

## "Moving Into The Future: The Minimization Of Construction Risk By the Surveyor, Professional And Client"

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### **Abstract**

The area of design, engineering, and construction has long been protected by the perception of professional expertise. With the advent of global competition, information technology, and lean thinking, pressure has been applied to the construction industry to become more efficient and effective in delivering performance. The client's emphasis on value rather than technical expertise is reflected in the client's primary award system in approaching both design and construction. This owner paradigm change affects the position of the construction professionals. Where previous practice allowed the professional to work in a protected technical silo, the future professional must work through the philosophy of a "supply chain" provider in a "transparent silo." They must decrease the overall transaction costs and construction risks of the entire supply chain and show "value added." The new environment will include measurement of performance factors, performance lines of all participants, minimization of duplication of tasks, Alternate delivery processes including construction management @Risk, design-build, indefinite delivery, indefinite quantity, private/public/partnerships and design/build/operate are moving in that direction.

### **Current Issues with the Price Based Construction Environment**

The Construction Industry Structure (CIS) model (Figure 1) illustrates the different environments in the construction industry. Due to the expanding worldwide marketplace, construction clients have sought increasingly competitive environments in order to receive lower prices. However, in efforts to reduce costs, high performance has been difficult to maintain (Post 1998; Murray 1993). Accordingly, the majority of procurement occurs in the price based environment, lacking the results of the efficient best value environment (Herbsman and Ellis 1992). An analysis was conducted, identifying the major differences that influence the level of performance obtained in the price based system compared to the best value system. They will be briefly listed, followed by a more extensive explanation of each difference based upon logical, theoretical research that has been corroborated through industry tests and contribution (Kashiwagi, 2006).

1. The price based approach places the construction professionals as the "center of the universe." The owner relies on the technical expertise of the professional to sufficiently direct any contractor. The best value environment places the contractor as the "center of the universe" and technical expert. (Suttell 2004, Occupational 2003)
2. The price based arena currently uses only technical information (specifications) in place of performance information, resulting in an adversarial environment. Performance information is required to sustain efforts in the best value environment. (PCS 2003)
3. The price based concept motivates contractors and manufacturers to maximize client risk of nonperformance in order to maximize their own profit. The best value environment transfers

owner risk to the contractor, who is then able to maximize profit by efficiently minimizing the risk. (ENR 2004, Stuttel 2005)



Figure 1: Construction Industry Structure (Kashiwagi, 2004)

### *The “Center of the Universe”*

The price based approach was created by the client’s professionals. In an effort to strengthen their position and value, they increasingly turned the focus of their efforts on the contractor instead of where their initial value lay, in programming, planning, and design. They have become the “Expert” or the “Center of the Universe” that the contractors and other technical components revolve around. They design, direct, manage, control, and inspect the contractor’s work. They have become essential in delivering construction services through the price based environment.

This movement has had the following results (Collett 1981, Condon and Hartman 2004):

1. Professionals have no responsibility or risk in the process, and obtain a greater benefit by thinking in their own best interest instead of acting in the best interest of the supply chain.
2. The professional increases the transaction costs of the supply chain by duplicating tasks of other components or causing additional work to be done by other components because of their actions.
3. Throughout the supply chain, the amount of management, control, and inspection is increased within parties and between parties.
4. The professionals become the decision makers, the entity that minimizes project risk (both technical and non-technical), and the expert of construction in terms of quality, cost, and time.

The designer’s professional has created the characteristics of the price based environment. Their proposed values and actions are synonymous with the attributes of the price based environment.

### *The Adversarial Environment*

In advertising a project, client's professionals use technical information in the form of minimum requirements and standards in specifying their conditions. Their objective is to state what is unacceptable, hoping to receive performance above the specified minimum (Figure 2). While the professional views the standard as a minimum, the contractors and vendors convert the standard to a maximum (Butt and Clinton 2005). Their goal is to deliver the lowest acceptable quality, to maximize their profits in a commodity marketplace. The resulting gap and different objectives (the client wants high performance and the contractors and vendors want to provide the most inexpensive acceptable product) forces an adversarial environment. This adversarial environment is further exacerbated by the fact that many of the material minimum standards and minimum contractor qualifications have no correlation with performance (how long and well a product performs over time).

