

# The Impact of Utilizing Expertise to Project Risk and Performance

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Organizations have had difficulty in finding good project and risk management techniques that will deliver high performing projects. Research has identified common risks that occur on projects, but previous research has had difficulty coming up with reliable methods to mitigate those risks. However, the Best Value Approach (BVA) has proven to be effective in minimizing risk and increasing project performance. The crux of the BVA is the utilization of experts to minimize project risk. The BVA approach is unique from other project management methodologies which focus on increasing communication, collaboration and decision making. Previous research shows that client stakeholders are the cause of the majority of project risks, while the expert vendors usually do not cause risk on a project. It has been observed that expert vendors are able to minimize client stakeholder risk by transparent planning and tracking. Using case study research, an expert contractor's project is analyzed to determine the impact of using the BVA project management methodology to minimize project risk. As a result, the contractor did not cause any risk based on time and cost and helped the client minimize their risk. The research identifies eight risk mitigating actions the contractor applied through the BVA. The majority of the risk mitigating actions were performed primarily in the preparation and preplanning phases of the project.

**Keywords:** Expert, Expertise, Project Management, Project Performance, Best Value Approach, Procurement, Risk Mitigation, Risk Management.

## Introduction

Organizations in multiple industries (such as information technology (IT), construction, health, aerospace, energy and manufacturing) have struggled to find project and risk management practices that have proven to deliver high performing projects (Rivera, 2017). According to a study by Rivera (2017), the average percent of construction and IT projects delivered on time is 20% and 40% respectively. Meanwhile, their percent of projects delivered on budget is 32% and 43% respectively. By analyzing project case studies, researchers have identified common risks including weather conditions, design changes, payment issues, shortages and additional work (Algahtany, 2018; Le, 2019). Methods to mitigate project risks have not led to a conclusive solution. There is a need in all industries to identify more efficient and consistent practices to mitigate risk and increase project performance.

### **The Best Value Approach and Risk Mitigation**

The Best Value Approach (BVA) is a paradigm applied throughout the supply chain of a project (including procurement, planning and execution). The BVA has been shown to be effective in minimizing risk and increasing project performance (Duren & Doree, 2008; State of Hawaii Report 2002). Kashiwagi (2019) indicates that at the crux of the BVA is the utilization of experts to minimize risk and increase project performance. This means that the BVA aims to minimize management, communication, and collaboration by shifting full accountability and control of the project to the expert vendor. Rivera and Kashiwagi (2016b) analyzed 12 different project management methodologies (such as agile, lean, waterfall, and Prince2) and found that the idea of utilizing expertise to minimize risk and increase performance is unique to the BVA model. They identified that the majority of project and risk management models focus on increasing communication and collaboration to mitigate risk and increase performance. Ultimately, the BVA process is effective because each step facilitates the utilization of expertise. It has been proposed that the BVA is successful in mitigating risk because it makes the expert vendor accountable, because the expert is the only person with the capability to minimize risk. For over 20 years, the Performance Based Studies Research Group has researched the BVA and the expert's responsibility of risk mitigation and have identified the following (Rivera, 2014):

1. Experts have no risk in a project.
2. The greatest risk to a project is caused by nonexpert stakeholders.
3. Experts are able to minimize risk caused by nonexpert stakeholders through transparent planning and tracking.

These findings have been confirmed in two longitudinal studies with the US Army Medical Command (J. Kashiwagi, Sullivan & D. Kashiwagi, 2009; Kashiwagi, D., Kashiwagi, J., Smithwick, J., Kashiwagi, I., Kashiwagi, A., 2012;) and a Conglomerate of Minnesota government entities (Kashiwagi, 2012; Rivera & Kashiwagi, 2016a). The US Army Medical Command (MEDCOM) study identified that the vendor caused 0.0% cost deviation and 2.2% schedule deviation for 619 projects valuing \$1.027 billion. The client, identified as the greatest source of risk, caused 4.13% cost deviation and 30.84% schedule deviation. The Minnesota study identified that the vendor caused 0.01% cost deviation and 2.65% schedule deviation for 399 projects valuing \$438.88 million. The client was identified to have caused 7.61% cost deviation and 21.92% schedule deviation to the projects. Other case studies have confirmed similar findings, including:

1. \$1 billion pilot project in the Netherlands for road widening (D. Kashiwagi & J. Kashiwagi, 2011; Van de Rijt, Witteveen, Vis & Santema, 2011) that identified the client to be the source of 99.5% of cost and 82.5% of time deviations.
2. A longitudinal study of a Dutch government agency Rijkswaterstaat (Van de Rijt, Witteveen, Vis & Santema, 2011; Witteveen & Van de Rijt, 2013) which identified in 80% of their quality procured projects the winning vendor was also the lowest cost. The study identified experts to deliver lower costs at higher value due to their capability to minimize risk and inefficiency.

