

State of the Art Research Model: Brunfield Research Center

Dean Kashiwagi , Jacob Kashiwagi

Del. E. Webb School of Construction, Arizona State University, Tempe, AZ, USA

dean.kashiwagi@asu.edu, jacobk@exchange.asu.edu

Abstract

A major problem in the construction management research area is the difficulty for traditional research programs to add value to the construction industry in a timely manner. Some of the issues include the methodology of doing research and getting research grants, the requirement of researchers to do administration work and teach undergraduates, the lack of research laboratories in the area of construction management and delivery, the disconnect between the academic research community and the industry, and the inductive exploratory research approach of the academic research groups. Brunfield is a highly progressive development/construction group, which not only optimizes its current operations, but every five years they plan significant changes to their operations to increase their value generation. Brunfield will take a very progressive research model and simultaneously perform theoretical research, prototype testing, implementation, their supply chain, development, real estate operations and construction operations as laboratories for research. The paper describes their research model, their research staffing, publication and implementation of the research, and interface with university research institutions.

Keywords

Construction system solution

1. Introduction

The Malaysian construction industry has funded the Construction Industry Development Board with research funding to solve problems in the industry (CIDB, 2009). However, the mechanism has not been very successful in assisting university research groups to acquire funding, do meaningful research, or impact the industry with value added results (Hussein, 2009). The problem is not clearly identifiable, but the industry has blamed the university research groups for not being capable, while the university groups blame the industry for not partnering and using their capability. By observation, the following can be identified (Kashiwagi, 2010; Hussein 2009):

1. University research groups have not been successful in helping the industry.
2. The industry has not partnered with the university research groups.
3. The issues are not clearly identified.
4. There are problems in the delivery of construction.
5. There is no strategic research plan to improve the industry.

The Performance Based Studies Research Group (PBSRG) at Arizona State University (ASU) has proposed for the last 17 years, that the construction industry has a system problem, and not a technical

expertise problem. The problem is that the industry has tried to minimize the risk of nonperformance using management, direction, control, inspection instead of the alignment of expertise. PBSRG also proposed the following:

1. The wrong party, the buyer, is doing the talking.
2. The right party, the expert vendor, should be doing the talking.
3. Communication between buyer and vendor should be minimized.
4. The price based delivery system forces contractors to be reactive, and minimizes the value of technical expertise and planning, and forces contractors to maximize risk.
5. The use of the contract to control the contractor is "useless" and the biggest source of risk.
6. Best value contractors instinctively think in the best interest of the client/buyer.
7. The contract should be a risk minimization mechanism, that identifies what is to be accomplished, and should be written by the vendor.

These concepts have been implemented by visionary owners and contractors over the past 17 years (Kashiwagi, 2011; PBSRG, 2011). Most of the visionary owners have been government groups. The tests incorporating these concepts have been very successful (PBSRG, 2010). However, government groups are very bureaucratic, and the implementations have been limited in scope. A major private organization has not implemented the best value PIPS model and the accompanying Information Measurement Theory (IMT) philosophy. There are several issues in implementing the best value environment, which depends on the university research group:

1. Experts in IMT are rare.
2. There are no university courses teaching IMT and PIPS in Malaysia. Two programs that do have courses are Delft in the Netherlands and Arizona State University in the United States.
3. Traditional construction management courses teach concepts of management, direction, and control which are opposite to IMT.
4. University curriculums are setup for traditional management, direction, and control.
5. Industry demand for the results and environment of best value PIPS and IMT is high, but due to a lack of educators, researchers, and educational programs, owners/buyers and contractors cannot resolve the current issues.

Even in the U.S., where Arizona State University (ASU) has used the best value PIPS to save \$100M in university services, the value of PBSRG (source of PIPS/IMT) has not been recognized by the peers in their own department. As the usage of the best value PIPS system increases, it places traditional construction management education and research at risk due to the following reasons (Muatjetjeja et. al., 2009; Kashiwagi, 2010):

1. The source for the traditional management, control, and direction approach to the delivery of construction has been the university educational and research programs.
2. The alignment of expertise replacing the management, direction, and control approach is in conflict with traditional project management and risk management approaches.
3. The change that is required may be beyond the capability of very rigid university programs which are disconnected from the industry and using textbooks with traditional practices being taught by educators with no practical industry experience.
4. University research groups have defined their level of performance not on the ability to improve industry practice, but on peer reviews of their peers, relationships with other academics, using the material of their peers and getting research grants from government research grant groups where the decision makers are academic researchers.
5. Academic researchers use the inductive or exploratory approach to research. They rarely use real construction tests, testing out the hypothesis, adjusting the hypothesis, and retesting (the scientific method.)

