. A circular process of locating any referenced articles was repeated for all new articles that were located and added to the database. Searches continued until all new articles provided no new articles that were not already contained in the database.
The terms that were searched via the search engines during the initial literature search are logged in Table 1. Also logged in Table 1 is the number of hits provided by each search.

**Table 1: Key Word Search Log**

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<tr>
<th>Terms Searched Search</th>
<th>Engine</th>
<th>Hits</th>
<th>Engine</th>
<th>Hits</th>
<th>Engine</th>
<th>Hits</th>
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<td><strong>13,182,800</strong></td>
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</table>

After the original search, follow up searches were conducted on the various key words that were identified by the original search. The key words and acronyms identified during the original search were searched in combination with any or all of the following terms (dependant on whether or not the key word applied to that industry): “construction”, “procurement”, “facility management”, “design”, “architecture,” or “engineering”. The key words and acronyms were identified by reading applicable articles that were identified by the original search. Some of the identified key words that were searched include:
1. PQI: Process Quality Indicators
3. PSI: Project Success Index
4. PMS: Performance Measurement System
5. SPM: Stakeholder Perspective Measurement
6. BPM: Basic Performance Measurement
7. EVM: Earned Value Management
8. KPI: Key Performance Indicators
9. Balanced Scorecard
10. Total Quality Management Reengineering Construction
11. Revaluing Construction
12. The Performance Prism
13. CBPP: Construction Best Practices Program

The literature review and research effort was affected by two major constraints: a language barrier and access to articles. The first constraint was created by a language barrier which was experienced by those conducting the search. The literature review was conducted entirely in English, for it is the only language the researchers were fluent in. Therefore the findings included only literature that was originally presented in English or had been translated to English from another language.

The researchers collaborated with the members of CIB Task Group 61 in order to avoid a potential bottleneck, created by the language barrier, which would limit the investigation into the use of performance information within the construction industry.
Members of the group cover many regions of the globe from Africa, Asia, Australia, Europe, and North America. An invitation was sent out to all TG61 members asking them to submit any literature pertaining to the use of performance information in construction for review. The survey also asked for suggestions of experts to review, or programs to research. Any articles that were received via this method were reviewed for content and then added to the database. A separate literature search was conducted using the same steps previously used in the original literature search for each person who was identified as an expert by the returned surveys.

The second constraint that literature review faced was the ability to access certain articles. The researchers conducting the review lacked affiliation with certain scholarly archival services, thus they were prevented from accessing several articles. The list of these articles is provided in Appendix A. (The researchers would like to openly invite any of the authors listed in Appendix A to submit a copy of their work, so that they can be identified and given credit as an expert in the use of performance information).

Guiding Document

During the literature review a report created by PSI Bouw was discovered. PSI Bouw is a network formed by companies, government and other organisations and universities, in which all innovative knowledge and experience are concentrated on regenerating Dutch construction industry (“What is PSI Bouw?” 2008). The document discovered was the final report from a review of international experience in construction benchmarking. This document served to help shape the goals of TG61 as they pertained to the search
for performance information within the construction industry. The review covered various benchmarking systems from around the globe and chronicled the various metrics that were used by each system in order to determine what system or metrics would be the most beneficial if applied in the Netherlands. The report provided a thorough summary of 25 different benchmarking schemes. Though 25 separate systems were chronicled no information was provided as to what impact these systems have had on the industry.

**Literature Search Results**

After reviewing all of the information provided by the literature review it was clear to the researchers that there are many different proposed systems for the measurement of performance within the construction industry. However, there is no consensus amongst the authors and researchers reviewed as to whether or not the systems are based on appropriate metrics. Furthermore, there is no consensus as to whether or not the proposed systems are capable of being implemented on a broad scale.

The proposed systems to utilize performance information that were discovered during the literature search were vastly different and were proposed by many different authors and organizations. The proposed metrics that would be used to measure performance in the located articles also varied greatly, both in complexity and ease to gather. A majority of the articles proposed a plethora of metrics that were difficult to track and compile or even accurately measure. The detailed nature of the proposed metrics found in most of the reviewed literature prohibit them ever being utilized in an efficient
manner that would actually drive performance. As was mentioned previously The International Review of Benchmarking in Construction noted that in their experience they found that it is better to focus on a small number of well defined metrics, than to attempt to produce a large quantity of metrics. In an industry that is typically viewed as slow to change and that is limited by resources, it would likely be difficult to institute any performance measurement system on a broad scale in which contractors or owners were responsible for tracking hundreds of metrics.

The most common metrics that were proposed in the reviewed writings included variations of the following: cost measurements, safety records, schedule, customer/client satisfaction, and productivity. These elements were often proposed in various forms, there was no consensus as to how the individual elements such as cost or schedule would best be measured and tracked.

The search engine results that were returned during the literature search provided more than three million articles. Of the three million articles located 4,500 articles were identified as potentially relevant and were reviewed either by reading the entire article or reading the abstract. Of the 4,500 articles reviewed, 137 fit the criteria to be included in the database and were then sorted into the three groups shown in Figure 1.
Group One: Articles Identifying the Need for Performance Information

The literature review returned 79 articles that identified the need for performance information within the construction industry. These articles are identified in Appendix B, Part 1. Many of these articles proposed a system for measuring performance within the construction, facilities management, or design industry but took no actual measurements. These articles establish that for performance within the construction industry to improve, performance information is necessary in order to create a performance baseline that can be used to measure future gains. A common theme in the 79 articles in group one is that there is no consensus amongst researchers and industry as to which metrics are the most effective metrics to utilize. Many of the articles strive to simply identify effective measurements that can be implemented and suggest future testing upon those metrics.
One such writing that established a need for the use of performance information was titled “A Methodology for designing performance measures for the UK Construction Industry”. One take away from the article was that many measurements that are being considered by other researchers are too far removed from the individual project to make them effective measurements to incite change, “KPIs (Key Performance Indicators) are high-level indicators and both companies and projects will need a broader range of metrics to enable them to continuously improve the design and construction process (Lee 2000).”

Another article which identified the need for performance information within the construction industry was titled “Management’s Perception of Key Performance Indicators for Construction” and was published in the Journal of Construction Engineering and Management. The article states: “There is a great need in the construction industry for identifying a set of common indicators to be used by construction executives and project managers in measuring construction performance at the project level (Cox 2003).” The article also identifies that in order to effectively implement the use of performance information within the construction industry simple methods must be used, “Instead of reporting and disseminating every piece of information gathered on the job, a more simplified method should be used to gather only that data which directly predicts performance for the task to be measured (Cox 2003).” An additional finding of the article was that there are existing models for implementing and monitoring construction activities, however “[the models] fail to identify which indicators will accurately portray the changes in performance (Cox 2003).”
Group Two: Articles Chronicling a Case Study on the Use of Performance Information

In addition to the 79 articles that identified the need for performance information or proposed a system for measuring performance, 42 additional articles were located that had tested a proposed system for the implementation of performance information and/or actually collected performance information. The articles are identified in Appendix B, Part 2. The 42 articles that make up group two were primarily made up of case studies. These articles typically proposed further research to determine the effect that the proposed metrics or system could have on the construction industry. Future research and/or the implementation of pilot programs could potentially be used to demonstrate that these systems do indeed drive performance within the industry.

