Improving the Management of Environmental Engineering
Projects through the Best Value Project Management Model
for a State Agency

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The State Agency is the regulatory agency responsible for ensuring quality of air, land, and water
resources. Historically the State Agency has experienced difficulty in managing environmental
professional services. To potentially address the issues, the State Agency tested a new approach
to managing their projects, the Best Value Project Management Model (BV PMM), which
focuses on using logic and natural laws instead of technical information and experience to
improve project performance. This paper presents a case study on the State Agency’s
implementation of the BV PMM on their indefinite delivery indefinite quantity (IDIQ) Water
Quality contract that ran 60 individual projects. The main functions of the water quality unit
program is to identify, assess and remediate sites that are contaminated with hazardous
substances. This paper presents the BV PMM, its development, and documents the case study
results after one year of implementation. Results include an improved PM utilization rate (22%
increase), increase in vendor work performed (102%) in 33% less time, and increase in customer
satisfaction (22%).
Keywords: Best Value Project Management Model, State Agency, Best Value PIPS,
traditional.

Introduction

The State Agency covered in this paper is the environmental regulatory agency for one of the
United States’ top 18 largest states, covering a population of close to 10 million people. Its
mission is to protect and enhance public health, welfare and the environment in its state. The
State Agency today administers a variety of programs, to improve the health and welfare of its
citizens and ensures the quality of its air, land and water resources meet regulatory standards.
With an average of 400 employees managing various contaminants and pollutions, the State
Agency strives to lead its state and the nation in protecting the environment and improving the
quality of life for the people in its State (PBSRG, 2016).

Over the last decade, the State Agency has tried to make the changes necessary to accomplish its
mission, but has been having difficulties with the performance of their environmental
professional services. The upper management at the State Agency identified the following
problems:

1. Unable to identify performance and value of vendors / environmental experts.
2. Vendors were not meeting the quality expectations of the State Agency.
3. Management requirement of the vendors was too high.
4. Inability to spend all available resources.
Most of the issues the State Agency was experiencing were common among environmental quality projects. Environmental projects are expensive, complex in nature and often times require multiple testing and invasive investigations over a period of many years before the final end goal of the project can be clearly defined. This makes it difficult to clearly set expectations and plan resource requirements, causing inaccurate expectations of the time, cost, and quality of projects. The lack of important pieces of information at the beginning of a project also increases the risk of the project. This is an issue that has been plaguing the environmental engineering industry and many others worldwide for decades (Vaughn and Ardila, 1993; Filipovich, 2001; Esty & Porter, 2005; International Rivers, 2005; Macek, 2006; Reuters 2009; Bo-Jie, et al., 2010; Fu et al., 2010; Buntaine, et al., 2013; Fisher, 2013; IEG, 2013; Padgett, 2014; AFP 2014).

As a result, over the past few years the State Agency has become increasingly dissatisfied over the past few years, with the delivery and project management requirement of environmental professional services. The State Agency identified that the lack of information forced them to make more decisions on projects, making it difficult to hold the vendors accountable for their work due to the direction the State Agency was giving them.

With the budget continually shrinking and increasing requirements, the State Agency was in search of a solution to help them improve their management, efficiency, and performance in delivering environmental services, and minimize the issues they have been facing.

**Problem**

The State Agency began deploying Lean principles in 2013, which geared staff toward eliminating waste and increasing value for its customers by improving internal systems and processes. Its water quality program has implemented process improvements to accelerate clean-ups, engage responsible parties and ultimately reduce the overall costs of remediating contaminated sites. The State Agency lacked a consistent contracting and project management mechanism that paralleled the process improvements that the agency was implementing. As the water quality contract was coming up for re-bid, the State Agency desired a process that would accurately identify the quality and performance of the environmental work being completed, and promote their vendors and internal personnel to be more proactive and accountable for their work to achieve their accelerated cleanup model. Some of the difficulties the State Agency faced in doing this are as follows:

- Lacked the number of in-house project managers to perform environmental work.
- No project performance information was collected.
- Current processes did not differentiate the value and performance of vendors for new contracts.
- Increased pressure on the State Agency to utilize all resources provided.
Best Value Performance Information Procurement System (BV PIPS)

The State Agency identified the Best Value Performance Information Procurement System (BV PIPS) as a potential solution to their problem, due to the similarity of the complexity that construction and IT projects have with environmental quality projects.

The BV PIPS has been tested in the entire supply chain (construction and non-construction services). Its developments have been researched and developed, in support of professional groups like the International Council for Research and Innovations in Building and Construction (CIB) and the International Facility Management Association (IFMA) for the last 23 years, and has been identified as a more efficient approach to the delivery of professional services.

