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Transitioning to an Information Environment: Performance Research in Large Capital Projects and Facility Management Group

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Abstract
An information environment uses non-technical performance measurements to provide data that indicates relative efficiency and effectiveness of all key participants in a system. The movement from a traditional environment, which relies upon technical information, high levels of management and control, and large amounts of information transfer, to an information environment, which relies upon non-technical information, minimal levels of management and control, and minimizes information and communications, is difficult. In construction and facilities, the industry is predominately traditional in its characteristics and the transition to an information environment often is converse to standard practices and thinking. This paper presents research conducted at the University of Minnesota (UMN) Capital Planning and Project Management group and their movement from a traditional organization to an information environment. The UMN's traditional management and system structure is presented along with the intermediary steps taken in the transformation to a performance information-driven system. In the transition, the UMN began with using performance measurements in small maintenance and repair requirements (specifically mechanical, electrical, and roofing services) on vendors and contractors. The system was then expanded to consider larger providers of services and some internal assessment of department performance. As the environment evolved, the performance measurements were directed inwards, with an initial examination and tracking of project managers, designers, facility managers, etc. The resultant environment is presented along with the most recent performance results of the research.

Keywords
Information environment, performance information, capital projects, facility management

1. Introduction

This paper presents the research conducted by the Performance Based Studies Research Group (PBSRG) at Arizona State University and the Capital Planning and Project Management (CPPM) group at the University of Minnesota. The research was performed over a sixteen month period from October 2005 thru January 2007 and focused on testing best value methodologies to increase the level of construction performance received in a capital projects and facility management group. Starting with small projects, with shorter durations, the testing considered mechanical, electrical, and roofing services to provide an initial baseline of applicability of best value methodologies. The research results were positive and the effort has since expanded to include general construction services and an initial examination of facility management, design, and other services.

1.1 About the University of Minnesota - Capital Planning and Project Management

The University of Minnesota (UMN) is one of the largest universities in the United States, servicing over 50,000 students. The largest campus is in the City of Minneapolis, Minnesota (USA). The Capital Planning and Project Management (CPPM) group is responsible for the procurement and delivery of all new and existing facilities on the Minneapolis Campus. On average, the CPPM group procures 300 projects a year on $40M in services. The goal of the CPPM is to maximize the efficiency of the group (both internally and externally to maximize the performance for the University), and ultimately, the taxpayers.

1.2. About the Performance Based Studies Research Group

The Performance Based Studies Research Group (PBSRG) is a research group at Arizona State University. The PBSRG specializes in best value procurement and efficiency improvements. Since 1994, the PBSRG has procured over half a billion dollars in procurement services on over 480 projects. The majority of the procurements have been on construction related services, but a growing number of projects have been on other types of services (IT, food services, industrial relocations, etc.). The research has maintained performance results of 98% on-time, 98% on-budget, and 100% client satisfaction (PBSRG, 2007)

2. Problem Statement

The low-bid construction environment has the following documented performance results (Post, 1998):

- On-budget Rate: 33%
- On-schedule Rate: 42%
- Client Satisfaction: 53%

The University of Minnesota was also experiencing poor performance and was acting in a traditional fashion (as shown in Figure 1 (Quadrant I):

- Contractor selection is determined based upon price.
- Bidding contractors are treated as a commodity and UMN used the bid documents (specifications, drawings, and standards) to dictate the level of construction required
- UMN, through management and inspection, oversaw and directed the work resulting in a situation where the UMN Project Manager was responsible for minimizing the risk of non-performance.
- The performance received by UMN from their vendors and service providers was not rigorously tracked in useful measurements of budget, schedule, and satisfaction; as is the case in numerous large organizations. The data is often “available” somewhere, as was the case with UMN, but the data is not organized, impossible to access, not consistently tracked,

and/or nearly meaningless in what was captured (e.g. unstructured and poorly referenced meeting minutes).