The articles in group two were typically case studies that were intended to lead to future research. One such article was titled “Performance measurement in the construction industry: An action case investigating manufacturing methodologies.” This article chronicled a case study in which a performance measurement system (PMS) was created in order to show that there are benefits to implementing a performance information system. The article provided, “Empirical evidence that appropriately designed performance measurement systems developed from different stakeholders, if appropriately implemented will improve visibility, communications and other cultural changes such as a more proactive management style (Nudurupati 2007).” Even though the article established the benefits of a performance measurement system, it also noted that the conclusions were based on a single case study (Nudurupati 2007).
A similar paper titled, “Benchmarking System for Evaluating Management Practices in the Construction Industry” had also taken performance measurements. Again this article failed to capture the impact of that performance information. The article does not identify any sustainable performance gains; rather it “presents the results obtained for the initial application of a management evaluation system whose objective is to provide a continuous improvement tool for construction companies through benchmarking management practices (Ramirez 2007).” The takeaway from the article is that a qualitative benchmarking system was established for the construction industry. The qualitative benchmarking system provides information on the basis of the knowledge and perceptions of key personnel. The system described is part of a management evaluation system that aims to compare management practices, discover relationships between performance data, and determine industry trends (Ramirez 2007). The article provided no data as to how the performance of construction benefited from this benchmarking system.

Often times the articles in group two suggested that further research be conducted into the use of the performance information system which they had tested or collected measurements for. Many of the systems were a part of relatively infantile research endeavors that could benefit from further exploration. It is possible that in the future the systems described in Group 2 could produce sustainable measurable increases in performance within the construction industry.
The results of this literature review revealed that there are currently systems in place that are using performance information in order to increase performance. These systems had documented results showing performance gains which could be directly attributed to the use of performance information. Three different systems and a total of 16 articles, which documented performance increases due to the use of performance information, were identified by the literature search. These 16 articles are identified in Appendix B, Part 3. The systems that successfully documented the use of performance information within the industry in order to drive performance will be discussed in the following order: the PASS system, the Fort Worth Equipment Services Department system, and the PIPS system.

**PASS**

A documented system that has improved construction performance is PASS (Performance Assessment Scoring System) system. The PASS system was created by the Hong Kong Housing Authority in 1990. The system was created as means to facilitate the ultimate target of “continuous quality improvement” in managing the list of building contractors (HKHA 1994). PASS measures performance output directly against defined standards by using yes or no answers where work is judged in terms of its compliance with pre-defined standards. When future tender opportunities are presented by the Hong Kong Housing Authority a construction firms existing PASS score is used for their consideration (Tam 2000). The system regulates poor performance by ensuring that low performing contractors eliminate themselves from obtaining future contracts by
receiving low PASS scores. Documented increases in performance include that in the past three years (2004-2007) alone the average PASS score has increased 4.5% (Fung 2007). An increase in a PASS score indicates that work being performed is increasing in its compliance rating with the defined standards. PASS also tracks safety on the jobsite by recording injuries and accidents. Since the implementation of the PASS system there has been a 95% increase in safety performance (Fung 2007).

**Fort Worth ESD**

The literature review identified a facilities management organization in Fort Worth, Texas that has been using performance information to increase performance since 2001. The Equipment Services Department at the city of Fort Worth implemented a performance measurement system. In Fort Worth the Equipment Services Department is responsible for the fleet services of 36 different city departments. These departments include the water, police, and fire departments. The Equipment Services Department realized that a paradigm shift was necessary when vehicle availability and labor utilization were lagging and the department was over budget. The assistant equipment services director Rudy Payton stated, “We changed from a culture where we were considered successful by our adherence to rules to a culture where every person, right down to the shop floor, is responsible and accountable for the organization’s results (Stewart 2005).” The shift was made by instituting performance measurements. The department began measuring the amount of time every individual technician spent on each work order placed in their care. This allowed the department to measure each individuals daily output. The performance measurements that were recorded then served as an incentive to high performers who wished to obtain high performance ratings. The
performance measurements also exposed low performing individuals. Once the performance information was available to them, the department was able to decide on a path of action and has increased vehicle availability by 15 percent. An additional benefit realized by the performance measurement system was that when low performers were removed, work order response time decreased and the number of work orders decreased from 58,000 in 2002 to 39,000 in 2004. The decrease of 19,000 work orders per year can be attributed to the removal of low performers. With high performing individuals performing all of the work, repairs are being done correctly the first time and the need for rework has been eliminated (Stewart 2005).

PIPS

The final system that was identified during the initial literature review, which was identified as using performance information to increase performance, was PIPS (Performance Information Procurement System). This system was the most documented system discovered by literature search. PIPS was developed as a procurement process designed to assist owners in the identification of the best value contractor for their construction projects. During the 15 years since its creation, the PIPS process has evolved into a project management model. The procurement model incorporates the use of past performance information (PPI) as one of the key components in the decision making criteria. The past performance information aspect of PIPS uses eight simple criteria on which contractors are rated on a 1-10 scale. These ratings are completed by a contractors past clients in order to create a performance line for that contractor. Each separate firm proposing on a given project has a performance line created that
will remain in the owner’s database and be used on future projects as well. PIPS forces contractors to perform by having the owner rate a contractor’s performance at the end of the project. In turn, that rating counts for 50 percent of that contractor’s future performance line when submitting on work with that owner. If a contractor fails to perform and receives a poor rating, that rating will greatly reduce said contractor’s chances of obtaining work with that owner in the future. Some of the documented results for the PIPS system include that 61% of the owners utilizing PIPS say that it requires less effort than traditional procurement methods and 91 percent rate PIPS better than previous methods of procurement (Kashiwagi 1999). The most staggering of the results documented by the PIPS system include a 98 percent on time on budget rate as compared with a 60-70 percent on time on budget rate within the rest of the construction industry (Kashiwagi 2005). During the 15 year history of PIPS, owners employing the system have been surveyed to identify their satisfaction with the PIPS system. When asked to rate their satisfaction with their previous procurement process, owners indicated their level of satisfaction with performance was an average three on a scale of 1-10 with 10 being high. Those same owners rating of the PIPS process was nine on the same scale (www.pbsrg.com).
Section 3 - Identification of Experts

For the purposes of this report, there were two ways in which an individual could be considered an expert in the use of performance information within the construction industry. The first way for an individual to be considered an expert would be through identification by their peers. Thus, the members of CIB TG61 were surveyed and asked to identify leading researchers. The second way for an individual to be considered an expert in the use of performance information was to have three of their works contained in the literature database. Having three published academic papers was used to indicate that an individual has spent significant time researching performance information.