6. The major tool for construction management research has been the survey and the validation of the survey results by statistical tools. This mechanism is more likely to maintain the status quo (what industry people think) rather than to change practices.
7. Many university professors consider their academic duties and rules and teaching more important than industry research objectives. The goal of many academic researchers is to one day become an administrator who directs other younger academics to do the research.
8. Many academics never do a research test with the construction industry.

2. Problem

The movement of the best value technology to Malaysia was initially designed to go through the academic research institutions. PBSRG made efforts to partner with the largest university, the best research rated university, the oldest university, and a university that provided the most interns to Brunfield. In all cases, the efforts have been difficult, not consistent, and time consuming. In each case one of the aforementioned issues became a stumbling block. Although PBSRG is still pursuing these efforts, the effort that has been rapidly shaping up is a new concept to create a research center in the construction industry which can provide all the resources for education, research, and implementation.

3. Hypothesis

Instead of the traditional model of the university being the head, and the industry supporting the the university, this effort will identify if the industry can set up the research center, and visionary universities support the industry research center. The research center requires PhD leadership, with the potential of producing PhDs and Masters degrees, laboratory resources for leadership, project development, financing, design, construction, strategic sourcing and supply chain, facility management, facility maintenance, and the performance of systems and products. The laboratory must include physical sites, projects, and industry participants.

4. Methodology

The authors have proposed that the research center have all the characteristics of a research center, but the organization and the functions will be composed of parts from different organizations. The objective of the research center will include:

1. Publications.
2. Participation in a worldwide research group.
3. Changing of current practices.
4. Study, modification, and optimization of supply chains.
5. Performance measurements of components of the supply chain.
6. Improvement of development, design and construction activities.
7. Development of leaders, leadership practices, and organizational efficiency.
8. Development of education and training systems.
9. Education of industry participants including buyers, suppliers, vendors, professionals and government regulators.

The components required include:

1. Professors.
2. Directors.

3. Educators.
4. Students.
5. Researchers.
6. Industry participants.
7. International conference presentations.
8. Journal participation.
9. University participation.

The research center shall differ from a traditional university research center in the following ways:

1. It shall be controlled by the president of Brunfield.
2. Research objectives will support business objectives of Brunfield.
3. Main research approach will be deductive instead of inductive.
4. Research results in terms of financial and quality improvements.
5. Basic theoretical, prototype testing, and implementation research will be done simultaneously.
6. Components of the research center shall be selected based on research production, flexibility, vision, and ability to support business objectives of Brunfield.

5. Research Center Organization

The strength of the concept is that Brunfield has "seemingly" unlimited capability to provide for all the components of the research laboratory. Because of their constant need for change and improvement, the laboratory is already there, but now will be formalized with some visionary assistance from very productive researchers from PBSRG.

The first order of business was to sign the research agreement and license with Arizona State University. The license allows Brunfield to own everything that ASU has and will develop. They now become the source of the best value technology in Malaysia. Brunfield therefore, is the PBSRG of the Pacific theater.

The second step is to ensure that Brunfield has an immediate educational arm which can educate, do postgraduate programs, and have leaders within Brunfield as researchers with masters and doctorate degrees. This was formulated within six months, as the UTAR University, joined the partnership by awarding Kashiwagi an adjunct professor role, with the ability to mentor PhD and masters students in the UTAR system. Kashiwagi will now work on transferring the IMT/PIPS education and research to UTAR through mentoring both the Brunfield candidates and the UTAR professors. UTAR will use the license of Brunfield since Brunfield is a major industry supporter of UTAR.

6. Research Projects

The first three research projects included:

1. Identifying how to increase performance of construction group.
2. Implementing Weekly Risk Reports (WRR) and Risk Management Plans (RMP) for all projects.
3. Creating an organizational method to educate and train future visionaries.