Some of the impacts of the BV PIPS are as follows (Kashiwagi, 2013; Rivera, 2014; PBSRG, 2015):

- 1800+ projects and services delivered / $6.4B of projects and services delivered.
- 123+ unique clients (government and private sectors).
- 98% customer satisfaction / 9.0 (out of 10) client rating of BV PIPS model.
- Decreased the cost of services on average by 31%.
- Vendors were able to offer the client/owner 38% more value.
- Decreased client efforts by up to 79%.
- 57% of the time, the BV PIPS selects the highest performing experts for the lowest costing services.
- International recognition: Canada, Netherlands, Botswana, Malaysia, Australia, Democratic Republic of Congo, and France.
- Largest projects: $100M City of Peoria Wastewater Treatment DB project; $53M Olympic Village/University of Utah Housing Project; $1B Infrastructure project in Netherlands.

The BV PIPS process consists of three major phases (selection, clarification, and execution). During selection, vendors compete based on their level of expertise. This is determined by their past performance metrics, ability to identify risk, and capability of their key personnel. The vendor that is highest ranked move into clarification. In clarification, the vendor is required to explain how they will accomplish work efficiently and with high customer satisfaction. They are required to identify performance metrics that they will track throughout the contract. Vendors do this by creating a plan that includes their scope, detailed and milestone schedules, budget, risk management plan, and performance metrics. Vendors then set up a meeting to clarify the project to the owner for approval. Upon approval of the project, the last phase vendors move through is execution. In this phase, vendors will receive projects, as work is required. Vendors project progress is tracked in a Weekly Risk Report (WRR), which is an excel spreadsheet that measures cost and schedule deviations, and turned in each week to the client. The WRR is submitted to the client throughout the execution of the project, and becomes performance documentation of the project after completion.
Currently the BV PIPS is a proven high performance process of no decision-making, no management, direction, and control, and no thinking. It is used mainly as a procurement and risk management system. The process has project management applications; however, it has not previously been used as a project management system.

**Hypothesis**

Due to the success of the BV PIPS in improving project performance, using its principles as a new project management model, could increase the efficiency and productivity of the State Agency’s project managers and assist in delivering high performing project results.

**Methodology**

To confirm the hypothesis, the following research steps will be taken:

- Identify the project management principles used in the BV PIPS process to develop the Best Value Project Management Model (BV PMM).
- Perform a research case study implementing the new PM model on the State Agency projects for one year.
- Document implementation of the new project management model.
- Document the results of the new project management model.
- Compare the results of the State Agency’s traditional PM model with the new BV PMM.

**Best Value Project Management Model**

A literature research was performed identifying the project management (PM) principles found in the BV PIPS process. The following publications and sources were used (Kashiwagi, et al., 2009; Kenny, 2008; Kashiwagi & Mayo, 2001, Kashiwagi & Byfield, 2002a-d; Kashiwagi, et al., 2003a-c; Kashiwagi & Morrison, 2012; Rivera, 2014; CIB W117, 2015; Kashiwagi, 2015; PBSRG.com, 2015):

1. 200+ academic conference and journal papers.
2. The Information Measurement Theory and Best Value Approach manuals.
The BV PIPS was derived from the principles of the Industry Structure (IS) model and Information Measurement Theory (IMT). The IS was developed in 1991, and proposed that the buyer or end user, may be the major source of project cost and time deviation. The Industry Structure model shown in Figure 2 identified that in the environment of high competition, the biggest difference in low performance and high performance, was the use of management, direction, and control (MDC) by the buyer over the vendor.

Figure 2: Industry Structure chart.

The IS proposes that a project manager should not manage, direct, and control others. They should utilize the expertise of others on a project. Utilizing expertise instead of MDC involves the following changes to a project manager’s role (see Figure 3):

1. Identify an expert to perform the project.
2. The PM is responsible for Quality Assurance and not Quality Control. The PM is responsible for ensuring the expert has a plan, the plan is understandable to everyone, and they have a way to measure the quality of their work throughout the project.
3. Minimize the decision making of the PM. The PM requires the expert to take control of the project and make any decisions required. This will also increase the accountability of the expert.
4. Coordinate and ensure any tasks outside of the expert’s scope of work are complete for the project.