Experts Identified by CIB TG61

In the fall of 2007 a survey was sent out to all 91 members of CIB TG61 representing 23 countries. The survey asked the members to identify any researchers or any research reports that documented successful and sustained implementation of performance information within the construction industry. TG61 members provided little information pertaining to researchers in the use of performance information within the construction industry. The recipients of the survey were asked to identify any leading researchers in their region of the globe in the following fields: risk minimization, performance metrics, and efficient construction.

Of the surveys returned, no single survey identified more than five individual researchers. Most of the surveys returned identified zero to two researchers focused in any of the
aforementioned areas. Due to the broadness of the fields surveyed (risk minimization, performance metrics, and efficient construction) the researchers conducting the survey were expecting a much larger number of individuals to be identified than actually were. Within the list of researchers identified by the survey, most already had works contained in the literature database created during the literature review. Any researcher/author that had been identified by the returned surveys had a literature review completed to cover all over their published works. If any applicable works were identified, then those works were added to the database.

Beyond asking for researchers to be identified, the survey also asked whether or not those taking the survey could identify any other use of performance information, performance measurements, or performance metrics that are currently in place or that have been successfully used within the construction industry. As with the previous question regarding the identification of researchers, there was very little information provided by the respondents. The members of TG61 could not identify more than five researchers and in many cases zero researchers who are researching the use of performance information within the construction industry. This fact indicates that currently there is no collaborative effort amongst researchers or within the industry to use performance information in order to improve the performance of the industry as a whole. A total of 35 individuals were identified as experts by the survey.
Experts Identified by Literature Review

The authors having works included in the database represent a broad spectrum of countries and organizations. Many of the authors within the database are represented by more than one article. The researchers conducting the literature review determined that any author with at least three works in the database could be considered an expert. By contributing to a minimum of three articles demonstrates that an individual has knowledge in the area of performance information in the construction industry. Three articles also demonstrate a time commitment that has been made into the researching of the use of performance information in the construction industry. Table 2 shows that 168 authors had at least one article in which they were the author or a coauthor. Also shown in Table 2 is that there were 26 individuals who had authored or coauthored a total of two works contained in the database. Finally, Table 2 also demonstrates that there were a total of 25 individuals who had authored or coauthored at three or more articles.

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<th>Number of Articles:</th>
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<td>2</td>
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<td>&gt;3</td>
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Of the 25 individuals who have at least three works in the database, five were also identified by the surveys conducted by CIB TG61. These five individuals are as follows: Luis Fernando Alacron, Dayana Costa, Carlos Formoso, Dean Kashiwagi, and Kenneth
Sullivan. A list as well as a small biography of the 55 individuals identified as experts by either the survey with or the literature review can be found in Appendix C.
Section 4 - Future Developments

As CIB TG61 progresses in their identification of the use and impact of performance information within the construction industry there are several deliverables being manufactured in order to assist the group in disseminating their findings.

Journal for the Advancement of Performance Information & Value

The survey that was sent out to the 91 members of TG61 also contained a section where respondents were asked to qualitatively rate statements relating to the use of performance information in the construction industry. A rating scale from one to ten was used for the respondents' answers. A rating of one (1) indicated that the respondent fully disagreed with the statement that they were rating. A score of ten (10) meant that the respondent fully agreed with the statement. Table 3 shows the results of two of the statement that the respondents were asked to rate.

<table>
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<th>Statement</th>
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<td>Performance Information is used widely in the construction industry:</td>
<td>3.75</td>
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<tr>
<td>Performance information should be used much more in the construction industry:</td>
<td>9.31</td>
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The qualitative results provided by the returned surveys confirmed the quantitative results obtained via the literature search, which indicated that performance information
is not widely used in the construction industry. The survey results in Table 3 show that there was a consensus amongst respondents that performance information is not widely used within the construction industry. At the same time there was a consensus that performance information should be used much more within the construction industry. In order for performance information to be used on a broader scale within the construction industry there needs to be a platform created from which all relevant studies and literature can be presented. The researchers within CIB TG61 have created *The Journal for the Advancement of Performance Information and Value* in order to serve this need. *The Journal for the Advancement of Performance Information and Value* is a publication dedicated to the use, implementation, and documentation of performance information within all aspects of the construction industry. *The Journal for the Advancement of Performance Information and Value* differs from traditional academic journals in the following ways:

1. Peer review will be done by both academics and industry personnel.
2. Peer review will be refereed by the editorial board. Contrary reviews will have to be supported by expertise and documentation, or the review will be overturned.
3. Peer reviewers will be responsible to be accurate and have supporting documentation.
4. Submittal, peer review, and publication will be done in less than six months.
5. Publication standard is to add significant knowledge or impact to the industry in the area of use or documentation of the use of performance information. Peer review will not be to judge the theoretical content for correctness, but rather to
judge if the hypothesis is supported by information, and the hypothesis testing was done correctly.

6. If the proposing author submits references within their paper, the paper must either be in the TG61 database, or the author must show how the referenced individual is in a position to make the referenced statements.

**Global Database & Performance Information**

The living database classifies all relevant articles into one of three categories. Group one in the database contains those articles that identify a need for performance information to be used in the industry or propose a performance measurement system. Group two in the database is compiled of articles that ran a case study and collected performance information, but did not use that information to increase performance within the construction industry. Finally, group three contains the articles that chronicle a system whose users are using performance information to increase performance within the construction industry.

The database will be updated in two different ways. The first way that the database will be updated will be via new submissions from author/researchers. When an article is submitted, it will be reviewed for relevance and acceptance for publication. If an article is deemed to be relevant it will be classified into one of the three groups. The references contained within any submitted paper will also be checked for relevance and be reviewed for inclusion in the database.
The second way that the database will be updated is through biannual literature searches. The biannual literature searches will be conducted using the same format that was outlined in Part 1 of this report. Those responsible for the updating the database will perform journal searches and employ the same academic search engines, as well as any new mediums that are identified to assist in a thorough review. Figure 2 illustrates the process of updating and maintaining the database.

![Figure 2: Article Review Process](image)

The database will also house an interactive interface that will allow users quickly access real-time performance information by scrolling over various parts of the globe. The interface will consist of a globe that when scrolled over by a users mouse will provide performance numbers for various countries, regions, or systems. Performance lines will be created for countries, regions, and systems based on the information that is pulled from articles within the database.

