W117 Performance Information in Construction: Summer 2019 Research Roadmap

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Introduction

W117 is responsible for the development and continuous testing of the following technologies:

1. Best Value Approach (BVA) (Kashiwagi, 2019).
2. Best Value (BV) Intellectual Property (IP) technology.
5. Information Measurement Theory (IMT) and Kashiwagi Solution Model (KSM) and related models such as Spectrum of Observation (Kashiwagi, 2019).
7. A new project management model based on IMT.
8. Definitions of Risk, Expert and movement of Project Management by management, direction and control (MDC) to Project Management by simplicity, alignment of expertise, language of metrics and transparency.
9. A new risk management model that focuses on the risk that the expert vendor does not control.

To help understand the value of information and transparency, the Industry Structure (IS) model which was created in 1991, and modified continually, has been changed to an information based IS model (Figure 1). The development of the information based IS model has identified the importance of information and transparency. This has become the model that is transforming the Saudi Arabian Classification System.

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**Figure 1: Information Based Industry Structure Model**
The activities of WII7 are responsible for the following impacts of the Best Value Approach (BVA) concepts on the delivery of construction:

1. Rijkswaterstaat, the largest user of construction services in the Netherlands, won the 2012 Dutch Sourcing Award (DSA) for the successful completion of a $1B infrastructure project called “fast-track projects” using BV-PIPS.

2. NEVI, the Dutch procurement professional organization, has licensed the Best Value technology from ASU and has identified the approach as a mainstream approach to the delivery of services, educating and certifying procurement professionals in the delivery of construction and other services.

3. Dutch visionary and author Sicco Santema, and his protégé Jeroen Van de Rijt, published a Best Value Procurement (BVP) book, using Dutch test cases to show the BVA technology was compliant with European Tender Law (12,000 books sold). Other books (in Dutch) were also published for the contractor community.

4. RISNET, a Dutch risk management association, licensed the Best Value Approach in order to increase the use of the risk-based project management in the construction industry.

5. W117 BVA certification system was developed, which certifies competence of BV professional practitioners.

6. W117 introduced the BVA into Canada, resulting in $3M research grants for the delivery of construction services in 25 different universities and government organizations.

7. W117/PBSRG Best Value signed a sole source agreement with the National Association of State Procurement Officials (NASPO) and their subsidiary, the Western States Contracting Association (WSCA), to allow all states to utilize the W117/PBSRG technical expertise by “sole source.” This has led to tests in 33 different states.

8. Introduction of BV into Malaysia in 2012, into the Project Management Master’s Program, led by Dr. Fah Choy Chia at Universiti Tunku Abdul Rahman (UTAR).

9. Introduction of BV into India in 2014 resulting in the noted engineering school, SJCE, adopting the curriculum into their engineering school.

10. Introduction of BVA into Norway in 2014, through the FIR, the construction engineering association. FIR also translated the Dutch book into Norwegian, going public on June 20, 2016, during a three-day event to include the first certification of Best Value professionals in Norway. The first BVA testing occurred in 2016 (with the award made in 2017), and with a minimum of five additional tests scheduled in 2017. The first large BVA certification testing sponsored by W117, occurred in 2017 in Trondheim, Norway. Earlier individual certifications occurred in 2014 and 2016.

11. Introduction of BV into Poland with a three-day conference in Krakow in March 2016, with the publication of the translated Dutch Best Value Procurement (BVP) book into Polish. The first W117 sponsored certification training occurred in April 6, 7th 2017 with the licensed Polish BV Foundation. The first BVA project is currently being run in 2019 to procure an IT software package.

12. A major classification system project is being designed for the Kingdom of Saudi Arabia [2016 – present].

13. A major joint venture is investigating creating a BVA training site in Belgium.

14. Introduction activities in Switzerland, Denmark, Finland, Hungary, and Germany.
These research efforts have led to the following future research and development opportunities:

1. Development of the language of metrics in the delivery of construction services.
2. The development of a new risk management and project management models.
3. Opportunity to test the sustainability of innovation in traditional environments.
4. Opportunities to test the innovative concepts in different countries.
5. Opportunity to identify and test the sustainability of testing new theoretical concepts in the industry without the traditional extensive academic research literature search and investigations.

**Future Direction of W117 Research (2018 – 2023)**

The worldwide competitive marketplace is moving toward automation and information systems. The major user of automation is the country of China. By observation, once the user of low-cost labor, the inconsistency results have forced China to become the world’s foremost user of automation. This type of competition is forcing the optimization of supply chains (lower costs and higher performance). W117 has been the leader in the documentation of performance information research and how to utilize the performance information to increase project performance in the CIB. Dr. Dean Kashiwagi (co-chair) has identified a very aggressive course of the next five years of W117 to address the following:

1. Make the current academic/industry research structure more efficient and effective.
2. Create a research structure that takes the information to the industry through a more effective website, presentations and satellite sites.
3. Create transparency through easy and fast access of information.
4. Change the education/training path to the industry by exposing the information environment to the future generation before they enter the industry.
5. Change the supply chain to take advantage of a more automated risk management and project management model utilizing the theoretical definitions of experts, risk, risk mitigation and project management. Although these concepts were previously identified by W117 research, implementation in the industry has been challenging.

