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ARTICLE

A Tale of Two Roofs: A Large Private Organization Achieves High Performance but Reverts to Traditional Procurement Practices

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ABSTRACT

The Best Value Approach (BVA) is a new project delivery method that has been documented to increase performance and value. It does this by changing the traditional project delivery characteristics of managing the expert and focusing on the technical side of the project, to utilizing the expertise of the experts and using performance information and risk mitigation to manage the project. Large organizations have had difficulty in sustaining the BVA. A large private organization agreed to test the BVA on the replacement of a roofing system on one of its facilities. A case study research was performed on this project, using the grounded research approach, to identify if a large supply chain stakeholder can utilize the BVA to sustain high performance, value, and low price at the same time in a highly competitive marketplace. The research proposal is to document issues and benefits of utilizing the BVA. Identifying why large organizations have an issue with sustaining the approach and being utilized on more projects. The results of the paper will identify issues organizations have with implementing the BVA and the benefits in using the delivery system on construction services. The case study utilizes a stakeholder in the roofing industry supply chain and shows an approach to construction services that utilizes performance information and risk mitigation.

1. Introduction

The construction industry has been having difficulty delivering services on time, on budget and with high customer satisfaction[1][2][3][4][5]. This has been verified by literature research. This portion of the paper will identify the results of what has been found.

Despite improvements, according to a study conducted in 2015 by the Construction Industry Institute, the following was identified regarding worldwide construction performance[6][7]:

• 2.5% of projects defined as successful (scope, cost, schedule, & business).

• 30% of projects completed within 10% of planned cost & schedule.

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• 25 to 50% waste in coordinating labor on a project.

• Management inefficiency costs buyers between $15.6 and $36 billion per year.

• Rework by contractors is estimated to add 2-20% of expenses to a contractor's bottom line.

• An estimated $4 billion to $12 billion per year is spent to resolve disputes and claims.

This has been observed and documented around the world[8][9]. Interestingly, this issue is not unique to the construction industry[5][10][11][12][13][14][15]. Table 1 shows the delivery of services performance in multiple industries.

Table 1: Performance in Numerous Industries[8]

A Few Major PM Industries	On Time	On Budget	Customer Satisfaction	Quality
Information Technology	40%	43%	3.6/10	Fair
Construction	25%	32%	N/A	Poor
Health Sector	N/A	N/A	6/10	Poor
Aerospace and Defense	14%	38%	N/A	N/A
Manufacturing	67%	50%	7/10	N/A
Energy	59%	59%	7/10	N/A

This is echoed by a recent presentation conducted bThis is echoed by a recent presentation conducted by Bechtel President and COO Brendan Bechtel in the construction industry, which he identified that mega-projects within construction services (projects larger than $100M USD) are 98% cost overrun and delayed, with an 80% average cost increase[16].

The issue is that the industry does not understand the source of the poor performance[4]. Although, efforts have attempted to resolve non-performance in the construction industry for the past 25 years, only a few approaches developed in the last decade for the delivery of services have performance documentation showing an increase in customer satisfaction and value (schedule, budget, flexibility, and quality) on construction and non-construction projects[3][17][18]. Three studies were conducted to identify which approach had the most documented performance information[4]:

1. In 2006, the International Council for Research and Innovations in Building and Construction (CIB), one of the largest global organizations that bring international and government research institutes to collaborate on the building sector, sanctioned Task Group 61, to investigate construction performance, with an objective to stimulate global research efforts from its findings, to improve construction overall on a global scale.

2. In 2008, Task Group 61 [later elevated to a working commission called W117 at the end of 2008] conducted a worldwide study to identify any innovative construction methods that used performance measurements as a means to increase project performance. The study filtered through 15 million articles and reviewed over 4,500 articles. Out of the 4,500 articles, it found 16 articles that identified three construction methods being used that showed how customer satisfaction and value on projects, were improved through numerous tests. The Performance Assessment Scoring System (PASS), and the City of Fort Worth Equipment Services Department (ESD – FT), two out of the three systems and after further investigation, were found to either have performance measurements with no identification of its structure and how well it worked, or could not show exactly how it improved project performance through performance measurements[3][17][18]. The final system the CIB Task Group identified was a delivery/risk management system called Performance Information Procurement System / Performance Information Risk Management System (PIPS/PIRMS) [also known as the Best Value Approach], developed by an international research group (Performance Based Studies Research Group (PBSRG)) out of the Arizona State University. The Best Value Approach was the only system that had documented performance of industry impact and added value, and how it was structured to implement the advancements it found during test cases in industry.