Brunfield had identified one of their major problems as needing more technical expertise in the project management area (Gan, 2011). The first thing Kashiwagi observed that with a two year construction schedule, up to six months was being spent on re-engineering based on overdesign. Due to the condensed

construction schedule, losing six months to re-engineering and re-scoping on a two year schedule was crucial (25% of construction schedule.) The following observations were made:

1. When the developmental plan was being created, the scoping and costing was not accurate enough.
2. The difference between the developmental plans and the building drawings should have been minimized. However, the designers were not designing with enough detail until the building drawings were required.
3. The construction drawings were made off of the building drawings, and that is the first opportunity for the construction team to see the project drawings.

There was no method to quickly and accurately get a bill of quantities (BOQ) at an earlier stage. The designers were waiting as late as possible to do their building design with the specifications. Brunfield had made a concerted effort to implement the BIM program REVIT. However not all architects were familiar with the program. The following observations and conclusions were made:

1. All architects would be required to use the BIM 3 dimensional design package REVIT. This was previously developed by Brunfield, but the implementation was not done completely.
2. The specification and building drawings would be set during the developmental phase.
3. The Brunfield contracting group would then take the building drawings and scope/cost out the project.
4. If the construction group did not cost and scope, thus verifying the budget, the development plan could not be completed. If this was done in the development phase, the difference between the development phase and the building drawings phase would be minimized.
5. The contracting group would essentially be doing their major preparation work before the construction phase.
6. The construction group would be the regulating group at every major stage (Brunfield's core expertise and what differentiates them with other competitors), forcing the development/design to be within budget (the major problem in the delivery of construction).

The system modification has tremendous ramifications in the delivery of construction:

1. It forces the use of 3D BIM technology (REVIT).
2. REVIT 3D design drawings allow the construction experts to immediately review scope and cost.
3. It identifies that a contractor's major role of costing and scoping should be done in the development and design phase, and not in the construction phase.
4. The streamlining of the process will minimize schedule deviation, thus improving the chances that high performing vendors can participate with minimal risk, thus improving quality and minimizing overall cost. It identifies the inability for high performing vendors to overcome the high cost of "down time" as the major culprit in the "high costing proposal."

The next major research objective is to implement the WRR and RMP on all projects, regardless of the phase of the projects. Kashiwagi spent a week briefing all project managers, including managers of projects in development, design, and construction. Every project manager is required to turn in a weekly risk report (WRR) and risk management plan (RMP.) The Risk Management Plan is a list of risks that Brunfield does not control, and shows how the Brunfield PM will identify and mitigate the risk. The WRR tracks the deviation in the schedule of the project. It forces the PM to:

1. Identify the source of the deviation from the plan.
2. Forces the PM to have a clear plan of what will transpire.
3. Forces a milestone schedule which identifies risk is happening.
4. Differentiate between risk that Brunfield does not control, and risk that they should control.

From this simple exercise, Kashiwagi identified the following:

1. PMs did not have a clear milestone schedule, and were not tracking deviations.

2. PMs did not have a clear plan that was well thought out and would be used to deliver the project.
3. The milestone schedule is not set up to mitigate risk, but to alert the client and the supplier when there is risk.
4. It was very difficult for the Brunfield CEO to confirm the dominant information that he needed to run the organization.

Even though presentations were given, the PMs still seem to have difficulty submitting their RMP and WRR. (Including the milestone schedule.) The next visit in July will quickly overcome the practice of not having a clear plan and milestone schedule. The last objective of the Brunfield research grant was most difficult. Brunfield wants the following (Gan, 2011):

1. Future visionary leaders identified.
2. Visionary leader training.
3. Visionary leader presentations which require extensive preparation.
4. No interruptions in the current visionary's work schedule.

A potential problem has resulted from the last objective. Many Brunfield personnel work six days a week, sometimes over 60 hours a week due to the aggressive approach to production and low risk. The future visionaries do not have time to prepare for their leadership training presentations and exercises. However, poor presentations and exercises are frowned upon as not being prepared, and the personal motivation and excitement for the voluntary program has not been the best. Some individuals do not want to volunteer for the leadership based program due to a lack of time and stress involved.