3. A state government agency (Kashiwagi & Rivera, 2016) increased their project manager's work capacity by 22%, with vendor's completing 102% more work in 33% less time, through the utilization of an expert vendor's performance tracking system.
4. A public university (Kashiwagi, Savicky & Parmar, 2003) completed 11 roofing projects (\$2.3 million) using the BVA process to utilize expertise. The projects were completed on time with 90% of projects ahead of time and 28% below budget. The study determined the high performance was due to the control over the projects given to the experts which allowed the experts to properly mitigate risk. In 56% of the projects, the vendor performed additional work at no charge and made higher profits than traditionally run projects.
5. The state of Hawaii (Kashiwagi & Savicky, 2003) completed 96 roofing projects using the BVA to utilize expertise. Through the use of expertise, the state was able to reduce projects costs by 13.8% compared to traditionally run projects which did not utilize the vendor's expertise. This was identified to be due to the mitigation of risks. The prime risks were reducing design errors from 11% to 2.5%.

The BVA research findings are not radical concepts. Expertise has already been linked to the improvement of risk management (Dreyfus & Dreyfus, 1980; Gobet, 2015). There are multiple factors which have been used to define experts and their level of expertise (Campitelli & Gobet, 2004; Epstein, 1996; Meehl, 1954). Common factors include experience, diplomas, and performance measurements specific to a domain. Gobet's (2015, p.12) definition of expertise is 'knowledge and skills', with an expert being defined as 'somebody who obtains results that are vastly superior to those obtained by the majority of the population'. This definition of an expert can be applied recursively to expertise, emphasizing both the individual's knowledge and the individual's skills. The application of this definition to skills is straightforward as the results of both an expert and nonexpert can be observed through project performance.

Gobet's (2015) research emphasizes that with any definition of an expert, perception is at the heart of expertise. He concludes "...experts literally 'see' things differently compared to novices". Dreyfus and Dreyfus (1980) established a standard five-stage model of mental activities (Dreyfus model) from novices to experts. The Dreyfus model addresses the change in perception and understanding of an expert which allows a situation to be seen less as a compilation of equally relevant bits and more as a complete whole in which only certain parts are relevant. Schoenfeld (1982) similarly identifies the difference in the perception between experts and novices to be rooted in their expertise. Benner's (1984) analysis of the Dreyfus model characterizes the expert's perception as the ability to see the overall picture and alternative approaches; the vision of what may be possible. As such, experts are identified to have an intuitive grasp of the situation. Klein and Hoffman (1992) identify that it is not just perceiving what is there but also perceiving what is not there. Benner (1984) notes that it is difficult to pass the expert's perception or mentality to others. Experts operate from a deep understanding of the situation which cannot be measured but can only be seen through their actions and outcomes.

Gobet, and other researchers in the field of expertise, have identified that the key to success lies with the expert. The only way to mitigate risk is through utilizing expertise. Applying this to the BVA model, it identifies that the BVA model should be a vendor centric approach and not a client centric approach, where the key to success and risk mitigation lies with the expert vendor

using the model. However, most research tests focus on how the client uses the BVA model, and not the impact the BVA model has when used by an expert vendor.

### **Research Proposal**

This research aims to document the impact the Best Value Approach (BVA) model can have when an expert vendor uses the model to minimize risk on a project, specifically within the construction industry. The research questions are as follows:

- What is the impact on project performance when an expert vendor utilizes the BVA?
- How does the BVA help a vendor minimize risk?

Case study research was used to answer the research question. The procedure followed includes:

1. Identification of an expert through the BVA process.
2. Documenting how the expert vendor used the BVA model.
3. Analyzing the impact of the expert vendor using the BVA model.