3. In 2013, PBSRG sanctioned a follow-on worldwide study to the CIB worldwide study in 2008 by Task Group 61. The study's objective was to identify all efforts [research or industry] around the world that are like the international research group, as well as the current construction performance. The study sifted through hundreds of papers, websites, and personal industry contacts, and did not find any approach to delivering services with more documentation showing high performance than the Best Value Approach in the world[4].

1.2 Best Value Approach

The Best Value Approach (BVA) was developed by Dr. Dean Kashiwagi in 1991. Since then it has undergone multiple name changes including: Performance Information Procurement System (PIPS), Performance Information Risk Management System (PIRMS), and Best Value Procurement. The approach has been applied and investigated by organizations all over the world including: University of Botswana, Brunsfield, Democratic Republic of Congo, NEVI (Netherlands), United States Medical Command, Hazim Consulting: Saudi Arabia, and Simon Frasier University (Canada). The majority of the BVA implementations have been performed with the assistance of the Performance Based Studies Research Group (PBSRG). PBSRG was originally housed under Arizona State University (from 1992 to 2016), but then moved under the International Council for Research and Innovations in Building and Construction Working Commission 117 (CIBW117) in 2017. In the last 26

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years more than 130 organizations have used the BVA to improve efficiency in their organizations and receive higher performing services.

The documented performance of the BVA is as follows[8][9]:

• Founded in 1992 [26 years of operation] and has documented performance on over 2000 projects and services delivered (construction and non-construction).

• $6.6B of projects and services delivered with a 98% customer satisfaction and 9.0/10 client rating of process.

• $17.6M in research funding generated, due to the effectiveness of decreasing buyer cost of services on average by 31% [57% of the time, the highest performing expert was selected and was the lowest cost].

• Contractors/vendors could offer the client/owner 38% more value and decreased client efforts by up to 79%.

• Change order rates were reduced to as low as -0.6%.

• 130 unique clients [both government and private sector] and received 12 National/International Awards.

• The most licensed technology out of Arizona State University [60 licenses].

• It is internationally recognized through repeated testing [Canada, Netherlands, Sweden, Norway, Finland, Botswana, Malaysia, Australia, Democratic Republic of Congo, France].

• Some of the largest projects documented were: $100M City of Peoria Wastewater Treatment DB project (2007); $53M Olympic Village/University of Utah Housing Project (2003); $1B Infrastructure project in Netherlands (2009).

• Some of the highest performing projects documented include: ASU tested BVA in their business services and procurement department, resulting in $100M of revenue. Changed the entire procurement service industry in the Netherlands through the success of a $1B infrastructure test that cut procurement cost by 50% and help the project finish 25% faster. As a result, the Rijkswaterstaat won the most prestigious procurement award in the Netherlands, the 2012 Dutch Sourcing Award, and now NEVI [Dutch Professional Procurement Group] is licensing BVA technology and certifying in the Netherlands[9].

The BVA has been audited multiple times in the last 26 years. Two of the audits identified the impact and effectiveness of the BVA in detail:

• The State of Hawaii Audit[19][20].

• The two Dutch Studies on the Impact of PIPS[21][22].

These studies confirmed all BVA performance claims were accurate. Duren and Doree's study found the following results for projects performed in the United States:

• 93.5% of clients who worked with BVA identified that their projects were delivered on time.

• 96.7% of clients who worked with BVA identified that their projects were delivered within budget.

• 91% of the clients stated that there were no charges for extra work.

• 93.9% of the clients awarded the supplier's performance with greater than an 8 rating (on a scale from 1-10, 10 being the highest performance rating).

• 94% of clients would hire the same supplier again.

The other groups that conducted audits were COE PARC, 2008; Zuyd University & University Twente, 2008; WSCA/NASPO Agreement, 2011[9].

Interestingly, though documenting high performance, one of the major issues identified with the BVA has been the difficulty for organizations to sustain implementation. Out of the 130 organizations that have implemented the BVA, less than 1% have been able to sustain the effort for more than 6 years. The longest implementing organization being Neogard, who have used the BVA for more than 20 years. This issue is more prominent in large organizations. In many cases the BVA was stopped before the organization even tested the process.