Each article accepted by the journal will be entered into a living database that is tied directly to the journal itself. The goal behind the combination of the new CIB Journal
and a database is to create a new operating procedure for future journals while also providing researchers with a valuable research tool. The journal and database will establish a single location for information on the use and impact of performance information in the construction industry to be accessed. It will have the following characteristics:

1. It will encourage the documentation of all uses of performance information.
2. It will not only have academic research results, but industry results captured by credible sources such as the Engineering News Record (ENR) in the United States.
3. It will minimize personal bias, by ensuring the expertise of the peer reviewers.
4. All peer reviewers will have their vitae posted in the accompanying database of information.
5. It will maintain integrity of the peer reviews by forcing reviewers to document any criticism of author’s assumptions and hypothesis with references that are in the accompanying database.
6. The peer review itself will be reviewed by the editors to maintain fairness.
7. All major references in the journal papers will either be in the database of performance information kept by TG61 or require the supporting information from the reference.
8. Papers will be reviewed and published within six months.
9. Access to journal papers and performance information database will be by over 1,000 construction clients, contractors, and designers within the US, and by researchers worldwide who are subscribers of the TG61 journal.
In addition to the journal and database, the research conducted has identified the following areas for additional investigation:

1. Impact of performance information in specific industry sectors.
2. Use of performance information in organizational change.
3. Use of performance information in the reduction of bureaucracy.
4. Use of performance information in procurement.
5. Use of performance information in the alignment of resources.
Section 5 - Conclusion

Currently there is a lack of documentation of the use of performance information within the construction industry. A survey that was sent out to researchers that were members of CIB TG61 was only able to identify 35 researches from around the world that were conducting research which focused on the use performance information within the construction industry. Although there were only 35 researchers identified by the survey, there was an overwhelming sentiment amongst those completing the survey that performance information should be used much more in the construction industry. A literature search that was conducted in conjunction with the survey was only able to identify 25 experts. This made for a total of 55 experts identified by TG61, due to the fact that five individuals were identified by both the survey and the literature review.

The literature search only produced 16 academic articles that documented the use of performance information in order to increase the performance of construction and/or contractors. The sixteen articles covered only three different performance information systems that had documented successful sustainable gains in performance due to the use of performance information. In addition to the 16 articles there were 42 articles that had performed an initial investigation into the use of performance information via a case study in which measurements were taken. These 42 articles took performance measurements, but failed to use the information that was collected in order to increase the performance of the construction industry. Of the articles that were accessible to the researchers completing the literature review, there are more articles that call for the
use of performance information than there are articles which took actual performance measurements or conducted a case study.

There is no consensus amongst researchers as to what metrics should be measured when implementing the use of performance information. This indicates that there needs to be more collaboration amongst researchers in the area of performance information. In order to combat the lack of collaboration amongst researchers TG61 has created The Journal for the Advancement of Performance Information and Value. The journal will serve as a platform for future research in performance information that can address the needs of the construction profession. The journal is unique in that it coincides with a database designed to house all of the articles published within the journal. The database will also house all of the articles referenced within the journal. The journal has created a situation, where for the first time, all of the available information in a particular field of research will be housed in one location. The database will also be connected to an interactive global interface that will allow users to obtain current performance information by scrolling their mouse over different regions of a map.

As was evidenced by the 16 articles that had documented results, performance information is a powerful tool that can be used to motivate and affect change if it is properly applied. The construction industry can greatly benefit from the usage of performance information. It is now the task of TG61 and all interested researchers and industry representatives to develop the optimal path for the future.
Bibliography


Appendices
Appendix A:
Inaccessible Articles
Appendix A- Inaccessible Articles


Fayek, A. Robinson. 2006. CSCE Canadian Civil Engineer, Special Issue on Benchmarking in Construction, Issue 23.4, Autumn.


Hassan Nasir; Mohamed Attalla; Ugyen Dorji; Carl Haas; Jeff Rankin; Aminah Robinson Fayek. Studies in construction performance benchmarking. Canadian Society for Civil Engineering, Annual Conference, June 10-13, 2008, Quebec City, under review.


Appendix B: Reviewed Articles
Appendix B - Reviewed Articles

PART 1 - Articles Identifying the Need for Performance Information (Group 1)


**PART 2- Case Studies on the Use of Performance Information (Group 2)**


**PART 3- Articles Demonstrating Sustainable Performance Gains Due to the Use of Performance Information (Group 3)**

Appendix C:
Experts in the Use of Performance Information within the Construction Industry
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<td>Sullivan, Kenneth</td>
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<td>Thorpe, Tony</td>
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<td>53</td>
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<td>Wamelink, J.W.F.</td>
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<td>55</td>
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<td>China</td>
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Appendix C:
Biographies of Experts
Name: Luis Fernando Alarcon

Email: 
Phone: 
Bio: A civil engineer from Universidad de los Andes (1975), Mr. Alarcon Mantilla attended graduate school in Economics at the same university and has a Master of Science in Civil Engineering - Hydraulic Resources Systems from the Massachusetts Institute of Technology – MIT (1979). In 1995 he took part in the Advanced Management Program at Oxford University. Before being appointed as General Manager of ISA, Mr. Alarcon Mantilla presided over the Asociacion de Administradoras de Fondos de Pensiones y Cesantias – Asofondos de Colombia and during the Presidency of Virgilio Barco served as Minister of Finance. Along his professional career Mr. Alarcón has additionally occupied the following positions: Colombian Representative as Executive Director of Inter-American Development Bank, President of Flota Mercante Grancolombiana, member of the Board of Directors of Banco de Bogota, Colombia Stock Exchange, Petrocolombia S.A., ISA, CTEEP and INTERNEXA.

Name: Dilanthi Amaratunga

Email: R.D.G.Amaratunga@salford.ac.uk
Phone: +44 (0)161 2954471
Bio: Dr Dilanthi Amaratunga is the Director of Postgraduate Research Studies of Salford University’s 6* rated Research Institute for the Built and Human Environment. Dilanthi has achieved widespread recognition of her work in facilities management and process improvement through an extensive number of published international refereed journal papers and by means of presentations made at major conferences in both UK and overseas. She is an Overseas Research Students Award Scholar, awarded by the Committee of Vice Chancellors and Principles of Universities in the UK for outstanding merit and research potential.
Name: Chimay Anumba

Email: c.j.anumba@lboro.ac.uk
Phone: +44 (0)1509 222615
Bio: Professor Anumba graduated at 18 with a First Class Honours degree in Building. He worked briefly as a Site Engineer and as a Design Engineer before undertaking postgraduate research in Computer-Aided Engineering at the University of Leeds. On completion of his PhD in 1989, he joined Curtins Consulting Engineers plc, and was involved in a wide range of civil and structural engineering projects. This was followed by a period as a Senior Lecturer and Reader in Computer-Aided Engineering at the University of Teesside. Professor Anumba is currently founding Director of the Centre for Innovative and Collaborative Engineering (CICE) and Professor of Construction Engineering and Informatics at Loughborough University.

Name: Wim Bakens

Email: wim.bakens@cibworld.nl
Phone: +31 10 411 0240
Bio: Dr. Bakens regularly authors single or in series scientific articles in the national and international building and construction press. He is the author - editor of the CIB Publication 172 on "Future organization of the Building process", 1997. He is a frequent speaker to industry and international conferences and symposia and lectures on building management and organization at Dutch Universities. Dr. Bakens is also a referee for the UK Journal "Construction Management and Economics." Currently Dr. Bakens is the secretary general of CIB. CIB is an international association whose objectives are to stimulate and facilitate international collaboration and information exchange between organizations active in the field of Building and Construction Research and Technology Development.
Name: David Baldry
Email: d.baldry@salford.ac.uk
Phone: 0161 295 4499
Bio: Research centre for the Built and Human Environment, School of Construction and Property Management, University of Salford, Manchester, UK. Full Member of Research Institute - Research Institute for the Built & Human Environment (BuHu), Full Member of Research Centre - Management in Construction, Member of Faculty - Faculty of Business, Law & the Built Environment and Associate Head of School (Teaching) - School of the Built Environment.