### **Case Study Documentation**

#### *Client Background and Requirement*

The client was a government organization familiar with the Best Value Approach. They have used BVA as a method to procure construction work for their school district for years. The client in this case was looking for a vendor (contractor) for the renovation of a school's kitchen and indoor air quality system. The project consisted of:

1. Demolition and removal of heating, ventilation, air conditioning (HVAC) systems in classrooms, hallways, offices, gymnasium and associate mechanical spaces including roof top equipment.
2. Installation of air handling units (AHU), energy recovery units (ERU), classroom induction displacement air units and chilled beams in order to provide ventilation, heat and dehumidification.
3. Installation of central chiller plant and ice storage system.
4. Installation of complete direct digital controls (DDC) to HVAC, plumbing, electrical and associated low-voltage systems.
5. Remodeling of bathrooms and kitchen to code compliance.
6. Providing related demolition, electrical, patching, miscellaneous equipment. Other architectural features will be replaced such as carpeting and doors.

The client provided the contractor with a budget: \$4,933,206 and all necessary construction documents including plans and specification.

*Education and Schedule*

The RFP was shared with contractors within the area. There were multiple contractors within the area which were experienced and familiar with the BVA as the client had delivered multiple BVA projects over the years. Due to the familiarity with the BVA, the client held one educational session (pre-proposal meeting) and allowed 14 calendar days for the contractors to prepare their proposals. In the RFP, the contractors were given the following schedule (see Table 1):

*Table 1: Procurement Schedule*

<b>Schedule Activity</b>	<b>Date</b>
RFP Released	1/28/2016
Pre-Proposal Meeting (MANDATORY FOR PRIME GENERAL CONTRACTORS)	2/2/2016
Last Day for Questions at 12:00 PM	2/5/2016
Proposals Due (10:00 AM CST Time) Risk Assessment / Value Enhancement due at 12:30 PM	2/11/2016
Interviews	2/12/2016
Identification of Potential Best-Value	2/15/2016
Clarification Kick Off Meeting (Tentative)	2/18/2016
Board Action	03/08/16 or prior
Project Award	03/09/16 or before
Start Construction Date	6/13/2016
Anticipated substantial completion date. The building must be ready for staff to clean, wax and move in. Work behind the scenes may continue.	8/19/2016
Final Completion	10/14/2016

*Selection Phase*

The client received two proposals from general contractors (Contractor A and Contractor B) both of whom utilized multiple subcontractors for critical components of the project such as electrical, mechanical, roofing. Each written submittal was evaluated, and the ratings identified a prioritized best value contractor. Three client committee members rated the contractor submittals and interviewed both contractors’ project manager and site superintendent. The results are summarized in Table 2.

Table 2: Contractor Awarded Points and Prioritization

<b>Average Raw Scores</b>			
<b>Criteria (Raw)</b>	<b>Units</b>	<b>Contractor A</b>	<b>Contractor B</b>
Level of Expertise rating	(1-10)	8.3	6.7
Risk Assessment rating	(1-10)	8.3	8.3
Value Added rating	(1-10)	8.3	8.3
References	Pass / Fail	Pass	Pass
Interview rating	(1-10)	10.0	9.2
Total Cost	\$	\$3,160,000	\$3,340,696
<b>Normalized Scores</b>			
<b>Criteria (Normalized)</b>	<b>Best Score</b>	<b>Contractor A</b>	<b>Contractor B</b>
Level of Expertise rating	8.3	1.00	0.80
Risk Assessment rating	8.3	1.00	1.00
Value Added rating	8.3	1.00	1.00
References	Pass	1.00	1.00
Interview rating	10.0	1.00	0.92
Total Cost	\$3,160,000	1.00	0.95
<b>Assigned Points and Prioritization</b>			
<b>Criteria (Assigned Points)</b>	<b>Weight</b>	<b>Contractor A</b>	<b>Contractor B</b>
Level of Expertise rating	20	20.0	16.0
Risk Assessment rating	20	20.0	20.0
Value Added rating	10	10.0	10.0
References	5	5.0	5.0
Interview rating	30	30.0	27.5
Total Cost	15	15	14.2
Total Points	100	100	92.7
Prioritization		1	2

The selection phase resulted in prioritizing Contractor A to move into the clarification phase. Contractor A’s cost was 23.25% below the client’s budget. They provided an expert project team based on the previous performance metrics including the project manager, superintendent, and electrical, mechanical and roofing subcontractors [see Table 3]. In comparison to their competitor, Contractor A matched or exceeded their competitors scores [see Table 2]. Additionally, Contractor A’s total cost for the alternatives was 26% lower than their competitor [see Table 4]. The alternatives were not included in the base proposal cost but were optional additions of the client. Beyond their overall level of expertise, Contractor A demonstrated the capability to mitigate risk for the client through the identification of key risks (Risk Assessment) based on the client requirement. Lastly, the contractor provided potential value-added options which could improve the quality of the client’s objective with options which could potentially minimize the cost to the client.