Some of the major issues organizations have experienced in following the process and sustaining it are as follows[9]:

1. Resistance to the process from client personnel.

2. Client's personnel making decisions to modify the process.

3. Inability to explain the value of the process to the C-Suite.

4. The BVA supporter in the organization retires or leaves the organization.

Interestingly, it has still been difficult for organizations to take full advantage of the BVA, despite having projects that experienced high performing results. This could be due to how different the BVA and current traditional project practices are when delivering services.

The traditional practices (Figure 1 – Quadrant I: Price Based) involve the following when delivering a project/ service:

1. The client develops the technical requirements for a project.

2. Technical information is reviewed by the client to determine the best vendor for the project.

3. The client develops the contract for the project.

4. The client and the vendor partners to deliver the project.

5. The client controls and makes the decisions for the project.

The BVA practices (Figure 1 – Quadrant II: Best Value Approach) involve the following:

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1. The vendor develops the technical requirements for a project.

2. Technical information is only shared with the client when a vendor is selected.

3. The vendor develops the contract for the project.

4. The client and the vendor do not partner to deliver the project.

5. The vendor has total control of the project and the client only approves the actions.

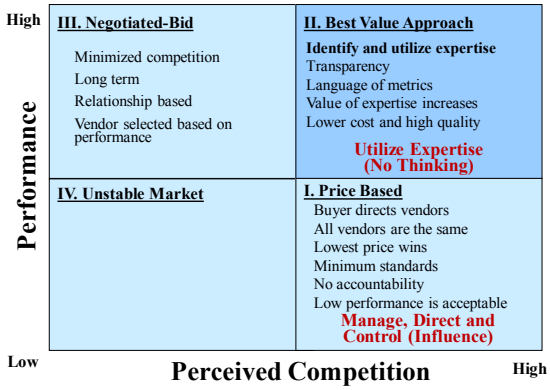

Figure 1. Industry Structure

The industry structure diagram in Figure 1, developed by researcher and Dr. Dean Kashiwagi, identifies that the major difference between the price based (low bid) environment and the Best Value quadrant, is that the client utilizes the expertise of the vendor to increase performance instead of trying to manage, direct, and control (MDC) the vendor. The opposite nature of the BVA from the traditional project delivery approaches, may contribute to organizations having difficulty implementing and sustaining it.

To assist organizations to overcome the resistance of the BVA's new ideas and project practices to delivery services, it has been adjusted over the last 10 years. The focus has been on continually simplifying the process and automating normal project delivery methods, to minimize the decision making of the client and ensure the process is followed and can show its value.

1.3 Large Private Organization

In the Spring of 2017, the global facility management director for large private organization (LPO), identified an opportunity within his organization to implement the BVA and be able to document its value, the issues and difficulties with running it, and the reaction of the technical personnel utilizing the process.

The LPO needed to replace their 18-year-old Roof "A". Roof "A" was 70,000 square feet and covered many important upper management personnel (i.e. lawyers and C-suite executives). Between 2013 – 2017, 30 unique reports were filed with the facilities management department (FMD) on leakage. Over the course of four years, the FMD had to replace many damaged ceiling tiles, repair light fixtures, and dry out wet carpet. The occupants became more concerned with massive roof failures at the end of 2016, due to the roof approaching its 20-year life and warranty. The concern was heightened, due to Arizona's impending monsoon season (June to September) 6 months away. Replacement of roof "A" became a high priority project for the FMD.

Although PBSRG had the support of the FMD, it still needed to convince the LPO project management staff to use the BVA and allow PBSRG to support them.

2. Methodology

PBSRG, planned to take the following steps to implement and document the BVA for the LPO's Roof "A" project:

1. Propose using the BVA to the LPO's project management team.

2. Provide education to the LPO's internal staff and roofing contractors.

3. Run BVA.

4. Document issues and difficulties:

   a. Review each phase of the BVA and how it was implemented.

   b. Identify how the organization dealt with the differences.