Though having low documented performance, the price-based environment is beneficial in several regards including it is well establish in industry and generates a high level of competition. It possesses objective fairness in that dollars are a quantitative metric that allows direct comparison of different bidders. The high level of competition is a necessary part of any sustainable environment, yet the high level of competition has not been successfully coupled with high performance, in comparison to some best value systems (PBSRG, 2007).

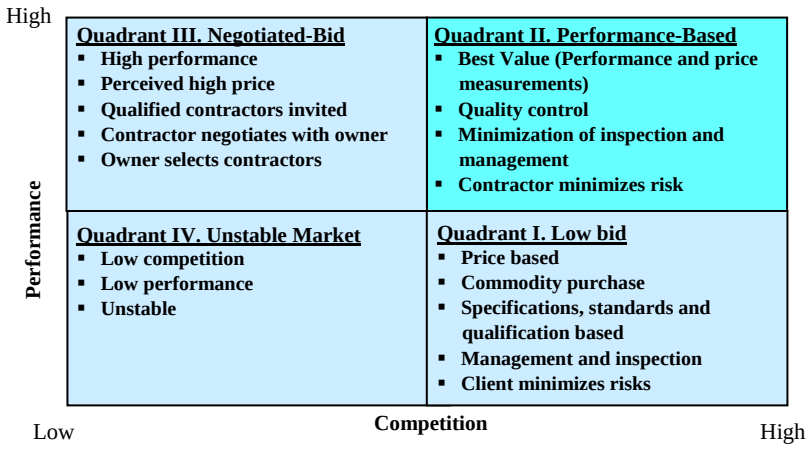

Figure 1: Construction Industry Structure

Best value, an alternative procurement methodology, has proven to provide a greater level of client satisfaction, on-schedule completions, and on-budget projects than the low-bid system (Post, 1998; PBSRG, 2007). Best value is represented in Quadrant II of Figure 1 and possesses the following characteristics (Sullivan et al, 2006):

- Contractor selected based upon performance and price.
- Contractor performs preplanning and quality control.
- Minimize client involvement, management, and inspection.
- Contractor drives efficiency for the project and all parties.
- Contractor minimizes risk of non-performance.
- Contractor held accountable for performance on the project.

Experiencing low construction performance, and identifying the potential efficiency increases documented in best value, the UMN sought to research best value concepts within its construction environment.

3. Research Hypothesis

The research hypothesizes that the use of best value concepts and methodologies will result in a change in construction performance (in selected services) and a resultant increase in client satisfaction for a large university capital projects program. The research uses the Performance Information Procurement System as the test best value process.

3.1. The Performance Information Procurement System

The Performance Information Procurement System (PIPS) is a best value process developed by the PBSRG. The process involves three major stages (shown in Figure 2). The first stage is used to identify the potential best-valued contractor from the available bidders. Once identified, the best value contractor must preplan the project in detail (during the second stage) to ensure potential risks are minimized and that the project will meet the intent of the client within the available budget. The client then issues an award, and the contractor manages the project using a performance based risk minimization tools (Stage 3).

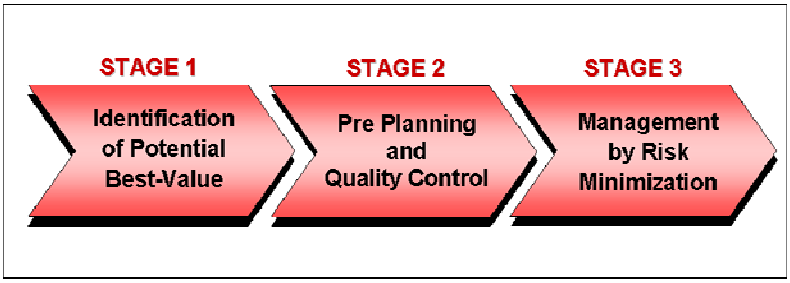

Figure 2: Major Stages of the PIPS Best Value Process

A more detailed diagram of the PIPS process is shown in Figure 3. The PIPS has six major filters. The first four filters are used to identify the potential best value contractor (Stage 1 in the process). These filters include:

Filter 1: Past Performance Information (PPI) is collected on all critical contractors. The contractors are responsible for sending out surveys to past clients, and ensure that the customers return the survey to the current client.