The major risks and value-added options were identified within the general, electrical and mechanical aspects of the project. Each risk and value-added option were supported by previous implementations. An example of a risk submitted by the contractor is as follows:

- General Risk – Scope of work changes due to building code, city plan review, and discrepancies in the bid documents due to unforeseen or existing conditions.

- Mitigation measure – The best value proposal includes only what was shown or easily understood from the bid documents. Each item that comes up will be resolved and a solution will be presented to the Owner within (5) days detailing schedule and cost impact to the project. If the Owner approves the time and cost impacts, we will generate the change order and proceed with the work. If the Owner objects, the time and cost impact will be tracked on the weekly risk report.
- Documented Performance – This process was utilized on 13 best value school indoor air quality projects with a total valuation of \$37,386,000. The schedule delay rate was (-1%), design-initiated change order rate was (2.6%), contractor-initiated change order rate was (-2%) and our overall customer satisfaction rating was 99%.

Examples of other risk and value-added options the contractor included in their proposal were as follows:

1. Electrical Risk – The new electrical transformers are located inside the new mechanical enclosure which doesn't meet the local power company's standard based on their website.
2. Mechanical Risk – There is existing piping that will be reused on this project. Based on past experience, some of the existing will not hold a final pressure test to receive final approval from the building official.
3. General value-added option – Provide chain-link fence with plastic screening in lieu of the sound wall specified at the mechanical enclosure. It would provide cost savings to the owner without impacting the final appearance of enclosure. This process was utilized on three Best Value school indoor air quality projects with a total valuation of \$5,415,000. The schedule delay rate was (-0.25%), design-initiated change order rate was (1.4%), contractor-initiated change order rate was (-3.5%) and our overall customer satisfaction rating was 98%.

Table 3: Alternative Costs Comparison

Alternate Costs	Contractor A	Contractor B	Difference (A – B)
Alternate #1 (Roof)	\$425,500	\$523,844	-\$98,344
Alternate #2 (Concrete Floors)	\$50,000	\$73,142	-\$23,142
Alternate #3 (Technology Cabinets)	\$10,800	\$13,594	-\$2,794
Alternate #4 (Delete Ice Storage Modules)	-\$80,000	-\$79,096	-\$904
Alternate #5 (Delete Fire Pump and Fire Pump room)	-\$29,000	-\$22,860	-\$6,140
Total	\$377,300	\$508,624	-\$131,324

Table 4: Level of Expertise of Contractor A’s Team

Contractor Team (level of expertise)	PM / Superintendent	Electrical	Mechanical	Roofing
# of similar projects	2 (within last year)	7	10	1
Total cost	\$ 7,140,000	\$ 10,590,000	\$ 13,439,000	\$ 3,400,000
Average cost	\$ 3,570,000	\$ 1,512,857	\$ 1,343,900	\$ 3,400,000
Time deviation	-1%	-0.25%	-0.25%	-0.25%
Cost deviation (due to contractor)	0%	-1%	-1%	-1%
Client Satisfaction	98%	98%	98%	98%

*Best Value Contractor’s Perception and Usage of the BVA Model*

Additional insights were gained by interviewing and discussing the project with the best value contractor. As a general contractor, they felt the BVA aligns best with their company’s core values of ownership, integrity and teamwork. When they find a project that will be awarded using the BVA, there is no hesitation to pursue it. The bid manager responded that: ‘*The BVA gives us an opportunity to do what we do best, pre-plan a project from beginning to end and share that plan and its associated cost with the owner.*’

This project was the contractor’s 12<sup>th</sup> awarded contract out of 16 BVA RFPs for this client over the course of 7 years. They were given 14 days to prepare and respond to the RFP. In this case after a review of the construction documents and other available project information the contractor knew they could align an expert project manager and superintendent to the project. Once the contractor’s internal team was determined, they focused on finding trade partners to bring onboard. The contractor also used the methods of the BVA model to select their subcontractors for this project. Identifying their subcontractors based on their past performance and level of expertise. Looking at performance metrics to select the mechanical and electrical subcontractors (see Table 4). With the contractor’s team in place they assigned a bid manager to the team.