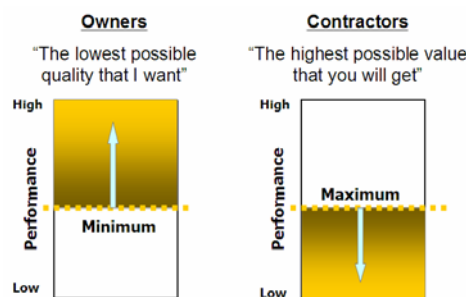


Figure 2: Adversarial Environment (Kashiwagi, 2004)

This environment is due to a lack of performance information. When contractors and vendors are not measured through performance information, there is no perceived risk or benefit in high performance. The driving force of profit encourages them to take on the following characteristics:

1. Volume based
2. Lower profit
3. Lower quality
4. Reactive
5. Minimized training, have a lack of and access to trained personnel and craftspeople

In this adversarial environment, the owner's procurement agents and lawyers have become much more dominant and have more authority than the designer, engineer, and surveyor in disputes (Suttell 2004). They force the use of "or equals" and "competitive range" that makes the delivery process cumbersome, creating situations where the lowest performing contractor has the competitive advantage. The possibility of a contractor protesting often spreads fear into the procurement agents, constraining them from being efficient or hiring the superior contractor providing the most value. This happens on many US federal acquisitions where the procurement agent forces everyone to sign a statement of privacy, stating that the information from the procurement cannot be released to any party after the procurement, unless approved by the contracting officer. The designers, engineers, and quantity surveyors are not qualified or educated to be construction experts. However, the procurement agents or owner's professionals, with less information and experience in construction, devise technical contracts. They are not

liable in any way or impacted by the finished construction, nor are they at risk for construction nonperformance. They have not been as successful in managing, directing, controlling and inspecting construction work as experienced contractors.

### *Encouraging the Maximization of Client Risk*

As previously noted, in a price based environment, the selection process is unable to distinguish between contractors due to a lack of pertinent performance information and must rely on technical information in the form of minimum standards/requirements. Therefore, it may be assumed that any environment that does not incorporate the contractors' past performance information or predictive performance information (ability to perform on the future project) into the selection process will produce price based results. A price based approach cannot identify differential in contractor experience. This allows lower performing contractors and vendors to be more competitive than high performers. The difference between an experienced contractor (Figure 3a: Contractor 1) and an inexperienced contractor (Figure 3a: Contractor 4) is that an experienced contractor (Cho 2005, Wang and Chou 2003):

1. Visualizes the project from beginning to end at the beginning, minimizing technical risks and identifying the risks that they cannot control (dependent on owner entities or variable factors).
2. Realizes it is the risk that they cannot control, that will most likely impact their performance and is therefore the most important. Knows how to plan and coordinate to minimize the risk that they cannot control.
3. Prices out a project not on not only what is directed in the specifications, but what is required to meet the intent of the project.
4. Is more competitive when the contractor is the "center of the universe," is in control of the project, can set the project duration, and is aware of the critical information of the owner's intent (including the budget).

The less experienced contractor on the other hand (Wang and Chou 2003, Condon and Hartman 2004):

1. Behaves reactively, addressing project risks only after they have begun impacting the project's budget or schedule.
2. Does not attempt to minimize or resolve any risks that are outside of their control (risks dependent on owner entities or variable factors).
3. Prices out only what is directed to them, although this may ignore components needed to actualize the owner's intent.
4. Is more competitive when the specifications are incomplete concerning intent, when the specifications include construction instructions on how to construct, and when the budget is not given to the contractors.



a) Contractor Performance/Risk Level      b) Effects of a Price Based Selection  
 Figure 3: Price Based Selection System (Kashiwagi, 2004)

When the client's selection process cannot tell the difference between the contractors, the following is true (Refer to Figure 3b) (Condon and Hartman 2004):

1. In order to compete, the high performing contractor must ignore project risk, maximizing the risk of the client, and forcing the client's professional to minimize the risk through management, control, and direction.
2. It is more likely that contractor #1 will act like contractor #4, then contractor #4 acting like contractor #1.
3. The delivery system makes contractor #4 more competitive by their nature of having personnel who are cheaper, who do not mind doing minimal quality work, and passing the risk of nonperformance on to the client's representative.
4. Vendors or contractors will send their "C" team, and not their "A" team (Figure 4).