This approach can be defined as an attempt to automate or streamline the W117 structure as well as the BVA IP technology utilizing performance information. By solving both problems by using performance information, W117 will propose that the performance information or BVA IP is recursive, and information is recursive in nature. The data which when analyzed normally identify the equation, will actually be used to replace the equation and thinking and decision making that goes along with the analysis.

**Changing the Education and Research Structure**

The traditional academic research model (see Figure 3) for the past 25 years has been where academic research analyzes industry practices and publishes the analysis in academic journals. The research normally takes 4 – 10 years to create the journal publication. University professors normally participate in a funded system such as the National Science Foundation (NSF),
Department of Transportation and other federal grant programs, Construction Industry Institute (CII) or smaller institutes such as the Design Build Institute of America (DBIA), Associate General Contractors (AGC) or other funding group. Researchers then propose on needs of the industry and must continually find and receive grant opportunities to sustain their research. The traditional research professor’s success depends on the ability to accomplish the following:

1. Get involved with the granting organizations.
2. Write proposals in the area of industry interest.
3. Be successful in winning a couple of grants.
4. Be promoted to academic administration positions such as director of research, department chair, or dean of the college and manage other young researchers.

Academic researchers rarely get the opportunity to become experts in solving industry problems. They cannot drill down into problems and become industry experts. This role is normally left to industry consultants who have the experience to solve industry issues. Academics attempt to differentiate between research and consultation. They have created silos (see Figure 3a) and have concluded that research is more valuable than consultation.

Dr. Dean Kashiwagi (founding co-chair) of TG61 and W117 was one of those individuals who was a research/industry expert (25 years, $17.6M funding, 2,000 tests delivering $6.6B of construction and other services, 9 different countries, and 62 intellectual property (IP) licenses (the most licensed IP developed at ASU), and 360 refereed journal papers, books, and conference presentations). He aligned his expertise with the Performance Based Studies Research Group (PBSRG) at Arizona State University, the W117, and the IP of Information Measurement Theory (IMT), the Best Value Approach (BVA) and the Performance Information Procurement System (PIPS) (Kashiwagi, 2019).
However, the inefficiencies of the academic research community (high overhead of university grants, the bureaucratic assignments of the university administration and complex rules of research engagement) encouraged Dr. Kashiwagi to move the research center PBSRG to the private sector to create a more dynamic research model which was more effective and efficient. Dr. Kashiwagi moved the financial support of PBSRG and leading W117 to KSM (a research consulting organization). It is the first Working Commission in the CIB that is being led by a private sector researcher and research group that has a foundation of concepts that were developed under the umbrella of the CIB (W117, 2018). To make this model successful, W117 is attempting to make the following changes:

1. Create a new structure where W117 researchers have full access to the IP and can educate and train others (see Figure 4).
2. Form an international board of industry experts for BVA IP certification to proliferate and development of the technology of performance information (see Figure 5).
3. Increase exposure into more countries by presentations, website, and publications through the creation of an international board of experts in using performance information and the BVA (Figure 5).
4. Increase the number of W117/PBSRG satellite sites that proliferate the technology through licensed and certified educators (see Figure 6).
5. Utilize Arizona State University intellectual property (IP) licensing to maintain successful implementation of the IP technology transfer.
6. Combine “research” and “consultation” to do a mixed methods approach which assumes that the construction industry after 60 years of research and practice, have not understood the major source of the problems in construction, risk and project management (see Figure 7).
7. Minimize the time to publish industry test findings and to immediately “put the information on the street” using free access, public website platform (W117 Journal and Research Gate open platform website) (Figure 8).
8. Test the BVA IP concepts on K-12 (high school students) to prove that the information concept is recursive and can not only be used to solve the industry problems, but also optimize the future generation of professionals’ comfort level with automation and information systems (see Figure 4, 9).
9. Implement the testing of BVA IP technology concepts into K-12 grades high school students to prepare the next generation for an information based and fully automated systems environment (Leadership Society of Arizona (LSA)). Implementation of the W117 IP Concepts (see Figure 9).

![Figure 4: W117 Research Pipeline](image)
Figure 5: International W117 BVA Board

Figure 6: Licensing and Distribution Pipeline

Figure 7: W117 New Research Environment Utilizing Actual Industry Testing

Figure 8: W117 and Research Gate Performance

Figure 9: Changing the Education Training Model
W117 research has identified the following challenges in the implementation of BVA concepts:

1. In the Netherlands, the W117 research activity led to the Best Value IP becoming the mainstream procurement approach. It led to multiple Best Value Procurement (BVP) publications and papers. However, the implementation of the BVA clarification phase and the Weekly Risk Report (WRR) have not met expectations.
2. The Best Value Procurement hybrids have become an issue.
3. The concepts of minimized thinking and decision making in the delivery of services has shown to be difficult to implement and sustain.