Name: Luis Fernando Botero
Email: lfbotero@eafit.edu.co
Phone: 
Bio: Architect builder, specialize in management of engineering companies. Professor, Civil Engineering Department, University EAFIT, research group coordinator GESCON (Construction Management). Medellin, Colombia.
Name: Daniel Castro-Lacouture
Email: dcastro@gatech.edu
Phone: 404-385-6964
Bio: Daniel Castro-Lacouture (Assistant Professor, Building Construction, Georgia Tech University) received his PhD from the School of Civil Engineering at Purdue University in 2003, a master’s in construction management and engineering from the University of Reading (UK) in 1999, and a bachelor’s in civil engineering from Universidad de Los Andes, Colombia in 1994.

Prior to his employment at Georgia Tech, Castro-Lacouture served as an assistant professor of construction engineering and management in the Department of Civil Engineering at Ohio University.

Name: Ada Chan
Email: ccada@hkcc-polyu.edu.hk
Phone: 
Bio: Dr Ada Chan obtained her Bachelor's Degree in Construction Economics and Management with a first-class honour at The Hong Kong Polytechnic University. Upon graduation, she joined Levett & Bailey Chartered Quantity Surveyors Limited - a leading firm in its field - as a quantity surveyor. In 2000, Dr Chan received a postgraduate scholarship to pursue her PhD studies with the Department of Building and Real Estate at PolyU and was awarded her PhD in 2004. Dr Chan is also a member of the Hong Kong Institute of Surveyors.
Name: Albert P.C. Chan  
Email: bsachan@polyu.edu.hk  
Phone: (852) 2766 5814  
Bio: Professor Albert Chan had 5 years hands-on experience in the field of construction project management before changing to an academic career in 1987. He is a Chartered Builder, Engineer, Project Manager, and Surveyor by profession. Prof. Chan has worked in a number of tertiary institutions both in Hong Kong and overseas, including City Polytechnic, the predecessor of the City University of Hong Kong, University of South Australia, Queensland University of Technology, Bond University, and The Hong Kong Polytechnic University. He has been commissioned by a number of organizations to provide consultancy services in project management and construction economics. Prof. Chan holds an MSc in Construction Management and Economics at the University of Aston in Birmingham, and a PhD in Project Management at the University of South Australia. He is an Adjunct Professor of the University of South Australia, and Queensland University of Technology, and Bond University, Australia, and a Founding Director of the Construction Industry Institute, Hong Kong.

Name: Daniel W M Chan  
Email: bsdchan@inet.polyu.edu.hk  
Phone: (852) 2766 4387  
Bio: Daniel obtained his BEng(Hons) degree in Civil and Structural Engineering and PhD degree in Construction Project Management from the Department of Civil Engineering, The University of Hong Kong. Thereafter, he worked as a Research Assistant and Senior Research Assistant for the same University until August 2000. He started his engineering profession as an Assistant Structural Engineer in September 2000 by joining a local leading structural building design consulting engineering practice. He is a project manager and construction manager by profession.
Monika Chao-Duivis (born in 1953) has been a full professor of Building Law since 2004. She specializes in private law, within which she focuses especially on contract law, tendering law and liability law. Research into the consequences of new European legislation is one of the aspects she deals with, and she also carries out research into relatively new types of contract, such as DBFM contracts (design, build, finance and maintain), where traditionally different roles are combined - a building contractor who also designs, or a business that is involved in design, building operations and management work, for example. Although this type of contract is very complex, Chao-Duivis sees opportunities for using elements from them in standard building industry contracts. She gives lessons in building law and supervises students approaching graduation and PhD students, and she also writes books and articles. Relaxation of tendering law is, in her opinion, set to become an important area of research in the near future. She would like to give more lessons at the faculty, particularly to architecture students, as they will need knowledge of the law later - either when advising their clients, or when setting up their own business.

In addition to her work as a professor, she is a director of the Instituut voor Bouwrecht (building law institute), that initiates and performs independent research in the field of public and private building law. She is a mediator at the Garantieinstituut voor de Woningbouw (housing guarantee institute) and the disputes committee of the KIVI (the Royal Institution of Engineers in the Netherlands), and spends one day a month as a judge or deputy judge at the court in The Hague. On behalf of TU Delft, she sits on the board of the Stichting Expertisecentrum Regelgeving Bouw (building regulations expertise centre foundation).
Name: Dayana Costa
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Phone: Ph.D. Candidate, Federal Univ. of Rio Grande do Sul (UFRGS), Bldg. Innovation Res. Unit (NORIE).

Name: Diego Echeverry
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Phone: +57 332-4312/14/15 Extn 3690
Bio: Civil Engineering, M.Sc., Ph.D., University of Illinois (USA). Associate Professor at Universidad de los Andes. Coordinator of Faculty of Construction Management and Engineering. He's currently the Director of the department of Civil and Environmental Engineering. He currently works in planning and project control, and in the application of computational tools in construction. His interests: Time-Lapse as a tool for observing constructive processes, in time periods (compressed video), for further analysis and optimization. Standardize bar codes in the construction industry to gain greater control of inputs (materials, equipment, tools and manpower), savings in time and resources, and reduced errors and inaccuracies in the management of inputs. Potential computational Internet tool, as a tool to support Project Management, primarily as a strategy of integration and communication in the construction industry. Alternatives that allow lower costs on materials and construction methods, to come up with solutions to the problem of housing.
Name: Charles Egbu

Email: c.o.egbu@salford.ac.uk
Phone: +44(0)161 2956807
Bio: Professor Charles Egbu joined the University of Salford in the Summer of 2007. Prior to Salford, Charles served as a Professor of Construction and Project management at the School of the Built and Natural Environment at Glasgow Caledonian University, Glasgow, UK. He is also the co-Director of the Centre for Advanced Built Environment Research (CABER), UK.

He obtained his PhD in Construction Management from the University of Salford, UK. He was previously a Reader of Construction and Project management at Leeds Metropolitan University; worked as a Lecturer and Senior Research Fellow at the University College London, UK and as Senior Consultant and Project Manager at the Building Research Establishment, UK.