Filter 2: A Proposal Form is required that identifies the cost of the proposal (lump sum), project duration, and contact information. This is attached to a Risk Assessment (RA) Plan, which is a two-page document (prepared by the bidder) that contains major risks on a project, solutions to the risks, and any value adding options. The contractors are required to not include any names (contractor name, project names, individual names) in the RA Plan. This requirement allows the client's raters to evaluate the plans without any bias towards a contractor (since the raters do not see the Proposal Forms).

Filter 3: Interview are conducted with critical individuals if necessary.

Filter 4: All of the collected data is analyzed to determine the potential best-valued vendor. The client may use decision making models to assist them in analyzing the data. Once a decision is made, the contractor names are reveled, and the potential best-value is invited to the next stage (Stage 2 – the Preplanning and Quality Control process – a.k.a. Pre-Award and Stage 3 – Performance Reporting).

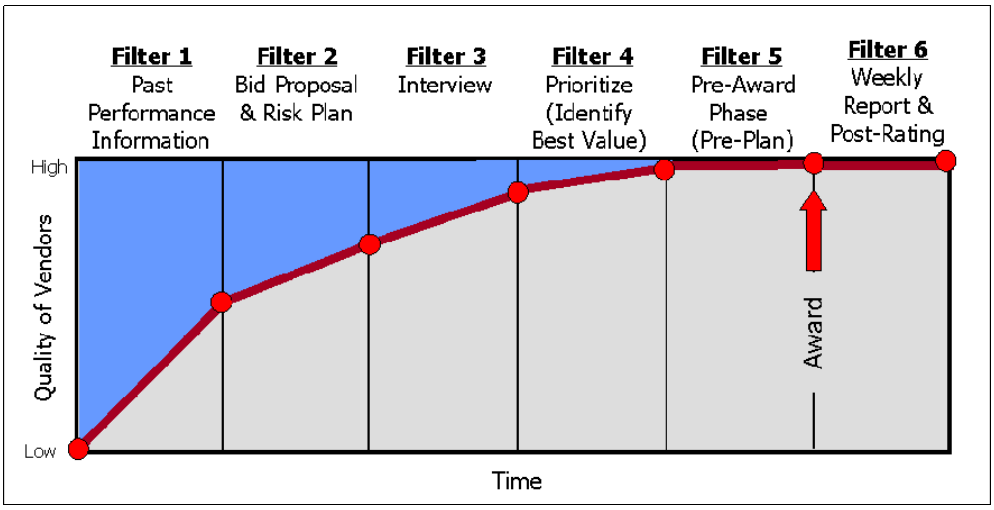

Figure 3: Major Stages of the PIPS Best Value Process

The research followed a traditional methodology of process configuration, pilot testing, analysis of initial results and further testing with modifications. The remainder of the paper presents the research process and initial results.

4. Pilot Program and Review of Results

4.1 Pre-Qualification Process

The CPPM's initial objective was to select a small group of high performing contractors that would be able to respond quickly to the University's needs at a competitive price for the research areas of roofing, mechanical, and electrical construction. The decision was made to pre-qualify a list of vendors in each area, and to identify three to five high performing firms. These firms would then compete on select projects. The pre-qualification program ran as follows:

1. Advertisements were issued, inviting all interested vendors to an educational meeting discussing the program.
2. Interested vendors were then required to prepare a list of past projects and send out performance surveys to their past clients.
3. The CPPM compiled all of the surveys scores, and analyzed the firms based on their customer responses.
4. The CPPM then shortlisted the firms in the specific areas shown in Table 1. On average, seven firms proposed in each area, and four were shortlisted.