Contractor's Simplistic Business Model:

Contractors or vendors retain employees of various levels of expertise. Figure 4 illustrates this, displaying a contractor or vendor with three primary teams:

1. A highly experienced team that pre-plans, identifies and minimizes risk that they do not control before they begin, has a history of completing a job on schedule, minimizing change orders and surprises, and setting and meeting the client's expectations. This team is paid the most, and maximizes their profit by using technical expertise to efficiently execute the project, avoid re-work and surprises, finish as early as possible, and minimize call backs after the project is complete. This team requires very little management.
2. A partnering team which works with the client to solve problems. This team has experience, but not enough to feel secure in taking control and responsibility. This team would rather have the client make the project decisions with them.
3. An inexperienced team that needs to be directed in every facet of their operation. They do only what they are told. They sometimes lack the experience to know when the directive is not optimal or if it will cause problems. They need to be directed and inspected, and feel very comfortable with being managed. They are the lowest paid employees in the firm. The

contractor makes money off of these folks by getting them to do more work, and not necessarily good work.

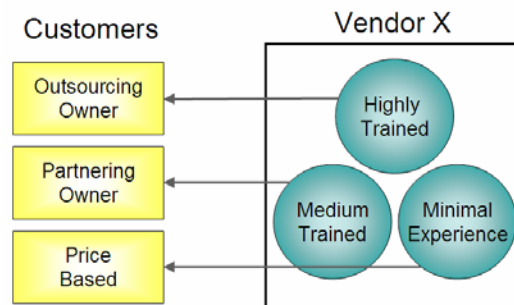


Figure 4: The Assignment of Contractor Personnel (Kashiwagi, 2004)

Vendors or contractors service three types of clients: the outsourcing client who buys based on value (performance and price), the partnering client who will work with the contractor/designer to solve the construction issues, and the price based owner who will manage, direct, control, and inspect, hiring only the cheapest contractor. In order to be successful on a business standpoint, the vendor will strategically allocate their employees to different types of jobs or owners. The vendor will send the most experienced, well paid personnel to the outsourcing client. This is simply because the vendor can make a larger profit on the experienced team, when the team is allowed to preplan and minimize risk before the project, perform the project just once (as planned), and finish as quickly as possible.

From the vendor's perspective, using highly skilled personnel in the most efficient environment is the optimal way to maximize profit. When the delivery environment is efficient, the buyer/client can procure the best value at the lowest cost, while maximizing the contractor's profit. When the client is a price based client, the contractor will often rely on the following to make a profit:

1. Hire the most inexperienced, low paid personnel.
2. Cut corners, use most inexpensive materials.
3. Become reactive to the client.
4. Do more work instead of becoming more efficient.
5. Not accept risk or attempt to minimize risk that they do not control (variable risk).

### **The Theory of the Event and Its Implications on Construction**

The most profound example in understanding the correlation between low performance and the price based environment is the model of the Event (Figure 5). The logical inferences of the model also represent the foundation for the development of the best value system, the Best Value / Performance Information Procurement System (PIPS).



Figure 5: The Event (Kashiwagi 2004)

An event has initial conditions, final conditions, and conditions which occur during the event. The conditions that occur during the event are results of the initial conditions as time passes. They are dictated by law, and the evolution from initial to final conditions is not random (laws which predict or explain the outcome of an event). The event can be understood by the following deductive concepts:

1. All events result in only one outcome.
2. Mankind has not verified a single event that is truly random or based on chance or probability.
3. If an event or system is explained as stochastic or probabilistic, sufficient information to explain the event in a deterministic manner is not perceived. Examples of this are the Heisenberg Uncertainty principle, quantum mechanics, and explanations of black holes and outer space.
4. If all the information of the initial conditions is known, the final conditions or outcome can be predicted.
5. When the IC are fixed, the FC are fixed.
6. Whether or not the initial conditions or information are perceived, because they exist, the final conditions will occur.
7. The more information perceived during the initial conditions, the higher the accuracy of the prediction for the outcome or final conditions.
8. The more initial conditions or information understood, the simpler or shorter the event is perceived as being.
9. If someone looks backwards from the final condition to the initial conditions, an understanding of the critical information will explain why the final conditions occurred. Hindsight is considered 20/20 vision.

The price based environment focuses the majority of the project resources on the time *during* the event, through management, inspection, and direction. However, client professionals who add value will realize the following:

1. Value is most effectively and efficiently added before the construction event.
2. Value is added in the accurate identification of client intent and design.
3. Value is added in selecting the best value contractor, and having a structure of leadership, supply chain, efficiency, and measurement.

## **Future Environment of Construction**

The future environment of the construction industry has slowly been moving towards the best value environment due to the following reasons:

1. Owners want the construction delivered on time, with minimized change orders, and meeting their quality and operational requirements.
2. Contractors must maximize their profit and not increase the cost to the client.
3. The industry must motivate their craftspeople and construction personnel to increase their capability to deliver to sustain the industry.
4. The value of the industry to both contractors and clients decreases when it becomes inefficient.