The bid manager’s tasks included:

1. Assign tasks to team members.
2. Coordinate plans and schedule creation with the project manager, superintendent, and partner sub-contractors.
3. Receive and review documentation and assemble relevant performance metrics for the contractor’s plan ideas.
4. Coordinate scope review with partner sub-contractors and contractor’s team
5. Receive and review all sub-contractor bid.
6. Submit official response to the owner.

In a traditional low bid environment, the contractor normally waits until the last minute for the lowest bid and scrambles to make sure that their bid is complete at the deadline. When following the BVA, the contractor focuses on selecting a proven team of expert contractors in key areas to help build the proposal, the building envelope, mechanical and electrical sub-contractors. The contractor then meets as a team prior to the proposal due date. All team members understand



everyone’s price, schedule, “plans”, potential risks and impact of those risks if they occur, and documented performance. The goal for the contractor is to have the assigned project manager do minimal work to run a successful project. The leg work is done while preparing the response.

During the preparation of the proposal the contractor did risk mitigating actions such as:

1. Identifying unique aspects of the project requirement including: the mechanical equipment yard being located directly adjacent to the playground, requiring a non-climbable enclosure; and shallow bed rock that made the excavations challenging.
2. Asking questions of the owner and design team to clarify unknowns.
3. Coordinating schedules and expectations internally to ensure optimized pricing and scoping. For example, during the development of their plan for the project the contractor realized that the polishing of the concrete floors would need to be done on the second shift for their plan to go well. This was necessary because the corridors and other spaces also had extensive mechanical and electrical work above the ceiling. To mitigate this risk, the contractor directed the polished concrete subcontractors, prior to bid, that they were expected to work 3:00pm – 10:00pm (second shift) so that their operations would not be in the way of the overhead work being done in the same area. Without this pre-bid communication, multiple contractors would show up to the project trying to work in the same space at the same time. Such a work atmosphere would lead to confusion, finger pointing, re-mobilization charges from some of those contractors and additional labor charges when they are directed to work second shift. In addition to the cost impacts, the hours it takes to resolve the issues are wasted, and in a project where it must be delivered in 10 weeks, every minute matters. Often days are planned down to 15-minute increments to get everything done on time.

*Clarification (Planning) Phase*

Once Contractor A received notification that they were moving into the clarification phase, they immediately began preparations and coordination. The contractor was familiar with the BVA and the purpose and process of the clarification phase which is intended as a planning stage in the project. Using a contractor generated checklist for clarification phase deliverables (see Figure 1), they set a clarification phase schedule identifying responsibilities of both client and contractor (see Figure 2).

<b>Preparations &amp; Kickoff Meeting</b>	
<input checked="" type="checkbox"/>	Identified vendor is notified
<input checked="" type="checkbox"/>	Vendor Prepares Kickoff Meeting Materials
<input checked="" type="checkbox"/>	Kick Off Meeting is scheduled
<input checked="" type="checkbox"/>	Financial Summary is prepared
<input checked="" type="checkbox"/>	Project Milestone Schedule is proposed
<input checked="" type="checkbox"/>	First draft Risk Management Plan is proposed to address major risks and client concerns
<input checked="" type="checkbox"/>	First draft Value Added Plan is proposed to clarify options for project
<input checked="" type="checkbox"/>	Clarification Phase Schedule is proposed (including Client and Vendor tasks)
<input checked="" type="checkbox"/>	Kick Off Meeting Is Held
<input checked="" type="checkbox"/>	Clarification Phase Schedule is finalized and agreed to by Vendor & Client (at a minimum,