Name: Mohammad El-Mashaleh

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Bio: Research Interests:
Contract administration and FIDIC conditions of contract
Information technology (IT) deployment and utilization in the construction industry
Benchmarking construction firm performance
Cost and schedule controls
Name: Carlos Formosa
Email: formoso@vortex.ufrgs.br
Phone: 
Bio: Employed by the Federal University of the Rio Grande Do Sul

Name: Rob P. Geraedts
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Phone: 31 15 278 1269
Bio: Expertise: Innovation of design & construction process; Open building implementation and concepts; Flexibility in the design & construction process; Flexibility of products; Transformation of buildings; Performance concepts in buildings; Design management
Name: Douglas Gransberg

Email: dgransberg@ou.edu
Phone: (405) 325-6092
Bio: Associate Professor/Professor, Construction Science Division, The University of Oklahoma, Norman, Oklahoma. Teaching both graduate and undergraduate courses in Construction Science and Contract Administration. Courses cover subjects such as cost estimating (using Timberline Precision Estimating and HCSS Heavy Bid software), project management (using Primavera P3 and SureTrak software), design-build contracting, quality control/quality assurance, construction contract administration and construction materials and methods. Conducting research in alternative project delivery methods, constructability, heavy highway construction methods, and numerical analysis to quantify the qualitative. Appointed as technical advisor to the Oklahoma Governor's Task Force on Construction Law.

Name: Carl Haas

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Bio: Carl T. Haas is the Tier I Canada Research Chair in Construction and Management of Sustainable Infrastructure at the University of Waterloo. His research, teaching and consulting are in the areas of advanced construction and transportation technology, sustainability, and construction workforce issues. He teaches courses in Construction Automation, Sensing in Civil Engineering, Heavy Construction, Optimization, Engineering Economics, Scheduling, and Project Management. His most recent research is in the areas of sustainability, rapid local area sensing and modeling for construction automation, 3D scanning and analysis of aggregates, tele-operated robots for hazardous environments, critical construction operations planning, automated infrastructure maintenance, trenchless technologies, remote highway condition and incident detection, and construction workforce issues. He has received several research and teaching awards. He consults in the area of construction and transportation technology issues. He has over 150 publications.
Name: Raymond Issa
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Bio: Consultant to various construction companies and on several engineering projects; Professor of Computer and Information Sciences; Mississippi Valley State University; Associate Professor, Architectural and Construction Engineering Technology; University of Southern Mississippi; ASEE/NASA 1992 Summer Fellow.

Name: Youngsoo Jung
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Bio: RESEARCH INTERESTS
- Project Delivery Systems: Project Delivery Methods, Project Management Systems
- Cost & Time Management: Estimating, Cost Control, Scheduling, Earned Value Management Systems (EVMS), Automated Performance Control (APC)
Name: Pekka Houvinen

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Name: Dean T. Kashiwagi

Email: Dean.Kashiwagi@asu.edu
Phone: (480) 965-4273
Bio: Dean T. Kashiwagi, PhD, is a professor at Arizona State University's Del E Webb School of Construction and also the Director of the PBSRG. PBSRG is the worldwide leader in improving facility/project performance and efficiency. Kashiwagi has developed a “hands off” approach to managing contractors or vendors in any industry. His concept is contrary to traditional price-driven procurement. The technology has been tested over 500 times totaling $1.135 Billion ($683M in construction projects and $451M in non-construction projects) with a 98% success rate since 1994. He work is now being tested in the Netherlands. Kashiwagi has integrated these concepts into a Facility-Project Asset Graduate Program at ASU. His presentations are highly sought out by highly recognized international organizations such as the Project Management Institute (PMI) Global Congress.
Name: Malik Khalfan

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Phone: +44 (0)161 295 6277
Bio: Dr. Khalfan is a Senior Research Fellow a Salford University. Dr. Khalfan's expertise is in construction management, procurement, risk management, sustainable construction, collaborative environments, supply chain management, benchmarking and key performance indicators.

Name: Juhani Kiiras

Email: juhani.kiiras@hut.fi
Phone: +358 9 451 3741
Bio: MSc (Tech) in Structural and Civil Engineering at HUT. Assistant, researcher and laboratory engineer in CEM unit at HUT. Professor in CEM 1978-1980 at Oulu University and Professor in CEM at Helsinki University of Technology 1981-. Expert and consultant in CEM for both public and private sectors. Supervision and instruction of about 400 Master’s theses, 15 Licentiate theses, and 5 Doctoral theses in CEM. Several hundreds presentations, research publications, conference papers, and consultation reports in Finnish as well as some in English, German, and Russian.
Dr. Mohan Kumaraswamy teaches and researches at the Dept. of Civil Engineering of The University of Hong Kong, where he has been since 1992. After his BSc. (Eng.) in Civil Engineering from Sri Lanka in 1976, he worked on designs, construction and construction management in Sri Lanka and Nigeria, before earning an M. Sc. in Construction Management, and then a Ph.D., both from Loughborough University, U. K.

He led many innovative construction project management assignments and internationally funded consultancies, before coming to Hong Kong. He has been active (and held key posts) in many Professional Institutions, including the Chartered Institute of Building, the Hong Kong Institution of Engineers and the Asian Construction Management Association. He contributes widely to Industry Development/ Link Bodies in Hong Kong, such as the Provisional Construction Industry Co-ordination Board, the Construction Industry Institute Hong Kong, and the Center for Infrastructure & Construction Industry Development (CICID), where he is the Honorary Executive Director.

Pertti Lahdenperä

Employed by VTT Technical Research Centre of Finland (CIB full member)
Name: Edmond Lam

Bio: Edmond W.M. Lam obtained his BSc(Hons) degree in Construction Economics and Management with commendation (First in Class). He completed his PhD in 2005 and he is currently a Project Fellow at the Department of Building and Real Estate, The Hong Kong Polytechnic University. Dr Lam has published several research papers on the theme of construction procurement management in refereed academic journals and international conference proceedings.

Name: Sergio Leusin de Amorim

Bio: Graduated in Architecture and Urbanism, Federal University of Rio de Janeiro (1974), Master in Production Engineering from Federal University of Rio de Janeiro (1981) and Ph.D. in Production Engineering from Federal University of Rio de Janeiro (1995). He is currently a professor at the University Federal Fluminense, which carries the post of vice-coordinator of the Graduate Program in Architecture and Urbanism. He has experience in the field of Architecture and Civil Engineering, with emphasis on technology, serving mainly in the following areas: management of process design, management and quality management in construction and applications of information technology in AEC.
Name: André Manseau
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Bio: N/A

Name: Tayyab Maqsood
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Phone: +61 3 9925 3916
Bio: Tayyab is a Lecturer in Construction and Project Management at RMIT in Melbourne, Australia. He is a Civil Engineer and has worked in Australia, Hong Kong, UK, Thailand, and Pakistan in various capacities as lecturer, project engineer and research associate over last 11 years. His doctoral research was based on the topic of Knowledge Management, Learning and Innovation in the Australian Construction Industry.
Name: Pedro Maria-Sanchez
Email: pmaria@uabc.mx
Phone: N/A
Bio: Professor, Faculty of Engineering, Km. 103 Carr. Tijuana-Ensenada, Univ. Autonoma de Baja California

Name: Gerry Meade
Email: gmeade@summitblue.com
Phone: 416-566-8616
Bio: Gerry Meade is a Professional Engineer with more than 25 years of experience in energy management including technology assessment, program design and support, project management and business operations. He is experienced in assessment of new energy efficiency technologies for the industrial, commercial and residential sectors, analysis of energy savings for a variety of energy management programs, and in program/project measurement and verification.