Table 2 analyzes the PPI of the pre-qualified firms. On average, the contractors received 15 returned surveys, and had an average rating of 9.7 out of 10. The analysis shows that there was very little variance in 1-10 scores (average deviation was 0.2 points), which indicates that all the firms were very competitive. The high customer satisfaction ratings were expected since the vendors were instructed to only submit "good" references. In the PIPS best-value process, the PPI scores are not as important during the initial selection of the project, but are more important at the end of the project (when the client will adjust their scores by 50% based on the performance of that project). Consequently, if a contractor does not perform on an awarded PIPS project, they will be at a disadvantage for future work compared to the vendors that were not awarded a project.

Table 1: Identification of the Number of Firms That Competed During the Prequalification Versus the Firms that were Pre-Qualified

No	Area	Trade	Total Number of Firms Competed	Number of Firms Pre-Qualified
1	Nominal Voltage	Electrical	10	6
2	Low Voltage	Electrical	10	4
3	Plumbing	Mechanical	6	3
4	Sprinklers	Mechanical	3	2
5	Sheet Metal	Mechanical	9	4
6	Pipe Fitter	Mechanical	9	3
7	Pipe Coverer	Mechanical	3	3
8	Roofing	Roofing	9	4
		Total	59	29

Table 2: Analysis of Past Performance Information Results

No	Area	Number of Vendors	Average 1-10 Score	1-10 Deviation	Average Number of Surveys
1	Roofing Contractors	4	9.7	0.1	17
2	Mechanical Contractors	7	9.7	0.2	15
3	Electrical Contractors	8	9.8	0.2	13
	Average:	6	9.7	0.2	15

4.2 Selection Process

Only the vendors that were pre-qualified were eligible to propose on upcoming pilot projects. The CPPM stated that they would modify the list of vendors (add and/or delete) if necessary, based on the results of the initial pilot projects. Once a pilot project was identified, the process proceeded as follows:

1. Pre-qualified vendors were invited to an educational meeting and site walk.
2. The vendors would then prepare and submit a risk assessment plan and cost proposal.
3. A selection committee, composed of 3-5 individuals, would evaluate the risk assessment plans blind (not knowing which firm submitted which plan), and send in their scores to the contracting officer.
4. The contracting officer would compile all information (past performance scores, risk assessment plan scores, equal opportunity scores, schedule, and price) and provide a matrix to the UMN project manager.
5. The UMN project manager would review the information identify the proposal with the best value. The potential best-valued contractor would then be invited to participate in the Pre-Award Phase.
6. Upon successful completion of the Pre-Award Phase, the contracting officer would issue an award.

4.3 Pilot Projects Procurement and Award Analysis

Sixteen projects were procured during the first phases of the best-value pilot program. Five of the procurements were roofing projects, five were mechanical projects, and six were electrical projects.

Table 3 provides a cost analysis of the projects. Based on the original allocation budget of $4.9M, the projects were awarded approximately 13% below the allocation budget (savings of $650K).

All of the qualified vendors were invited to propose on the pilot projects. On average, three contractors proposed on each project. On two projects, only one vendor submitted a proposal (but they were under budget in both cases).

Table 3 also provides information on the costs, Risk Assessment Plan scores, and the major factors for award. Out of the sixteen pilot projects, over half of the projects were awarded to the lowest bidder based on performance and price. This finding does not support any suppositions that best value is more expensive than low-bid. Five projects were awarded to the lowest bidder due to the lack of differential between vendors.

The greatest differential in most of the projects was the Risk Assessment Plans. The awarded contractors (BV) received a 7.3 rating (out of 10), versus the non-awarded contractors that scored 5.6 (out of 10). It is important to remember that the raters do not see any prices when evaluating the RA Plans (so the RA Plans scores are based solely on the content of the RA Plan (RAP)).