5. Analyze the documented information.

2.1 BVA Proposal to LPO

The LPO's FMD invited consultants to bid on the Roof A project. They only had two weeks to choose a consultant. Two consultants expressed interest in bidding on the project. PBSRG was one of the consultants. The FMD requested both parties submit a cost, scope of work and performance information. Table 2 identifies the difference between the two proposals:

1. PBSRG's scope provided more value to the client for the same cost.

2. PBSRG could complete the project 10% quicker.

3. PBSRG's provided past performance information that showed they were experts:

   a. 34 years roofing experience (started in 1983 with U.S. Airforce).

   b. 20 roofing journal articles.

   c. 6 books on roofing.

   d. 19 roofing conference publications.

   e. Over 2,000 site walks of roofs.

   f. Over 100 roofing projects in State of Hawaii alone

   g. Over 100 roofing projects at DISD over 4 million square feet

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h. Ran projects for: Motorola Scottsdale, Motorola Arlington Heights, IBM, Intel Corp., United Airlines, Honeywell, Facilities Management Group, PECO Nuclear Facility, IPI, State of Hawaii, Dallas Independent School District, Raytheon (Tucson), GSA Region 6).

i. Customer satisfaction is 98%.

j. Saved customers between 10-30% of the cost of projects.

Table 2: Consultant Proposals

Consultant A	**PBSRG**
Cost: $15,000	**Cost**: $25,000
Scope of Work	**Scope of Work**
Review the Owner's Requirements and related information, including schedule, budget, service life expectations, warranties, history, building usage, and contractor insurance requirements.	Would perform the same scope of work (SOW), but would also include the following: • Provide education to internal personnel and vendors. • Hold a roof site inspection for all potential vendors. • Help write the RFP • Hold a clarification phase the ensures the vendor will plan the entire project before an award is given. • Require the vendor to submit a weekly risk report that track all project performance metrics with impacts to cost, time, and quality. • Provide a close-out report to the LPO that documents the entire project from beginning to end. • Help on with any meditation that is needed during the project.
Schedule:	**Schedule**:
January: Contract negotiation period	January: Start immediately
February 20: Create request for proposal	February 1: Create request for proposal
March 1: Bid	February 16: Bid
March 20: Evaluation	February 17: Evaluation
March 23: Identify contractor	February 22: Identify contractor
April 20: Anticipated authorization to proceed	March 20: Anticipated authorization to proceed
July 15: Project completion	May 31: Project completion
n/a	June 16: Project report
Performance Information: no documentation was provided	**Performance Information**: Documentation was provided

PBSRG used the BVA to respond to the bid request and showed clear performance metrics that it was the highest performing vendor. However, for PBSRG to convince the LPO management to award them the project, they had to lower their cost to $15,000.

Clients focusing on cost instead of performance, is one of the issues with implementing the BVA. Although research on more than 2,000 projects show that large cost savings when delivering services come by hiring an expert, traditional clients continue to hire the lower costing vendor or attempt to force the high performing vendor to lower their cost.

Most organizations do not understand the detrimental impact [in terms of cost, time and quality] of hiring a low performing vendor or forcing a high performing vendor to perform a service, with less cost, then they usually need.

3. Best Value Approach (BVA) Implementation

The Best Value Approach has four phases (see Figure 2):

1. Prequalification: Educates vendors and client stakeholders on the Best Value Approach. Explains to vendors how to be successful in the bidding process. During this time PBSRG also helps the client collect any information required to enable the vendors to bid for the project.

2. Selection: uses a decision-less structure to rate contractors based on level of expertise (performance) and selects the high prioritized one.

3. Clarification: the highest prioritized contractor is required to create a non-technical plan from begin to end that creates transparency for all stakeholders.

4. Execution: the awarded contractor begins the plan they set forth in clarification and measures themselves throughout the entire project.

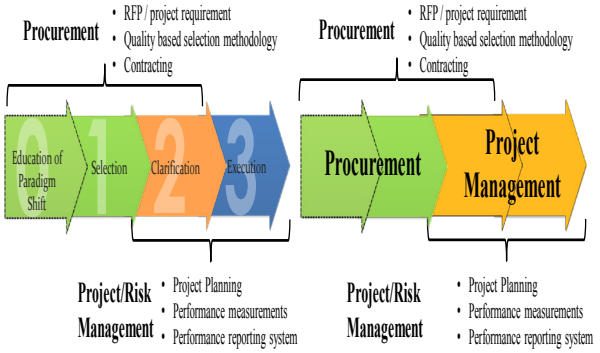

Figure 2. Best Value Approach

This section will review each step of the BVA and identify how each step was implemented at the LPO.