*Figure 1: Clarification Phase Checklist*

No	Clarification Phase Activity / Task	Party Responsible	Start Date	End Date
1	Clarification Phase Kick Off Meeting #1	All	2/18/16	2/18/16
2	A/E Review Value Add / Risks	Client (C), Designer (D), Contractor (V)	2/4/15	2/9/15
3	Clarification Phase Meeting #2	All	3/3/16	3/3/16
4	A/E and Owner Decisions on Value Add / Risks	C / D / V	2/11/15	2/16/15
9	School Board Approval	C	3/8/16	3/8/16
10	Project Award	C / D / V	3/23/16	3/23/16
11	Final Clarification Phase Meeting	C / D / V	3/23/16	3/23/16
12	Project Award / Notice to Proceed	C	3/23/16	3/23/16

Figure 2: Clarification Phase Schedule

Contractor A prepared the following documents within the clarification phase:

1. Milestone Plan with designated roles for each milestone.
2. Detailed Plan.
3. Assumptions, expectations, and roles/responsibilities.
4. Risk Management Plan.
5. Value added options.
6. Financial project summary (inclusive of scope changes).
7. Contract.

*Key Points to the Contractor’s Plan*

The best value contractor identified a few points which were key in delivering a successful project due to the clarification phase. During this phase, the contractor’s detailed plan was shared with the owner. By allowing the owner to see a simple and clear plan it allowed the owner to give feedback and questions before the project started, which normally would occur after the project started. Due to the upfront clarification and planning, adjustments could be made to the contractor’s proposal with little to no deviations. In this case, all the owner’s feedback was responded to in four weeks. None of the owner’s requests had any impact to the contractor’s overall plan.

In receiving the client’s feedback, an issue with traditional plans is that they do not include the expectations or action items of stakeholders involved in the project. Traditional plans only include the action items of the contractor performing the work. The contractor identified the client stakeholders as the greatest risk to the project and as such identified within their schedule (detailed and milestone) the list of all actions required for successful implementation and the party responsible for each action (see Figure 2). In identifying the contractor’s expectations of the client stakeholders, it allowed for proper clarification and feedback from the client to address potential risks or needed adjustments upfront rather than being surprised during the project.

An additional key part of the contractor’s plan is that during the clarification phase the contractor laid out their plan for dealing with unforeseen conditions. The bid manager noted that: “...there is always things hidden in walls, above ceilings or under floors when working in existing builds

*built in the 60s. Our detailed plan lays out who is required to do what within a given time frame. When an unforeseen issue arises, the plan goes into effect. Each person knows what to do, how long they have to do it and when it's complete. On a time-sensitive project like this every minute matters. The automated response eliminates the time to 'figure out what to do' so that we can focus on getting it done."*

The contractor provided a detailed plan to handle such risks. The risk mitigation plan identified the probability a risk would occur, description, plan to minimize risk from occurring, action if the risk occurred and projected impact (see Figure 3). Without this level of planning and risk mitigation, unforeseen conditions and owner requested changes could have added twice as many days and much more cost than they did. By preplanning and agreeing to procedures beforehand the contractor minimized the amount of waste caused by the traditional increase in communication and coordination.

<b>Identified Risk 1:</b> Risk Probability 90%	Scope of work changes due to building code, city plan review and discrepancies in the bid documents due to unforeseen or existing conditions.
Risk Description:	Each item that comes up will be resolved and a solution will be presented to the Owner within (5) days detailing schedule and cost impact to the project
Plan to Minimize Risk from Occurring:	<ul style="list-style-type: none"> <li>• On a weekly basis Contractor will submit a Weekly Risk Report notifying the project team of any potential time or cost deviation while reviewing the Risk Management Plan on a weekly basis.</li> <li>• In our contracts to our subcontractors we require each subcontractor to submit a Weekly Risk Report every week so we are continually notified of potential risks.</li> </ul> <p>These basic steps will prevent potential risks from beginning major issues and creating time and cost deviations.</p>
Action If the Risk Occurs	Once an item is encountered we will immediately notify all parties in writing on the day of the discovery of the potential time and cost impact. We will present to the owner and engineer the best solution that minimizes the time and cost impact to the project. If the owner approves the time and cost impacts, no action is required and we will generate the change order and proceed with the work. If the owner objects to the time and cost impact, we will not proceed with the work until directed in writing, and the time and cost impacts will be tracked on the weekly risk report.
Projected Impact (If Risk Occurs):	The time and cost impact will be addressed on a case-by-case basis.