Table 3 – Pilot Project Cost and Award Information

No	Project	Estimated Budget	Awarded Cost	Lowest Bidder	RA Plan Score BV	RA Plan Score Others	Primary Award Factors
1	Andrew Boss Lab	$120,000	$178,440	No	4.3	5.8	Price
2	Mayo Building	$850,000	$893,861	No	7.9	5.7	Price & RAP
3	Smith Hall	$1,250,000	$947,296	Yes	6.0	6.0	Price
4	Stakman Hall	$64,000	$101,900	No	8.9	4.2	RAP
5	Comstock Hall	$180,000	$72,400	No	7.5	4.2	RAP
6	Parking Ramps	$168,000	$192,185	Yes	7.0	5.4	Price & RAP
7	Tate Physics Lab	$490,000	$465,700	Yes	8.1	4.7	RAP
8	University Office	$410,000	$225,395	Yes	9.1	3.9	RAP
9	Child Care	$550,000	$443,100	Yes	6.8	7.5	Price & RAP
10	Cooke Hall	$50,000	$64,500	Yes	7.3	5.7	RAP
11	Elliot Hall	$120,000	$93,850	No	7.9	6.7	RAP
12	Lions Chiller	$143,000	$170,608	Yes	6.1	6.3	Price
13	Masonic Center	$220,000	$200,700	Yes	n/a	n/a	Price
14	Mayo Building	$52,000	$46,525	No	6.7	5.7	RAP
15	Middlebrook	$120,000	$68,400	Yes	n/a	n/a	Price
16	Mondale Hall	$160,000	$134,780	No	8.5	6.7	RAP
		$4,947,000	$4,299,640		7.3	5.6	

4.4 Pilot Project Final Results

Out of the sixteen awarded projects, ten projects have been completed and 56% were allocated to the lowest bidder. In a best value environment, where construction services are outsourced to the most effective vendor, the work can be completed more efficiently. A summary of the pilot test results yields:

- Based on the original allocation budget of $4.9M, the projects were awarded approximately 13% below the allocation budget.

- Contractors were selected based upon performance and price, with the largest differentiator in the selection being the ability to minimize risk.
- Two of the initial phases' 14 projects did have change orders, accounting for a change rate of 0.70%. The change orders were on the first round of the selection tests and the change orders should not have been granted by the CPPM. A lack of complete understanding and education resulted in a reversion of the CPPM project managers to allow the best value vendor to request change orders for foreseeable items. On the later projects, where both the client and vendors have had greater exposure and education, the change order rate has been zero.
- Two of the initial phases' 14 projects were completed late (with late being defined as not 100% complete at the contracted end date; substantially complete is not considered "complete.") The reasons for lateness were again due to a lack of education and reliance upon the traditional paradigm as there being no performance rating repercussion for being late. Though the tardiness was not severe, the projects are still tracked a late in the best value information environment.
- Each project was rated with 100% customer satisfaction.
- The CPPM is undergoing a paradigm shift from an environment without performance metrics to an information environment with performance metrics. The resulting process change has resulted in performance improvement and a reduction in effort by the client organization. One client project manager measured a 90% decrease in his efforts, allowing him to greatly increase his project load.

5. Conclusion

The CPPM group at the University of Minnesota has implemented a best value system, requiring a transition from a traditional construction environment into a performance-based, information environment, where the use of performance and price are used in selection, planning, risk tracking, and future competitiveness of vendors. The initial phases of testing yield results that are to the satisfaction of the client organization. A lack of performance measurement prior to the research testing makes a quantitative comparison of "before" and "after" impossible, relegating the research results to a subjective analysis of overall impact to the organization. Regardless, the results, thus far, have been positive with high levels of performance and an expansion of the program into general construction. The program and information environment concept is also being taken into the facility management division of the group and into the delivery of design and other services.

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