3.1 Prequalification

The BVA uses prequalification differently than traditional project delivery models. Instead of the owner identifying what requirements make a vendor qualified, it assumes all vendors are qualified if they decide to bid on the project. The prequalification phase focuses more on educating the vendors on the BVA to ensure they understand what the expectation of the client is and determine for themselves if they are qualified and can deliver the service. The BVA is designed so that a non-qualified vendor will never make it through the process. Thus, non-qualified vendors will only be wasting their own time and resources. The education performed in the prequalification helps them to understand this clearly. This involves explaining expectations of the client, current condition of the service (Roof A, see Figure 8), and the BVA process.

The first group on the Roof A project that PBSRG educated was the ON internal management team. This

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was performed in 2 meetings. From these meetings it was documented that the technical workers on the team had a very difficult time accepting the process. Since the BVA minimizes the technical participation of the client, the role of the technical personnel was minimized, which they had a difficult time accepting.

The information PBSRG proposed to provide the vendors were as follows:

1. Budget of the roof ($8/sq. ft.).
2. Size of the roof and date installed (70,000 sq. ft., reinforced single ply roof in 1995 and modified bitumen roof in 1998).
3. Client Satisfaction of the Roof (client was unsatisfied with previous roofs due to leaking).
4. Deck Composition (North side, insulation is unknown but mechanically fastened down, and South side insulation is glued down on a proposed stainless-steel deck).
5. Number of penetrations [equipment/material on the roof that protrudes from the surface] that the LPO would like removed.

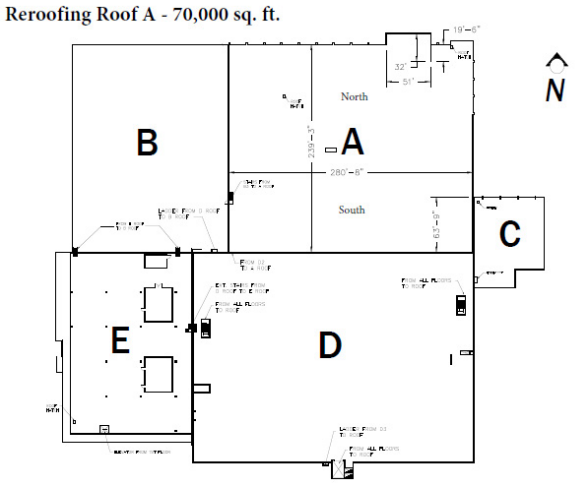

Figure 3. Roof "A" Full Facility View

The LPO's technical personnel felt that more information needed to be given to the vendors and required PBSRG to set up a moisture scan for the roof. A moisture scan identifies what percentage of the total roof has moisture in it. The reason PBSRG proposed to not perform the moisture scan, is because the awarded vendor would have to do it anyway, before being awarded a contract. In addition, performing the scan at that early point in the process would add a couple of weeks to the schedule. They also wanted the contractors to be able to take core samples [see Figure 5] from the roof to verify the roof's layer composition. This caused PBSRG to not only hold an educational session for the vendors but also hold a 2 more roof walk meetings for the vendors.

Figure 4. Roof "A" North Side

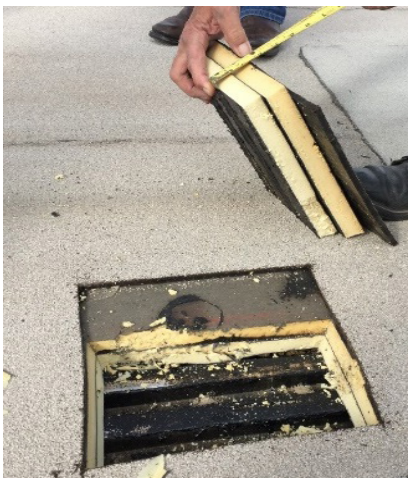

Figure 5. Roof "A" North Side

The moisture scan discovered that only 8.4% of the roof detected moisture. See Figure 7 below for results. Neither the core sampling or the moisture scan changed the contractor's pricing. In fact, the expert contractor already knew what percent of the roof had moisture and previously prepared for it. In the end, none of the technical information the LPO wanted to provide the contractors was needed, but due to the traditional way of doing things, the technical people still required it.