The majority of Mr. Meade’s career was spent at Ontario Hydro where he was responsible for analyzing new DSM technologies and evaluating their potential to meet the needs of the Ontario commercial and industrial customers. He reviewed and approved energy conservation applications for customers and verified the accuracy of the results. He was responsible for providing technical support on residential, commercial and industrial demand management programs and utility automated metering systems. He also conducted market research studies and developed marketing programs for commercial and industrial customers dealing with heating and cooling systems, lighting and lighting controls, building control systems and power quality.

Prior to joining Summit Blue, Mr. Meade was the Executive Director of the Canadian Construction Innovation Council (CCIC), a new association that provides leadership in promoting and coordinating research and innovation in and for the Canadian construction industry. He performed a similar function as the founding Executive Director of the Continental Automated Buildings Association.
Name: R. Edward Minchin

Email: minch@ufl.edu
Phone: 352-273-1153
Bio: In a 25-year career, Dr. Minchin has worked for four major areas of highway construction. Starting his career with Couch Construction Company (later APACFlorida), he worked for a highway construction contractor. Moving to the Florida Department of Transportation (FDOT), he worked for a major construction owner in a number of capacities, from construction inspector to the state’s Chief Area Construction Engineer. Once in academia, Dr. Minchin served as a consultant to the Iowa Department of Transportation (IDOT) on two contracts dealing with the largest construction project in the state’s history, the I-235 Corridor project through Des Moines. Finally, as a researcher, he has participated in numerous highway construction research projects for the Pennsylvania Transportation Institute, the USDOT, IDOT, FDOT, and equipment manufacturers Ingersoll-Rand and Caterpillar.

Name: Sherif Mohamed

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Phone: (07) 555 28575
Bio: Prof. Mohamed's principal research interests lie in the area of project and construction management. More specifically, he focuses on the development of theoretical knowledge and operational tools needed for effective management of risk, knowledge, quality, safety, technology, investment, etc. He is actively engaged in scholarly work and employs a variety of qualitative and quantitative techniques, ensuring that he is well grounded in modern research tools of the project management, operational research, engineering economics, business and social science fields. He has authored and co-authored over 100 refereed journal and conference publications in the last 10 years.
Name: Thomas Ng

Email: tstng@hkucc.hku.hk
Phone: +852 28578556
Bio: Thomas Ng, an associate professor in HKU's Department of Civil Engineering

Name: William J. O'Brien

Email: wjob@mail.utexas.edu
Phone: (512) 471 4638
Bio: William is interested in cost and information modeling of collaborative systems to aid construction industry efforts in design-build, supply-chain management, and e-commerce. Current research projects include: Subcontractor cost and information modeling, as part of a larger initiative in supply-chain management. Determining the value of collaborative information technology (such as project web-sites) on design and construction projects. Design and implementation of next generation collaborative systems, including integration of heterogeneous information and connection of distributed processes.
Name: Pekka Pajakkala
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Bio: Employed by VTT Technical Research Centre of Finland

Name: Ekambaram Palaneeswaran
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Name: Hee-Sung Park
Email: jackdaniel@cricmail.net
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Bio: Assistant Professor, Dept. of Civil Engineering, Hanbat National Univ., Daejeon, Korea.
Name: Feniosky Pena-Mora

Email: feniosky@uiuc.edu

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Bio: Associate Provost Feniosky Peña-Mora is an Edward William and Jane Marr Gutgsell Endowed Professor in the Department of Civil and Environmental Engineering, Center Affiliate at the National Center for Supercomputing Applications and a Faculty Affiliate at the Beckman Institute at the University of Illinois. Professor Peña-Mora earned a Master of Science (M.S.) degree in Civil Engineering and a Doctor of Science (Sc.D) in Civil Engineering Systems from the Massachusetts Institute of Technology (MIT) in 1991 and 1994, respectively. Before coming to the University of Illinois in 2003, Professor Peña-Mora was an Associate Professor of information technology and project management in MIT’s Civil and Environmental Engineering Department. Professor Peña-Mora has also held positions as a visiting professor at Loughborough University in Great Britain and at the Ecole Polytechnique Fédérale de Lausanne in Switzerland. Professor Peña-Mora is the holder of some of the most prestigious awards in the profession; the 1999 National Science Foundation CAREER Award and the 2000 White House Presidential Early Career Award for Scientists and Engineers (PECASE) Award. More recently, he has won the 2007 ASCE Walter L. Huber Civil Engineering Research Prize and the 2008 ASCE Computing in Civil Engineering Award. He has served as an Associate Editor for the ASCE Journal of Computing in Civil Engineering and editorial board member of the IEEE Internet Computing Magazine. He is currently a Specialty Editor for the ASCE Journal of Construction Engineering and Management and editorial board member of Automation in Construction, the Journal of IT in Construction and the Revista Ingeniería de Construcción. He has been invited to give keynote and plenary speeches at numerous conferences and symposiums, including the 2001 National Academy of Engineering Frontiers of Engineering Symposia, the 2003 American Society of Civil Engineers Symposium on Information Technology in Civil Engineering, and the 2004 National Academies Convocation on Facilitating Interdisciplinary Research. Currently, he is serving in the National Academies’ Committee on Advancing the Productivity of the U.S. Construction Industry.
Name: A.D.F. Price
Email: a.d.f.price@lboro.ac.uk
Phone: 44 (0)1509 222627
Bio:
Over 25 years design, construction and industry-focused research experience. Obtained BSc in Civil Engineering from Nottingham Trent University. Worked for four years as Structural Engineer for Jackson Peplow Consultants before joining Loughborough University as Research Assistant in 1981. Became a lecturer in Construction Management in 1984. Early research focused on construction productivity and the motivation and development of human resources. This evolved to include several project management related topics, including integrated design and construction, integrated supply chains, partnering and less adversarial long-term relationships. In recent years, the focus has moved towards measuring and improving the socio-economic aspects of construction performance, this has included: construction value, sustainability; performance improvement; Total Quality Management; and benchmarking.