The Information Measurement Theory (IMT), which uses natural laws and logic to explain reality and identify expertise and value, was also used to develop the BV PIPS system. The main idea IMT proposes is that one individual has no impact, influence, or control on other individuals, it supports the IS in minimizing management, direction, and control. It also identifies characteristics of an expert. The logic it uses to come to this conclusion is as follows:

1. Natural laws are not created. They are discovered.
2. Every set of conditions based on a location and time is unique. Each set of conditions has a different set of characteristics that makes it unique. Unique characteristics include time, location, resources, people’s perceptions, and physical conditions.
3. Unique conditions change over time based upon natural law. Thus, unique conditions of the past are related to the unique conditions of the present and the future.
4. The more information (understanding of natural laws and knows the unique conditions) an individual has the more they can predict the future conditions.
5. If future conditions are predictable then any event can happen only one way.
6. The initial conditions of an event will determine the final conditions of an event.
7. Any attempt to change unique conditions that is not based on natural law is impossible.
8. The more information an individual has in an area the more expertise and value they can provide.
9. The more expertise an individual has the more they do not believe in the ability to control or influence other people.

An expert is identified as an individual with more information in a certain area. Hence, the more expertise someone has the less they believe in the ability to control or influence other people. The more they believe that they control their own life and have 100% accountability for it.

Figure 3 shows the difference between the belief in influence and control and no-influence and no-control. On the left side, the arrows are facing out showing that the individual is accountable for his life and his environment. On the right side, the arrows are facing in showing that the individual believes their environment and life is responsible for what happens to them. The corresponding characteristics of each belief are also found in Figure 3.

**Figure 3: No-Influence vs Influence model.**

The IS and IMT identify that the more a PM has to MDC the less efficient they are. Characteristics of MDC are the following:

1. Communications.
2. Meetings.
3. Reports.
4. Inspections.
5. Making decisions.
6. Requirements.
The new BV PMM identifies that the role of the PM changes from being a manager to now being more of a leader. A manager being an expert that directs others and makes decisions on project (PMI, 2000), and a leader being one that aligns expertise. The manager requires technical knowledge and understanding. The leader requires an ability to use the expertise of others. To make this transition the IS and IMT identify the following requirements for the new model:

1. Due to the PM no longer being the expert all communication must be non-technical.  
2. The PM must ensure and require the vendor to simplify the project and create transparency.  
3. All efforts must be measured. Measurements must be simple, understandable, and non-technical. Measurement enables the PM to know the level of performance of the expert.

From literature research of the BV PIPS, the following characteristics of the BV PMM were identified (Rivera, 2014; PBSRG, 2015):

1. Utilize expertise – Align vendors and personnel with projects that fit their expertise.  
2. Minimized MDC (meetings, decisions, reports, inspections, and communications).  
4. Quality assurance – ensure that the expert has a plan before they begin a project and they can explain the progress and changes to the plan throughout the execution of the project.  
5. Out of scope coordination – PM takes responsibility for anything outside of the expert’s scope of work.  
6. Transparency – all stakeholders have access to all project information and can understand the information without an explanation.

**State Agency’s Implementation of the BV PMM**

In January 2014, the State Agency partnered with a world renowned research group at Arizona State University, called the Performance Based Studies Research Group (PBSRG), for training, mentorship and assistance, in the implementation of the BV PMM, for the delivery of their professional services on their environmental assessment and remediation projects. The new model proposed the replacement of management, direction, and control (MDC) with the utilization of expertise. The effort would develop a project management structure that would use performance metrics and non-technical communication to create transparency and increase the accountability, value of expertise, and efficiency of the entire supply chain of professional environmental services.

The State Agency chose to test the BV PMM in their water quality unit, on its indefinite delivery indefinite quantity (IDIQ) contract. The contract had 10 vendors that could perform work for the department. This department was responsible for identifying, assessing, and cleaning up soil, groundwater, and surface water sites contaminated with hazardous substances. The unit conducts these efforts throughout its state with support from state funds. The program also oversees privately funded cleanup efforts. Before the BV PMM was implemented, the State Agency project managers were given training to help them understand the change in their roles. Figure 4 shows the main difference between the PMs and vendors previous responsibilities and roles on a project, and their new roles under the BV PMM.
This next section will discuss the implementation of the six BV PMM characteristics in the water quality unit, and how each characteristic changed the responsibilities of the State Agency’s PM. The six characteristics are the following:

1. Utilize expertise.
2. Minimized MDC.
3. Non-technical communication.
4. Quality assurance.
5. Out of scope coordination.
6. Transparency.

**Utilize expertise**

Utilizing expertise is one of the most difficult leadership characteristics for traditional PMs to adhere to (Kashiwagi, 2013, PBSRG, 2016). It requires the PM to understand that they must minimize MDC. It requires the PM to turn over the decision-making and accountability for the project to the vendor (expert). The PMs were only able to provide the experts an objective and estimated budget. They were no longer required to MDC the project set up through completion. Instead, they were only required to ask questions of the expert when they did not understand. The traditional decision-making performed by the State Agency’s project management was as follows:

1. Identify which vendor should perform each project.
2. Identify what is included in the scope of each project.
3. Identify what a reasonable cost for the project should be.
4. Identify what the timeframe for the project should be.