Current movements of the industry are to change the delivery system to design-build, construction management at risk (CM@Risk), indefinite delivery, indefinite quantity (IDIQ), and design-build-operate (DBO), private, public, and partnerships (PPP) (Garvin 2003, Stainback and Donahue 2005, Wardani et al. 2006, Ritenburg 1995). In all these processes, the client's professionals are affected in the following manner:

1. The need for the professional representing the client is minimized.
2. The contractor gains more control over the construction portion of the project.
3. The contractor's personnel act more like a supply chain, minimizing the redundant functions, and any additional effort of all components in the supply chain.
4. The supply chain model minimizes the adversarial relationships of components.
5. Every component becomes more efficient in their own task as well as assisting others to be efficient, minimizing the supply chain costs.
6. All components will be measured in terms of participating in supply chains that deliver on time, minimizes increases in construction cost, surprises and change orders, and meets the expectations of the client.

#### *Developing and Testing of the Futuristic Environment*

The primary development of this futuristic best value environment has been occurring over the last 12 years. The Performance Based Studies Research Group (PBSRG) at Arizona State University is the world leader in hypothesis testing of the futuristic best value environment and the use of performance information. They are the co-coordinator of the CIB TG 61, the Benchmarking of Performance Information. Their \$6.2M research effort has included simultaneous basic theory/conceptual development, prototype testing, and implementation testing. The following are some of the results of the testing ([www.pbsrg.com](http://www.pbsrg.com)):

1. 470 tests delivering \$521M of construction.
2. 98% on time, no contractor generated cost change orders, and meeting client expectations.
3. 42 different clients, including both public and private sector.
4. Minimized construction management by up to 90%.
5. Process also used to deliver IT services, and food services.
6. Used to deliver \$30M food services/year (potential ten year contract valued at \$400M.)
7. Contractors maximize their profit and make an average of 5% more, and minimize their financial risk.

8. There is no proven relationship between performance and price (Guo, 2006).

One of the most critical components of the PBSRG research tests has been the education and training of the client's professional. The group has found that the higher an organization's ability to think in terms of the supply chain, the minimization of transaction costs, transferring risk, not making decisions, and releasing control, the easier it was to successfully run the best value system.

### *Transitioning to the New Best Value Environment*

Professionals representing the clients must become more leadership based than management based. They need to act as a supply chain component instead of a management and control agent. They need to maximize their decision making in planning, programming, and design, and minimize their decision making in construction. They should make the contractor the "center of the universe" in construction forcing the contractor to preplan, minimize risk that they don't control, be efficient, minimize cost and increase quality. To achieve this, the professional should outsource construction by:

1. Requiring the contractor to preplan, schedule, identify and minimize risk
2. Determining fair procurement prices by competing the contractors based on their value
3. Minimizing the flow of information to risk and performance measurements
4. Minimizing their decision making concerning construction
5. Minimizing their management, control, and inspection of the contractor.

The future construction professional representing the client will become more of a leader than a manager, will outsource construction, will motivate contractors to compete, send their most qualified personnel and become as efficient as possible, and will be able to differentiate between those who can effectively and efficiently do construction. The future construction professional will become more adept at using performance information/measurements. This movement will move construction from the price based environment to the best value environment.

### **Conclusion**

Over the few decades, the areas of design, engineering, and construction have been and will continue to be scrutinized and placed under greater pressure to show value added to the "supply chain" in terms of time, money, and quality (owner satisfaction). The best value environment provides a system that has resulted in high efficiency, offering greater value to its participants (higher quality, performance, and profits, for the same costs). This is done by using a methodology that enables the client's professional to differentiate between the performance of multiple contractors, and select the best value available (in terms of value, price, and performance). It allows the client's professionals to concentrate on planning, programming and conceptual design, and capturing the intent of the client in the most accurate manner. By focusing on the initial conditions of a project and minimizing the time and resources used during the project, the professional is able to maximize their efficiency. After the best value contractor is identified, the system enables the contractor to control the project by preplanning, minimizing

risk, and optimizing the construction. The system is self-sustaining, requiring little assistance. Competition between high performers, and a system that makes high performance more competitive, will motivate the industry to train its personnel. The best value contractor will regulate themselves by performance measurements and risk management. As competition continues to increase, the future of construction lies in the ability to identify performance, minimize risk, and maximize efficiency.

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