Figure 3: Example Risk Mitigation Plan

#### Execution Phase

Due to the upfront planning, the contractor initiated their plan without promptings from the owner. Long lead time products were ordered, and everything was being put into place to prepare to start work on site on June 13, 2016. The contractor's crews mobilized to the site and things worked well. During the project, unforeseen conditions added 57 days and \$129,808 to the project. Due to the pre-planning of the contractor to deal with these items as they came up, the impact to the cost and schedule were minimized.

For example, near the end of the project the owner came to the contractor with a request. The owner surprised the contractor with a special event in early August. The special event would require the contractor to focus their efforts in one section of the school so the rooms could be used for the event. This altered the initial plan and added cost for the overtime to recover the schedule deviation. Additionally, the owner had many other requests for additional scope of work to be added to the project. The additional work added 17 days and \$56,446 to the project.

Throughout the duration of the project the contractor utilized the weekly risk report (WRR) tool provided through the BVA process. The WRR was used to coordinate and communicate the status of the project in terms of the schedule, potential risk, deviations to the project schedule / cost, and project performance. The WRR was an ongoing document which was sent to all major stakeholders allowing the client and contractor to continually have the same perception of the project status and upcoming actions necessary, with minimal communication.

### Case Study Results

Contractor A was able to complete the original project scope on time in terms of the substantial completion and owner move-in dates. The project was extended (delayed) 74 days due to additional work the client requested which could not be completed until Christmas break, due to the school year. The project ended overbudget at a final cost of \$4,002,549 due to unforeseen site conditions, design errors and client requests. The customer satisfaction on the project was given a 10 out of 10 overall rating (see Table 5 for full client ratings). It is identified that the schedule delay and increased cost was not due to the contractor (see Figure 4). In reviewing the project, the contractor bid manager noted that: *“This project for them proved once again that the owner is their biggest risk. However, with sufficient preplanning and coordination even unforeseen or client generated risks could be minimized and at times eliminated.”*

Budget		Schedule	
Initial Allocated Budget	\$3,786,043.00	Initial Start Date	6/13/16
<b>Current Estimated Budget</b>	<b>\$4,002,592.00</b>	Initial Completion Date	10/14/16
<b>\$ Over Budget</b>	<b>\$216,549.00</b>	<b>Current Completion Date</b>	<b>12/27/16</b>
\$ Due to Designer	\$30,631.00	<b>Days Delayed</b>	<b>74</b>
\$ Due to Client	\$56,446.00	Days Due to Designer	0
\$ Due to Contractor	-\$336.00	Days Due to Client	17
\$ Due to Unforeseen	\$129,808.00	Days Due to Contractor	0
<b>% Over Budget</b>	<b>5.72%</b>	Days Due to Unforeseen	57
% Due to Designer	0.81%	<b>% Over Schedule</b>	<b>60.16%</b>
% Due to Client	1.49%	% Due to Designer	0.00%
% Due to Contractor	-0.01%	% Due to Client	13.82%
% Due to Unforeseen	3.43%	% Due to Contractor	0.00%
		% Due to Unforeseen	46.34%

Figure 4: Final Project Performance

Table 5: Client Close Out Performance Survey

#	<b>VENDOR PERFORMANCE EVALUATION CRITERIA</b> [10 represents that you were exceptionally satisfied, 5 that you were unsure/don't know and 1 represents that you were unsatisfied]	UNIT	Rating
1	Ability to manage the project cost (minimize change orders).	(1-10)	10
2	Ability to maintain project schedule (complete on-time or early).	(1-10)	10
3	Quality of workmanship.	(1-10)	10
4	Professionalism and ability to manage risks on project.	(1-10)	10
5	Ability to follow the user's rules, regulations, and requirements.	(1-10)	10
6	Vendor discussed alternative actions and explained why the selected process/monitoring/alternative represents the best value to the client.	(1-10)	10
7	Vendor has prepared the SOW so that risks are minimized.	(1-10)	10
8	Vendor provided a clear explanation and understanding of how all activities support achievement of client's objectives on the project.	(1-10)	10
9	Vendor's project deliverables (reports, actions, or key milestones) are delivered on planned schedule; if schedule deviations occurred, they were fully justified.	(1-10)	10
10	Weekly Progress Report is clear, concise, timely, and easy for client to understand.	(1-10)	10
11	Overall satisfaction and comfort level in hiring the vendor again.	(1-10)	10

The testing of the BVA resulted in a selection time of 14 calendar days (88 days if you include the clarification/planning phase) with a savings of \$1.15M (23.25%) which includes added alternatives. Identifying and utilizing a contractor that also utilized the BVA model, who preplanned, performed risk mitigation and was able to deliver the project on time. The contractor was not responsible for any of the project time or cost deviations (see Table 6). The expert contractor was identified to apply the BVA model with the following eight key actions which reduced or eliminated project risk. These BVA actions summarized in Table 7 were shown to assist in reducing project risk and achieving the project performance results.