The State Agency was asked to explain how they performed the above decisions. These are the main actions performed to make the above decisions:
1. The vendors were chosen based upon the relationship they had with the State Agency and their price.
2. The State Agency determined the scope, cost, and timeframe of each project based upon their technical experience and understanding of the site.
3. When the vendor was selected for a project, a negotiation would occur to ensure the vendor was offering a reasonable cost.

The success of this process was based off the State Agency PM’s expertise and experience. The BV PMM identified that the vendors (experts) must perform all of these responsibilities now. This changed the above four traditional PM responsibilities to the following:

1. Identify overall State Agency expectations on work that should be performed.
2. Identify overall State Agency budget to be spent on the projects.
3. Require the vendors to differentiate themselves based upon performance and price to identify which vendors should receive each project.
4. Once it was identified which vendors should receive each project, then let the vendor identify the scope, cost, and time required to complete each project.

At the start of the implementation of the BV PMM the vendors were unable to differentiate themselves by their performance. None of the vendors had documented sufficient performance information to differentiate themselves. Due to the inability of the vendors to differentiate themselves for the first year, the State Agency assumed all vendors had the same level of expertise and used a round robin (rotational) system to divide the projects. The round robin system is depicted in Figure 5 and Table 1. The only reasons a vendor would not receive a project was due to:

1. The vendor declined the project.
2. The State Agency had information that caused doubt in a vendor’s ability to perform.

Figure 5: Round Robin Selection Tool.
Table 1

<table>
<thead>
<tr>
<th>No.</th>
<th>Firm</th>
<th>Project</th>
<th>Vendor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>1st Street</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>2nd Street</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>3rd Street</td>
<td>C</td>
</tr>
<tr>
<td>4</td>
<td>D</td>
<td>4th Street</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>E</td>
<td>5th Street</td>
<td>E</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>6th Street</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Next Vendor in Line:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7th Street</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8th Street</td>
<td>B</td>
</tr>
</tbody>
</table>

After each vendor was assigned a project, the vendors were then given the following information:

1. Overall expectation of the State Agency for their projects.
2. Overall the State Agency budget limitations for their projects.
3. A requirement to create a plan for the project, within a timeframe of 14 days. The amount of days that deviated from 14 was dependent upon how simple or complex a project was.

The above information was incorporated into the State Agency’s regular project administration form. In order for the vendor to complete their plan and begin the project, the State Agency PM was required to approve the plan. The State Agency PM would not approve the plan if they had any of the following:

1. Questions.
2. Concerns.
3. Confusion.

It was the vendor’s responsibility to create a plan that was clear, understandable, and made the State Agency PM feel comfortable. If there were any questions on price or the scope of work, the vendor would have to provide a sufficient explanation to the State Agency PM.

One of the requirements of the plan was identifying performance metrics that would track the vendor’s performance on the project. This was performed for every project. Due to this requirement after one year, there was sufficient performance information to differentiate the level of performance of each vendor. Thus, moving into the second year of implementation of the BV PMM was now using performance information from the vendors to select vendors for each new project. Figure 6 shows the shift from a round robin to a selection of vendors based on past performance information.

**Figure 6**: Highest to Lowest Performers Selection Model.
Table 2 and 3 identifies one type of project performed for the State Agency and the information that the State Agency PMs looked at to differentiate the vendors based upon performance and price. Looking at Table 2 it identifies that Vendors A, E, and F had lower levels of expertise than vendors B, C, and D. It also shows that vendor C was able to deliver projects the quickest, with the lowest price, and the highest customer satisfaction. Future distribution of work will enable C to receive the most work, followed by B. If cost is an issue, the State Agency could also give vendor D work depending on the complexity of the project. Table 3 shows a cost breakout of the projects. This table shows the efficiency of vendor C compared to the other vendors.

Table 2

<table>
<thead>
<tr>
<th>Preliminary investigation vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
</tr>
<tr>
<td>Total Cost</td>
</tr>
<tr>
<td>Average Project Cost</td>
</tr>
<tr>
<td>Budget deviation justification</td>
</tr>
<tr>
<td># of projects</td>
</tr>
<tr>
<td>Average Duration of Projects</td>
</tr>
<tr>
<td>Complexity</td>
</tr>
<tr>
<td>% of SOW completed</td>
</tr>
<tr>
<td>Customer satisfaction</td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Preliminary investigation vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
</tr>
<tr>
<td>Data Collection</td>
</tr>
<tr>
<td>Work plan/Tech Memo</td>
</tr>
<tr>
<td>Draft PI</td>
</tr>
<tr>
<td>Final PI</td>
</tr>
<tr>
<td>NFIA</td>
</tr>
</tbody>
</table>

The main purpose and benefits from this characteristic of the BV PMM are:

1. Increases efficiency of projects by letting people who are experienced and already know what to do, perform the projects.
2. Increase project performance by allowing the people who perform the work, to also identify what the project is and what the outcome of the project will be.