Name: David Proverbs
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Phone: 01902 32 2786
Bio:
David Proverbs, Professor of Construction Management, BSc(Hons), PhD, MCIOB, PG.Cert. Ed. is presently Head of the Construction and Infrastructure Department in the School of Engineering and the Built Environment at the University of Wolverhampton, UK. His academic career began in 1994 as a Research Assistant, this following ten years of industrial and managerial experience in the UK construction sector. He became a Lecturer in Building Technology in 1995; followed by promotion to Senior Research Fellow in 1998 and then to Academic Section Leader (Principal Lecturer) in 2000. He is now Vice-Chair of the Council of Heads of the Built Environment (CHOBE) in the UK and a member of the CIOB Educational Committee. Areas of research specialism include international benchmarking; construction productivity; contractor performance; flood damage assessment and flood repair; and satisfaction issues.
Name: Jeff Rankin

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Phone: (506) 453-4618
Bio: Current Research Interests:
- Information mobility for the AEC industry
- Knowledge management for the AEC industry
- Technology adoption within the AEC industry
- Systems of innovation for the AEC industry
- Novel approaches to and applications in support of project management

Name: Dr. Aminah Robinson Fayek, Peng

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Bio: Dr. Robinson Fayek has developed a core research program in the development and application of fuzzy logic techniques for use in intelligent decision support systems, to help design and construction personnel improve the cost, schedule, and productivity performance of their projects. Her current focus is on developing hybrid systems that incorporate fuzzy logic with other artificial intelligence and modeling techniques (such as artificial neural networks, expert systems, and simulation models) to overcome the limitations of each, and to provide more robust modeling approaches.
Name: Sicco Santema

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Phone: +31 (0)15 27 84896
Bio: Director and founder of Scenter, also professor of B2B Marketing, Delft University of Technology professor and E-Business Marketing & Procurement at TU Eindhoven. Sicco Santema is technically business and tax advice with experience in business and government. He is CEO and founder of Scenter. Within Scenter methods and models are developed for increasing the efficiency of marketing and sales functions in organizations. Scenter customers are particularly medium-sized business-to-business companies. Sicco Santema focuses on the upgrading of industrial sales and account planning for industrial companies. He has worked at Shell and in the organizational adviesbranche by Boer & Croon and Holland Consulting Group. He is also part since 1992 Business Marketing professor at the Technical University of Delft since 2001.

Name: John Savicky

Email: John.Savicky@asu.edu
Phone: (480) 965-4273
Bio: John Savicky is a lecturer and senior project manager at the Performance Based Studies Research Group (PBSRG), at Arizona State University (ASU). John has 11 years of experience in best-value systems, and is an expert on the Performance Information Procurement System (PIPS). His main duties involve; educating users and vendors on how PIPS works, assisting users with test implementations, assisting users in modifying PIPS to meet legal requirements, and educating vendors and users on the IMT concepts and PIPS process. John has been the lead project manager on 439 PIPS projects, procuring almost $610 Million in construction and non-construction related services. John has worked with both private and public agencies including: the University of Minnesota, United Airlines, City of Peoria, City of Roseville, Harvard University, State of Hawaii, University of Hawaii, Dallas Independent School District, State of Utah, Raytheon Missile Systems, the US Coast Guard, and the US Army Medical Command.

John Savicky received his undergraduate and graduate degrees in Construction Management from Arizona State University. John has published over 30 articles and currently teaches a course on Best-Value Procurement at ASU.
Rodney Stewart

Email: r.stewart@griffith.edu.au
Phone: (07) 555 28778
Bio: Dr Stewart has active research interests in the field of engineering, construction and project management. Specifically his research covers topics such as innovation in construction (project information management systems, building information models, IT project life cycle management, innovation diffusion), process improvement (six sigma, TQM, international standards), modern procurement practices (joint ventures, PPP, BOOT, alliance contracts, technology transfer), water resource management (water end-use analysis, recycled water strategies, least cost demand management solutions), smart asset management (decision support systems, fibre optics) and engineering education (project based learning, work integrated learning, international students).

Kenneth Sullivan

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Bio: Kenneth Sullivan is the deputy-director of the Performance Based Studies Research Group (PBSRG) and the director of the Facility Management Research Institute (FMRI) as an assistant professor in the Del E. Webb School of Construction at Arizona State University. His research focuses on risk management, cost engineering, productivity, best value, and leadership in facility management and the built environment. He is well versed in quantitative methodologies, statistics, and data analysis techniques and teaches courses in advanced estimating, research methods, and facility management. Sullivan’s research fundamentally seeks to shift established organizational paradigms into a more efficient structures composed of measurement-based systems of accountability, resulting in the reduction of inefficient practices of over-management and the increase of risk control. As co-founder, and now Secretary of Research for the International Council for Research and Innovation in Building and Construction (CIB) Task Group 61, Kenn has been commissioned to generate a global performance metric for construction and facility management, and create a new journal focusing on performance information and risk. Kenn has also published 58 peer-reviewed papers and is a frequent speaker, both domestically and internationally.
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A professor of civil engineering who holds the Joe C. Walter Chair at the University of Texas at Austin College of Engineering. Tucker is a founder and former Director of the Construction Industries Institute (CII). This national research consortium involves 30 universities and 80 major corporations. As associate dean of Engineering at UT Arlington in the late 1960s and early 1970s, Dr. Tucker guided the development of graduate programs in civil, aerospace, materials, industrial, electrical and mechanical engineering. He has published hundreds of articles in professional journals and is a frequent keynote speaker at national and international conferences on construction issues. Dr. Tucker was named to the National Academy of Engineering in 1996 and received the Ronald Reagan Award for Individual Initiative in 1990. In 1994, he was chosen as a Distinguished Graduate from the UT Austin College of Engineering. He is the 1990 recipient of the Joe J. King Professional Achievement Award at UT Austin.
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Jeroen van de Rijt is a senior adviser to Scenter (www.scenter.nl). He advises organizations on diverse issues in the field of marketing and strategy. From the formulation of a corporate strategy for the long term and the development of new products to draw up plans account. He believes in making choices and its own based on the strength of the organization. This leads to more energy in the organization and thereby to a better feasibility of the plans. Jeroen together with Sicco Santema author of the book "Marketing Planning, the art of choosing" and "The final marketing plan, no choice without direction." He has also published numerous articles in professional journals.

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J.W.F. Wamelink has been appointed as professor of Design & Construction Management in the faculty of Architecture, department Real Estate & Housing since April 2006. His main focus is on the co-operation between the various parties involved in the building process, the relation between costs and quality, as well as on issues on steering possibilities in the development and realization phase of building projects. Research on new ways of contracting that will facilitate the parties to work together in a different way, is another issue. To gain new insights, Wamelink is also interested to compare the problems in the building sector with similar and different industries abroad. The Chair takes care of the education in bachelor as well as in the master degree programme. Apart from his job as professor, Wamelink is general director of Infocus, a company specialized in consultancy and building management. After finishing his Phd at the Delft University of Technology he worked for ten year as an assistant professor and researcher at the Faculty of Technology Management of the Eindhoven University of Technology.

Dr. Guangbin Wang is professor at Research Institute of Project Administration and Management (RIPAM), Tongji University in Shanghai China. His research fields include AEC project management, IT application in AEC. He is a member of CIOB, and a Registered Project Manager and Consultant Engineer of China. In the last 16 years Dr. Guangbin Wang was involved in construction practice of several large scale projects in China. His research will focus on VDC (Virtual Design and Construction) at CIFE in one year.


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