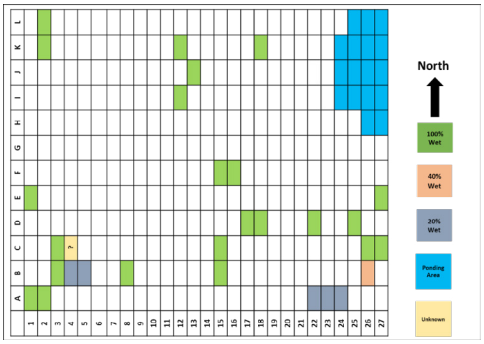

Figure 6. Moisture Scan Results

3.2 Selection Phase

The selection phase was delayed by a couple of weeks

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due to the changes in the prequalification phase. The LPO management team did agree to not create requirements for the vendors but allow the vendors to propose the best roofing system. This was identified in the Request for Proposal sent to the vendors. To select the best value vendor, the vendors were asked to submit bid proposals that included the following components:

• Key personnel proposal form (1 page) – leadership team with references.

• Level of expertise plan (4 pages) – performance claims about roofing project ability, supported with verifiable performance information, and a roof list [includes warranty length, leakage performance, and customer satisfaction].

• Risk management plan (2 pages) – claims about risks that could occur on a project, their experience with it and variable performance information to support.

• Value added plan (2 pages) – options that identify schedule and cost impact.

• Project cost proposal – roof system proposed, its specifications and cost.

• Project schedule (2 pages).

• A proposal for also doing Roof B.

The following evaluation weights were applied to the criteria:

• Level of Expertise, 35%

• Price, 35%

• Interview, 20%

• Risk and Risk Mitigation, 5%

• Value Added, 5%

In total, six bid proposals were submitted by four roofing contractors. Table 3 identifies what the contractors submitted followed by a comparison of the systems in Table 4.

Table 3. Bid Proposal Requirements Matrix

Requirements	Vendor A [10-year coating option]	Vendor B [25 year]	Vendor C [20 year]	Vendor D [20 year]
RFP Cover page/Checklist	X		X	
Key Proposal Form	X		X	
LE Submittal (LE, RMP, VA)	X		X	
Schedule			X	
Roof Performance List	X	X	X	X
Actual Performance Info				X
Asbestos		X		X
Performance Bonding		X		
Penetration/steel platform components removal		X		X
Roof B		X	X	X

Table 4. Roofing System Comparison

Company	System	Cost	$/sq. ft.	Annual $	Age of Roofs	# of References	Warranty
Vendor B	System 1 (BUR)	$761K	$10.74	$31K	Avg: 2 yrs. Max: 4 yrs.	3	25 years [QA]
Vendor B	System 1 (BUR)	$659K**	$9.30	$27K	Avg: 2 yrs. Max: 4 yrs.	3	25 years [QA]
Vendor C	System 2 (PVC)	$630K	$8.53	$32K	Avg: 2 yrs. Max: 4 yrs.	5	20 years [NDL]
Vendor D	System 2 (SPF)	$528K	$7.54	$27K	Avg: 4 yrs. Max: 5 yrs.	Surveys: 94 Roof list: 47	20 years [NDL]
Vendor D	System 3 (PVC)	$504K	$7.19	$26K	Avg: 5 yrs. Max: 15 yrs.	30	20 years [NDL]

An analysis on the proposals identified the following:

• None of the vendors turned in all the information requested from the Request for Proposal.

• 2 (out of 6) proposal costs were below the budget.

• One vendor was disqualified for turning in a roof system that was only warranted for 10 years (Client wanted a 20-year warranty).

• Only one vendor turned in adequate performance information on their roof system to verify their roof system met the performance expectations of the client.

After seeing the information, it minimized thinking and decision making by the selection committee to determine that the Vendor D System 3 and the Vendor C PVC roof systems as the two options that would move on to the interview stage.

After the interview of both contractor's and their systems, Table 5 shows their final evaluation ratings.