The PM’s role now changes from the expert on a project to now ensuring that an expert is chosen to perform the work, and that the expert knows what to do to complete the project.
Minimized MDC

In the traditional project management model, management, direction, and control are a critical responsibility of the PM (PMI, 2000). This is due to the PM assuming the position of the expert (the PM taking accountability for the performance of the project). Now that the PM is utilizing expertise, the vendor now becomes the expert that will take accountability for the success of the project. Thus, the PM no longer needs to make decisions, manage, direct, and control, or think.

The main activities the State Agency PMs performed in MDC on a project were as follows:

1. Directing the vendor on what to do if something unforeseen occurred on the project.
2. Directing the vendor on how to carry out a deliverable for the project.
3. Reviewing the vendor’s work and directing them on how to adjust it.
4. Explaining to the vendor why a part of their work is not acceptable.

Under the BV PMM the State Agency PMs were no longer responsible for any of the above activities. The responsibility for knowing what to do, how to do it, and ensuring that it was correct and acceptable was moved from the PM to the vendor. The vendor was still required to obtain client approval before any changes to the project were performed, but the vendor became responsible to bring the issue and the solution to the client and present the changes in a way the client could understand.

The BV PMM model recognizes that to an extent the State Agency PM and the client had information important to the project that the vendors did not have. Minimizing MDC did not mean the PM and client could not share information with the vendor. It only meant that the PM did not tell the vendor what to do and how to use the information. The State Agency PM only relayed information to the vendor when:

1. The vendor requests the information.
2. The vendor had identified their plan of action and the PM had questions or concerns with the plan or direction of the project.

The PMs were still allowed to review the vendor’s work, but their role became an information source for the vendors instead of being responsible to identify what should be done or to correct the vendor’s work.

The State Agency PM’s responsibility became:

1. The client authority to approve changes to the project.
2. Provide client information to the vendor.
3. Identify any concerns with the vendor’s plan.
4. Verify the vendor’s plan is understandable.

The main purpose and benefits of this characteristic is as follows:
1. Moves accountability for the success of the project to those that perform the work (expert).
2. Requires the PM to be informed of all changes to the project.
3. Enables the PM to voice any concerns with the vendor’s actions before any work is performed.

Non-technical communication

Previously, the State Agency PMs were responsible to understand the technical work of the vendor’s due to their responsibility to make decisions and MDC. The BV PMM now required the PMs to ensure that whenever the vendor relayed information it was simple and non-technical. Instead of caring about the technical details of the vendor’s work, they now cared that the vendor was able to explain what they were doing to people who had no knowledge of the project and the technical work being performed. The PM now became more concerned with how the vendor’s work interacted and affected anything outside of the vendor’s responsibility.

Technical information is identified as (Kashiwagi, 2015):

1. Requires technical training/education to understand.
2. Requires knowledge in a certain area to understand.
3. Detailed and complex.
4. Focused on the technical work instead of the impact and interaction the work will have on anything outside of the vendor’s responsibility.

The BV PMM made certain the State Agency PMs were also responsible to ensure that any information exchanged between parties in a project was simple and understood by everyone. Thus, the PM became the mediator of information, ensuring that the client, vendor, and all stakeholders’ relayed information that was non-technical.

During the first year of implementation, the State Agency PM’s focus was on ensuring the following information was communicated in non-technical terms:

1. Client expectations and constraints.
2. Vendor progress and performance on projects; change orders required on projects.
3. Client administrative requirements.

The first step to developing an environment of non-technical communication was creating a simple way for performance expectations to be relayed. Two things occurred here, first expectations were developed, and second the expectations were not on the technical quality of work of the vendors, but on the overall expectations the State Agency had on all projects. This was performed by developing a short list of performance metrics that identified the State Agency’s concerns. The State Agency’s major concerns being:

1. The vendors do not complete all of the work on a project.
2. The vendors work is not satisfactory to the State Agency.
3. The vendors require excessive support from the State Agency.
Table 4 shows the list of metrics that were developed to relay to the vendors the State Agency’s expectations.