Table 6: Vendor Performance

Selection Phase Performance	Results
Time to procure [including clarification/planning phase]	14 days [88 days]
Budget / Awarded Cost	4,933,206 / \$3,786,043
Procured Under budget	-23.25%
Project delivered on time (excluding additional work)	yes
Percent time and cost project deviation due to contractor	0%

Table 7: BVA Risk Mitigating Actions of Contractor

#	Risk Mitigating Actions
1	Contractor identification of expert personnel on team pre-submittal.
2	Internal coordination of expertise to eliminate any contractor risk pre-submittal.
3	Upfront use of the lead expert in the planning phase and using less expertise during execution.
4	Creation of plan inclusive of project risks outside of contractor control.
5	Contractor led project planning and coordination. Development of a non-technical simple plan that all stakeholders could understand.
6	Clarification of plan upfront with client stakeholders before project initiation regarding project roles and expected contribution to the project plan.
7	Setting agreed expectations and mitigating actions upfront which would minimize communication during the project.
8	Tracking of a non-technical project plan and reporting deviations through the Weekly Risk Report (WRR) and project performance metrics (time and cost).

## **Discussion and Findings**

This research identified that an expert contractor that utilizes the BVA model may have the capability to eliminate all project deviation (risk) caused by the vendor. Results demonstrated that the expert saved time and money for the client. In terms of risk caused by other stakeholders (designer and client) and unforeseen events, the expert vendor was able to minimize their impact to the project, but not able to eliminate the impact to the project. Isaac Kashiwagi (2019) determined a potential reason for this gap can be caused by certain risk ultimately being outside the control of the expert.

When analyzing the type of risk mitigating actions of the expert, it was determined that the expert's actions were centered on identifying internal expertise and the use of that expertise throughout the project. Seven of the eight mitigating actions were performed during the preparation and planning process, before the project entered execution. The expert vendor was able to leverage their internal expertise upfront through planning and coordination of their plan with client stakeholders. During execution, the highlighted risk mitigating action was the Weekly Risk Report (WRR) that was able to accurately track deviations to the initial project plan.

The test differed from other examinations of experts as the BVA process used to classify an expert was not based on their years' experience or perceived skill but their actual past project performance. This definition as noted by Gobet (2015), may be the most accurate indication of an expert. The highlighted risk mitigating actions may differ based on the distinction of expertise. Future tests should be conducted to enlarge the list of risk mitigating actions of an expert using the same definition and indicating factors.

## **Conclusion**

The construction industry has had a difficult time finding a model that can effectively minimize risk on a project and increase the project performance. The Best Value Approach (BVA) is one of the only delivery models that has had repeated testing documenting that it can mitigate risks that occur on projects and improve performance. The BVA model differs from other models because it focuses on mitigating risk through utilizing expertise and not management, communication, and collaboration. This makes the BVA model a vendor centric model instead of an owner centric model. It is a key difference between the BVA delivery method and other models being used in the industry. However, there have been very few research tests performed documenting a vendor utilizing the BVA model.

This paper performed a case study research documenting the impact of a vendor utilizing the BVA model on risk mitigation and project performance. The result of the research identified the following:

1. A vendor following the BVA model will select their subcontractors and team based on expertise and performance metrics.
2. A vendor following the BVA model will perform most of its risk mitigating actions before a project begins.

3. To mitigate the majority of risks a non-technical plan is required before a project begins and needs to be coordinated with all stakeholders.
4. A Weekly Risk Report (WRR) ensures that all stakeholders are satisfied and aware of the status of the project. It minimizes disputes and issues.
5. A vendor following the BVA model is able to increase performance and minimize the impact of all risks, regardless of if a stakeholder causes it.

The BVA delivery system is a vendor centric model. A vendor that adheres to its principles and follows its steps, has the ability to mitigate risk and increase performance. It is suggested that more case study research be performed to verify these results.

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