Table 5. Final Evaluation Ratings

No	Criteria	Vendor C PVC	Vendor D System 3
1	Level of Expertise rating	17.5	17.5
2	Risk Management Plan rating	2.5	2.5
3	Value Added rating	2.5	2.5
4	Interview rating	18.3	19.5
5	Cost	28.0	35.0
	Total Score	69.0	77.0

Vendor D System 3's option was identified as the best value. It was $70K below budget, $127K below competing PVC roof, and had greater documented performance information [30 references, average age of roof is 5 years, maximum age is 15 years].

3.3 Clarification Phase

The clarification kick-off meeting is the first time the vendor brings in their entire leadership team to discuss the details of the project with the LPO. The vendor was expected to have the following documents prepared to present:

1. Full draft plan.

2. A detailed schedule by roof area.

3. A detailed cost estimate, including the requested value-added items. Any removal activities and costs should

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be separated from the installation of new material. The rational is that the LPO is charging the project from two different sources of money.

4. Detailed specifications with any changes proposed.

5. Manufacturer's warranty with any changes proposed.

The contractor did not come prepared with all the above requirements. This led to the LPO identifying numerous documents missing:

- Safety plan.
- Copy of warranty.
- Letter that roof system meets FM Global requirements [NAV #].
- Roof system section, attachment pattern, and all flashing details and cap work.
- City of Phoenix Permit.
- Steel removal plan.
- Roster for safety training and completion of it.
- Updated cost breakout to include above items.

The Vendor proposed a start date of 3/27/2017 with an end date of 5/22/2017, which would meet the deadline requirement of 5/31/2017. Interestingly, in the clarification kick off meeting, the LPO identified a new requirement previously unknown to anyone. They identified that their facilities are insured by FM Global and need to maintain an FM Global standard rating that meets their minimum. Currently, the contractor felt comfortable they would meet the requirement, but the LPO's technical staff required the contractor to perform a pull test in order to show the roof would maintain the FM Global minimum standard. A pull test is when a screw is drilled into the deck, and a machine pulls the screw out of the deck. The pressure that was required to extract the screw out of the roof deck is recorded and compared to the standards to identify if it meets the minimum. The LPO was concerned that the screws holding down the roof would not meet the minimum. The pull test results showed that the strength requirement to screw (fasten) down the roof system met the FM Global minimum standard (see Figure 8).

Figure 7. Pull Tester

In addition, the LPO required the contractor to bring in a professional structural engineer to verify if their plan to remove the steel structure (far left pop out in Figure 9) would not compromise the integrity of the roof.

The additional requirements from the LPO were not necessary, but the LPO's technical personnel made a decision to require them. Their decision making did not change the vendor's plan but did delay the start of the project by a month, putting the project at risk of not completing before monsoon season.

3.4 Execution Phase and BVA Roof "A" Project Results

Despite the contractor not submitting a full plan until weeks after the project started, the roof was completed and the LPO was satisfied. The project was completed one month after the intended deadline but was 100% due to the LPO. Despite the schedule delay, the monsoon season was not in effect in Arizona at that time. In total, the LPO saved $270,000 on roof "A" and rated it 10/10. See comparison of before and after in Figures 9 and 10.

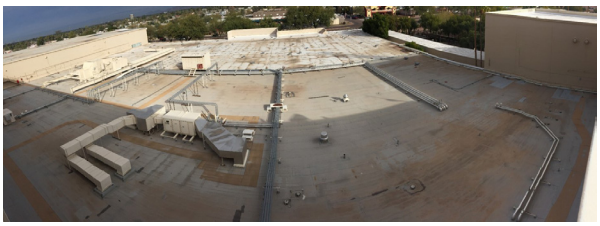

Figure 8. Roof "A" Before

Figure 9. Roof "A" After

3.5 Analysis of Issues in Implementing BVA

Throughout PBSRG's implementation of the BVA at the LPO, the biggest issue was the resistance from its technical personnel. If PBSRG did not bring in Dr. Dean Kashiwagi, who had been running BVA since 1992, the technical personnel would not have even tried the approach. Many times, the technical personnel would challenge the BVA ideas, and even after it was proven correct on the project, they still would claim the ideas was flawed. In fact, even after the success of Roof "A", the LPO team immediately made a decision to deviate from fully following the BVA and revert to their traditional way of doing business on their secondary roof project [Roof "B"]. The next section will explain the results of Roof "B".