<table>
<thead>
<tr>
<th>No.</th>
<th>Baseline Metrics</th>
<th>Unit</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Milestone Deliverables</td>
<td></td>
<td>#</td>
</tr>
<tr>
<td>2</td>
<td>Revisions required on milestone deliverables</td>
<td></td>
<td>#</td>
</tr>
<tr>
<td>3</td>
<td>Hours requiring State Agency Support</td>
<td></td>
<td>#</td>
</tr>
<tr>
<td>4</td>
<td>Client Satisfaction</td>
<td></td>
<td>(out of 10)</td>
</tr>
</tbody>
</table>

After the vendors understood the expectations of the State Agency, a reporting system was created that would ensure project progress and updates were communicated in non-technical information. The report that ensured this was called the Weekly Risk Report (WRR), which is an excel spreadsheet that the vendor filled out to document the project. The following is how it was used:

- Submitted weekly by vendor to the State Agency PM.
- Includes a weekly progress report pertaining to major deliverables, milestone schedule, risks that occur on project, risk management plan, invoice and price schedules, and a final report showing overall project progress and performance.

The WRR does the following for the State Agency PM:

- Alleviates the State Agency PM from remembering all the technical details of each project and what responsibilities the PM must do (see Table 5).
- Weekly informs the State Agency PM on progress and performance of project (see Table 6).
- Helps the State Agency PM perform quality assurance to make sure the vendor is doing what they said they would (see next section).
- Increases accountability of the vendor, requiring the vendor to be proactive and notify the State Agency PM, instead of the State Agency PM having to MDC the vendor due to not knowing what is going on.

The WRR contains the following sections:

- Project Setup Tab: basic information of project and contact information.
- Progress Report: a weekly report on the major activities the vendor conducted the week prior, and any major issues they believe the State Agency PM should be aware of.
- Schedule and Budget Tab: identifies the milestone schedule and any change orders on the project.
- Risks Tab: identifies all risk (what the vendor does not control) that is occurring on the project. It provides a description of the risk and how the vendor will manage it, date expected to resolve the risk, and impact to cost and schedule.
- RMP Tab: identifies the plan of the vendor’s foreseen potential risks on the project and how they will mitigate and manage it, and an estimated impact to cost and schedule.
- Performance Metrics Tab: identifies the performance metrics the client wants the vendor to track, as well as any additional metrics the vendor tracks to differentiate themselves and show high performance.
- Invoice and Price Schedule Tab: identifies the cost break out of each major deliverable, and when and how much the vendor will invoice the client.
- Final Report Tab: identifies the initial cost and schedule, and reflects any deviation to it, as well as what party was responsible (vendor, client, unforeseen, other).

Table 5 shows an example of a milestone schedule that includes the major tasks on a project from beginning to end including stakeholder responsibilities. This helps the State Agency PM quickly see what the vendor expects from them, what major tasks are being completed, the progress of each task, and when they can expect final deliverables. Additionally, if a deviation occurs, the actual schedule quickly assists the State Agency PM to see if the critical path has been affected.

**Table 5**

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>% Complete</th>
<th>Initial Schedule</th>
<th>Actual Schedule</th>
<th>Risk Sr.#</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Start Ground Water (GW) Sampling</td>
<td>100%</td>
<td>03/02/16</td>
<td>03/02/16</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>End GW Sampling</td>
<td>100%</td>
<td>03/30/16</td>
<td>03/22/16</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Draft Monitoring Memo</td>
<td>100%</td>
<td>05/16/16</td>
<td>05/16/16</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Monitoring Memo Comments</td>
<td>80%</td>
<td>05/23/16</td>
<td>05/23/16</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Finalize Annual Memo</td>
<td>25%</td>
<td>06/10/16</td>
<td>06/10/16</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>TO Completion Date</td>
<td>81%</td>
<td>06/30/16</td>
<td>03/22/16</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 6 is an example that shows a weekly progress report on all vendor activities relating to project completion and any upcoming State Agency responsibilities.

**Table 6**

<table>
<thead>
<tr>
<th>Week #</th>
<th>Date</th>
<th>Task Order Weekly Update History Log</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2/5/2016</td>
<td>~ project administration</td>
<td>~ preparation for field sampling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>~ laboratory coordination</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3/11/2016</td>
<td>~ project administration</td>
<td>~ received TO#88 on 3/3/2016</td>
</tr>
<tr>
<td></td>
<td></td>
<td>~ Conducted groundwater sampling</td>
<td>~ laboratory coordination</td>
</tr>
<tr>
<td>3</td>
<td>3/18/2016</td>
<td>~ project administration</td>
<td>~ received TO#88 on 3/3/2016</td>
</tr>
<tr>
<td></td>
<td></td>
<td>~ Conducted groundwater sampling</td>
<td></td>
</tr>
</tbody>
</table>
PDBs began being pulled and GW sampled on 3/21/2016. Some samples submitted to the laboratory for analysis. Vendor received an email on 3/22/2016 at 4:34 PM from State Agency that stated "Effective 3/22/16 please stop all work on the groundwater sampling for the following sites:
Site 1: $42,600
Site 2: $39,700
Site 3: $46,800

The final area the BV PMM minimized technical communication was with the client relaying the bureaucracy of their administration processes and business procedures with the vendors. This encompassed the following business processes:

1. Submitting invoices to the State Agency.
2. Submitting change orders to the State Agency.
3. Documentation and updates of accurate budget projections.