IMT states that (Kashiwagi, 2011):

1. Visionaries do less work and observe faster.
2. Each event has only one outcome, and the ability to observe the initial conditions to an event should bring the answer.
3. When extensive preparation and time is required to prepare, visionaries learn to use more of their experience and less observation.
4. Visionary work is done through observation, and not through transactions and more activity.
5. By forcing a lot of study and preparation, Brunfield may be confusing visionaries with hard workers who may be not as quick, better at preparation, and who will have a difficult time being visionaries.
6. IMT states that we cannot influence others.

Kashiwagi proposed that the education/training of visionaries be voluntary and the following be conditions of the education/training:

1. It is filled with more activities which require observation and exposure to correct concepts.
2. Participants are selected through exams, position, and motivation.
3. The program would be voluntary, and the motivation and excitement level would be very high.
4. The program would be innovative and exciting.
5. Education and training sessions would be the actual solution of Brunfield issues using IMT concepts.
6. The IMT class is brought to the participants by video. The participants also are invited to participate in the post graduate programs at UTAR under the direct mentorship of Kashiwagi.

The implementation of such an education/training program is a change of paradigm. The program will be tested out in the next three years.

7. Conclusion

The three initial objectives of the research effort: the system modification utilizing the alignment of expertise, the implementation of a WRR/RMP, and the IMT based education/training programs are all paradigm shifts for an already very successful organization. They all have the following characteristics:

1. Uses less effort and uses the alignment of expertise.
2. Requires the observation of the initial conditions and the ability to predict the future outcome.
3. Requires planning.
4. Uses dominant information to make the conditions transparent.

The Brunfield research effort is groundbreaking because:

1. A construction company is attempting to set up a research center which does forward thinking and "out of the box" conceptual research, prototype testing, and implementation.
2. The industry research center is doing research activity that is beyond most university research groups.
3. The research center has laboratory facilities that are realistic, can run repeated tests, and cover the entire supply chain in development, construction, and facility management.
4. Use concepts that are against the traditional management, control, and direct processes.
5. Implementing industry structure and IMT concepts that have not been introduced in developing countries.
6. An industry research center that is led by the industry and supplemented by visionary university groups.

PBSRG has proven that the industry will take risk to work with a university research group. Research groups need to show capability to make an impact. This test will be continuing for the next three years. If the results are successful, the construction management research environment will be altered.

8. References

- CIDB. (2009) "Bridging the Gap between Construction Industry Stakeholders and Researchers, (University/ Academia REPORT ON R&D FORUM)", *CIDB Convention Centre*, KL, Malaysia.
- Gan, D (2011). Brunfield Board Meeting, Brunfield, Kuala Lumpur, Malaysia, March 25, 2011.
- Hussein, J. (2009) "Bridging the Gap between Construction Industry Stakeholders and Academic Researchers." *A keynote address for 2nd Construction Industry Research Achievement International Conference (CIRAIC 09)*, Kuala Lumpur, Malaysia.
- Hussein, J. (2009) "Graduate Education Research Model of the Future" Chairman of Construction Industry Development Board Malaysia, *2nd Construction Industry Research Achievement International Conference*, Kuala Lumpur, Malaysia, Keynote Speaker 1, (November 3, 2009).
- Kashiwagi, D. (2011) *PIPS / PIRMS: The Best Value Standard*, "Performance Based Studies Research Group", Tempe, AZ, ISBN: 978-1-889857-32-9.
- Kashiwagi, D., Kashiwagi, J., and Sullivan, K. (2010) *Obstacles in Becoming a Research Institution in Developing Countries*, "RICS COBRA 2010", University of Dauphine, Paris, France, paper 2, ISBN: 9781842196199 (September 2-3, 2010).
- Kashiwagi, D.T., Kashiwagi, J., and Savicky, J. (2009). Industry Structure: Misunderstood by Industry and Researchers. *Journal of Research, NED University of Engineering and Technology*, 6 (2) pp.59-76
- Muatjetjeja, M. Mselle P., Kashiwagi, D. and Sullivan, K. (2009) "Development of a Professor in the Project Management Academic Profession" *The Fourth Built Environment Conference*, Zambia, pp. 308-320 (17 - 19 May 2009).
- PBSRG. (2010) Performance Based Research Group Internal Research Documentation, Arizona State University, Unpublished Raw Data.
- PBSRG (2011). *Performance Based Studies Research Group*. Retrieved February 23, 2011 from PBSRG Web site: <http://pbsrg.com/overview/documented-performance/>