New Research Concepts

As a result of the Dutch experience with the BVA, the following concepts will be redefined, simplified, implemented/tested and retaught to the industry:

1. Move the emphasis from using the BVA technology (performance information) in the procurement function to the project management function (see Figure 10).
2. Semi-automate the procurement function by removing need to think or process and make decisions (see Figure 10).
3. Change the project management model from a management model to a leadership model. Remove management, direction and control from the current project management model (see Figure 11).
4. Redefine risk in simple terms that were previously identified in the Information Measurement Theory (IMT) (see Figure 12).
5. Redefine the definition of an expert to concur with the BVA definition (see Figure 13).
6. Minimize risk and cost by using performance information instead of competition and MDC and negotiation (see Figure 14).
7. Redefine performance information to “machine language” definition (countable and observable or can be verified by robotics) (see Figure 15).

Figure 10: BVP to BVA
Figure 11: Traditional PM Model vs. New PM Model

Figure 12: Risk Transfer vs. Risk Mitigation

Figure 13: Non-Expert vs. Expert

Figure 14: Maximization vs. Minimization of Risk and Cost

Figure 15: Traditional vs. New Definition of Performance
W117 will link the past/traditional approaches (procurement, project management and risk) with the future approaches (automation, minimized human thinking and decision making and identification and utilization of expertise and metrics which are observable and countable). W117 is the only organization that has published work on BVA development and has the expertise to link the past BVA concepts to the future concepts that align with automation and information systems. W117 was organized around the expertise of its founder Dean Kashiwagi. As successful as W117 has been in identifying performance, improving performance, and documenting performance, W117 has perceived that a part of the problem in getting to change the industry may be the academic research model itself.

The new W117 research structure eliminates the bureaucracy and limitations that slow down the academic model. In the traditional academic model, research institutions collect data from industry projects, but the data is never applied to industry solutions (see Figure 3 on page 14). Instead, institutions use the data to write publications with the goal of gaining more research funding. This process involves lengthy review stages and publication restrictions. The goal of the academic-centric model is to receive recognition from highly praised academic sources.

The new W117 Industry-Centered model subverts the traditional publication process (see Figure 3a on page 14). Research data is taken directly from applied projects where it is rapidly published online and shared with industry stakeholders. This model creates a transparent flow of information between researchers, educators, and industry leaders. This model accomplishes more than publications, its goal is to improve industry performance. This model achieves the following:

1. Minimizes time to publish research findings on the street using W117 journal and free access, public website platform (see Figure 7 on page 17).
2. Form international board for BVA certification to proliferate the technology and increase exposure to more countries by presentations, website, and publications (see Figure 5 on page 16).
3. Increases the number of W117/PBSRG satellite sites that proliferate and maintain technology performance through Arizona State University intellectual property (IP) licensing (see Figure 6 on page 17).
4. Implements the BVA technology into the education cycle to prepare the younger generation for information based and fully automated systems (see Figure 9 on page 18).

Accelerate the Change in the Industry Supply Chain Structure to Overcome Industry Challenges

The W117 information technology research implements critical changes in the supply chain structure that can increase project performance. The change in the supply structure has the following facets:

1. Semi-automate the procurement function and transition to a project management focused model (see Figure 10).
2. Redefine project management focus from a management model to a leadership model.
3. Redefine risk management (see Figure 12).
4. Clarify the definition of an expert (see Figure 13).
5. Minimize risk and cost by using performance information instead of competition and MDC and negotiation (see Figure 14).
6. Redefine performance information to “machine language” (countable and observable or can be verified by robotics) (see Figure 15).

The newest BVA model will be created by semi-automating the procurement model and putting emphasis on the project management model which will also be a semi-automated model using the Weekly Risk Report (WRR) in the BVA model. The WRR will be the structure for the new, leadership-based project management (Kashiwagi, 2019).

The previously identified terms “expert”, “risk”, and “risk mitigation” will be documented in publications. Experts are defined by personnel who minimize their thinking, decision making and can see into the future from the beginning to the end of a project (see Figure 12 on page 20). Valid performance information minimizes thinking and decision making. If performance information must be analyzed, BVA does not define it as useful performance information.

Conclusion

The five-year future of W117 research will include the following:

1. Change the structure of W117. Take the leadership and operation participants from a university platform to a private sector platform. Create a structure of international experts who are vested in the theoretical area of performance information and the Best Value Approach (BVA). Use the information approach to optimize W117.
2. Have the private organization based W117 identify experts, researchers and university participation.
3. Move primary focus of W117 and research to project management instead of procurement. Develop a new project management platform to change the traditional management, direction and control (MDC) PM approach to a leadership-based PM approach that is based on information.
4. Increase the number of publications and decrease the time to publish the performance information technology. Make all publications from the W117 journal to the open platform Research Gate. Continue to double the reads, citations, and research followers.
5. Redefine the terms information, transparency, expert, risk and risk mitigation.
6. Increase the number of presentations of the information based intellectual property worldwide by industry experts.
7. Move into other industries such as services and education to implement the concepts of performance information to optimize the industries.

Much of the content of this paper is from the CIB W117 Roadmap, the latest published in Dec 2018. Permission has been received from the W117 to use the material (W117, 2018).
References