One of the constraints many vendors have is their conflicting internal processes that are different from the client’s internal processes. One of the methods the State Agency PMs used in order to overcome this issue was the following:

- Identified the internal processes the vendors need to become familiar with (invoice, change order, and budget projections).
- Mapped out their internal processes and simplified.
- Educated vendors on the three processes, and showed examples of how to use each one.
- Posted all internal processes online for vendors to easily access.
- Used the WRR as a mechanism to forecast budgets, invoicing, and change orders.

The invoicing process originally was lacking uniformity. Vendors submitted invoices to whomever the State Agency PM identified, which deviated from one department to the next. Figure 7 shows the adjusted system the State Agency put in place to create uniformity amongst vendors. All vendors were now required to submit their invoices to the accounting department for processing, and may copy their State Agency PM and business specialist for internal documentation. Once processed, the accounting office would notify the State Agency PM and/or business specialist of payment receipt.

![Figure 7: Invoicing Process.](image-url)
Second, the State Agency did not have a simple way to track each change order and whether it was justified. Each change order was handled slightly different depending on the State Agency PM. In the new process (see Figure 8), there were four major steps:

1. Each vendor was required to fill out a pre-made one-page change order template that included impact to cost and schedule, and attach their WRR with proper justification documented.
2. Submit to the State Agency PM for approval.
3. The State Agency PM submits to procurement for processing.
4. Vendor receives payment.

![Figure 8: Change order process.](image)

Lastly, in the traditional system, vendors were required to submit detailed time and materials cost breakouts that were confusing and difficult for the State Agency to compile for accurate budget projections. In the new system, vendors were required to simplify their time and materials to a price schedule which identified the major tasks on a project, cost of each task, and what month they would charge the State Agency. Table 7 shows an example of a simple price schedule.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>September 2015</th>
<th>October 2015</th>
<th>November 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Project Management and Sub Markup</td>
<td>$950</td>
<td>$950</td>
<td>$913</td>
</tr>
<tr>
<td></td>
<td>Finalize PI Report; FY2015 data submittal</td>
<td>$4,895</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td></td>
<td>PI Activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kenga bottled water</td>
<td>$300</td>
<td>$200</td>
<td>$140</td>
</tr>
<tr>
<td></td>
<td>Groundwater sampling and analysis of 15 private registered exempt wells and up to 8 unregistered exempt wells; Preparation of technical memo; Hand deliver fact sheets; Identify additional drinking water wells</td>
<td>$9,000</td>
<td>$10,000</td>
<td>$5,481</td>
</tr>
<tr>
<td></td>
<td>Database submittal FY2016 data</td>
<td>$0</td>
<td>$0</td>
<td>$2,850</td>
</tr>
<tr>
<td></td>
<td><strong>SUBTOTAL</strong></td>
<td><strong>$15,145.00</strong></td>
<td><strong>$11,150.00</strong></td>
<td><strong>$9,384.00</strong></td>
</tr>
<tr>
<td></td>
<td><strong>BUDGET TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>$35,679.00</strong></td>
</tr>
</tbody>
</table>

**Quality assurance**

Due to the role change of the PM from a manager to a leader. The PM no longer needed to perform Quality Control (QC) activities. QC activities included:
1. Inspection of the vendor’s work (Deming, 1982).
2. Explain to the vendor when work did not meet the technical standard and ensure that they fixed the work in a timely manner.

The elimination of the above activities made the State Agency PMs the most nervous. The main concern they had was: How do you ensure the vendor’s work meets the minimal quality standards?

The BV PMM does this through quality assurance (QA). Quality assurance is ensuring that the vendor has a plan, is following the plan, reports deviations to the plan, and is documenting the performance of the project, throughout the entire project, not just at the end. If a client performs QA correctly, the vendor will always produce high quality work.

Quality Assurance includes the PM ensuring the vendor does the following:

1. Creates a plan for the project.
2. Has a quality control (QC) plan to ensure the quality of their work.
3. Has a way to ensure they meet their schedule and budget forecasts.
4. Can explain any deviations that occur to their work, quality, cost, or schedule.