Additional issues documented while implementing the

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BVA were the following:

1. The need to convince multiple stakeholders and gain their approvals.

2. The BVA practices are different than the traditional way of doing things; it is difficult for the personnel to follow them.

3. Current relationships with vendors. Traditional project delivery is based upon creating a relationship between the client and the vendor. BVA requires the client to minimize the relationship and base the selection and execution off identifying the expert and letting them do their job.

3.6 Traditional Roof "B" Comparison

Due to the cost savings from Roof "A", the LPO decided to also complete another roof that was in need of replacement, Roof "B". Roof "B" was similar to Roof "A". The layers of Roof "B" were as follows:

- GBS granulated top layer.
- SP4 (smooth inner ply).
- Vented Base sheet.
- 2 polyisocyanurate.

Although, Vendor D was identified as the high performing vendor for Roof "B", the LPO decided to not follow the BVA prioritization and chose Vendor C [roof incumbent] to deliver the roof (see Table 6), due to their history with the contractor. The LPO did try to follow the BVA steps, however, after the initial clarification steps they stopped coordinating with PBSRG. Without the help of PBSRG, the LPO began falling back into the traditional model of management, direction, and control (MDC). PBSRG Director Dr. Dean Kashiwagi warned the LPO to stick with the structure and beware of developing a relationship with the contractor and the importance of sticking with the BVA process.

Table 6. Roof "B" Bid Proposal Comparisons

Company	System	Cost	$ / sq. ft.	Warranty
Vendor B	N/A	$ 81,382.00	$1.85	n/a
Vendor C	60 Mil Fleeceback TPO	$ 167,000.00	$3.80	20 years [NDL]
Vendor D	GAF Acrylic/Silicon Coating	$ 97,960.00	$2.23	15 years [Emerald Pledge Limited]

The LPO project management team spent time working with the vendor on the technical aspect of the proposed roofing system, requiring the contractor to perform a moisture scan and do an adhesive test [test how much wind is needed to uplift the top layer of the roof system from the deck] of the roofing material with the existing modified bitumen system. The LPO team also was concerned with the manufacturer's lack of warranty for the existing roof system. These issues along with waiting to get a budget for Roof "B" approved from internal management, caused a project start date of 5/24/2017 delay by 2 weeks [initial end date of 6/16/2017].

The contractor started the project on 6/7/2017 and projected to finish it on 7/15/2017. The major risk of this adjusted time frame was monsoon season. The last two weeks of the project had a high chance of rain storms. The contractor was awarded the project without successfully completing the clarification phase, and did not consistently submit a weekly risk report, which required them to report on the project each week.

Most of the project went well, and was looking to be completed on 7/3/2017, 12 days quicker than the adjusted schedule. The day before the contractor would finish the roof (7/2/2017) a major rain storm swept through Phoenix and uplifted 20% of the new TPO roof system (see Figure 11), destroying the existing modified bitumen system underneath as well. It was proposed that this issue occurred because the contractor does not normally seal up the ends of the roof until the very last step. This enabled a storm to come through and have the ability to get underneath the new TPO roof system and uplift a portion of it.

Roof "B" would end up completing, 3 months over schedule in October. The decision was made to remove the entire existing Roof "B" and replace it with a new roof. Insurance would end up covering the cost of the roof.

Figure 10. Roof "B" After Storm

4. Conclusion

The Best Value Approach (BVA) is a new approach that has been documented to improve the performance and efficiency of delivering services and projects. However, it has been difficult to sustain at organizations, especially larger ones. This paper documented a case study of a large private organization (LPO) that utilized the BVA on the replacement of a roofing system as a test to document its value, the issues and difficulties with running it, and the reaction of the technical personnel utilizing the process.

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To select, hire and deliver the project was done in record time and with high performance.

Despite the high performance and decrease in management, PBSRG identified that the biggest issue in implementing BVA at large organizations is due to the resistance caused by the technical personnel not wanting to switch their traditional approach of management, direction, and control (MDC) of the vendor to the utilization of their expertise.

However, despite the technical personnel not agreeing with the BVA and even making minor adjustments to it, it is able to override their resistance and deliver amazing performance. It requires the BVA implementers to be an expert at using information and metrics to simplify the project and create transparency, to minimize any decisions that the technical personnel would make.

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