The difficult part of this for the PMs is that they were used to being informed on the technical details of a project and how things were being performed every week. When their roll switched to QA and they received no technical information on a project the PMs became confused on what their function was.

Due to this confusion, training was developed for the PMs to help them understand how to perform QA. The following are the main QA activities and responsibilities that the PMs were required to perform:

1. Require the vendor to turn in a plan before they start working on a project. The plan included a scope of work, milestone and detailed schedules, price schedule and cost breakout, risk they do not control, risk mitigation and management plan, and performance measurements.
2. Understand and review the weekly risk report each week to ensure the plan is being followed.
3. Check any dependencies with related projects/activities and see whether deviations affect the critical path of the general plan.
4. Ensure vendor main deliverables are completed before payment is sent to the State Agency.
5. Compare the invoices of the vendors with their price schedules (budget projections).
6. Document and track all support and correspondence with vendors.
7. Ask questions whenever the PM is uncomfortable with any aspect on the project.

The following detailed steps and processes were developed for the PMs to help them understand how the above activities would help them know if the vendors were following their plan and were on schedule and budget:

1. Review of milestone schedule on WRR to identify progress of project.
2. Comparison of invoices to actual progress of projects.
3. Review of risk documentation on WRR to ensure change orders and adjustments to the project are justified.
4. Requesting of information from vendor before any approvals or changes are made.
5. Use of performance information to identify if a vendor is meeting expectations.

When the State Agency PM receives the vendor’s WRR each week, one of the first QA activities is to look at the milestone schedule (see Table 8). The milestone schedule shows the State Agency PM’s five major sections: major activities, percent complete, initial (baseline) and actual schedules, and any identified risks. There are only two major items of concern to the State Agency PM: what is the percent complete of the upcoming tasks, and is there any deviation in the actual schedule from the initial schedule marked by a risk serial number? If that is the case, they can immediately follow the risk serial number tracked in the risks tab, and now review a detailed plan on how the vendor will manage the risk, when they expect to complete it and what the potential impact to cost and schedule is. This minimizes the State Agency PM’s communication with the vendor, by only focusing on any concerns they have regarding the vendor risk plan.

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>% Complete</th>
<th>Initial Schedule</th>
<th>Actual Schedule</th>
<th>Risk #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Milestone 1</td>
<td>100%</td>
<td>11/25/14</td>
<td>11/25/14</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Milestone 2</td>
<td>100%</td>
<td>12/05/14</td>
<td>12/05/14</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Milestone 3</td>
<td>50%</td>
<td>1/25/15</td>
<td>2/25/15</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Milestone 4</td>
<td>35%</td>
<td>2/10/15</td>
<td>3/10/15</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>End Milestone 5</td>
<td>20%</td>
<td>2/26/15</td>
<td>3/26/15</td>
<td></td>
</tr>
</tbody>
</table>

The second major QA activity the State Agency PM conducted was to compare the vendor price schedule with both the milestone schedule and submitted invoices (see Table 7, page 17). In the price schedule, the State Agency PM was able to quickly see which major tasks were going to be completed, for how much, and when the vendor would bill the State Agency. It was also the responsibility of the vendor to update and notify the State Agency PM if there was any deviation. This allowed the State Agency PM to quickly ensure the vendor was being efficient.

The third major QA activity (see Table 9) the State Agency PM conducted was to look at the risk tab in the WRR and verify the vendor had a simple plan that identifies a planned resolution date and impact to cost and schedule. This quickly allowed the State Agency PM to understand if the vendor was taking the most efficient steps to resolve the issue. The value of the risks tab was its ability to document all deviation and identify the responsible party. It was a tool to increase accountability and proactivity.
The fourth major QA activity done by the State Agency PM after checking the vendor’s WRR, was to identify any upcoming deadlines the vendor is close to and requesting milestone information from the vendor. It is the responsibility of the vendor to know when they should turn in information periodically to the State Agency PM before approvals or changes are needed, however sometimes the vendors do not. The WRR is a mechanism that aids in the protection of the State Agency PM to foresee any issues and minimize them before they become one.

**Director’s Report (DR)**

To help the PMs and the management at the State Agency perform QA a Director’s Report was setup to quickly compile the information in a format that enabled the State Agency to know the status of any project quickly. This report was created once a week, to ensure accurate information.

When all the WRRs were collected each week by the State Agency PMs, they were compiled into the Director’s Report for upper management. The Director’s Report is a flexible and simple excel spreadsheet that includes:

- **Overview Tab:** identifies the overall project performance (compiled budget, deviations, risks, change orders, and responsible parties).
- **Discipline Tab:** breaks each of the projects by major discipline and allows the State Agency to compare one against the other.
- **Vendors Tab:** identifies all vendor performance in terms of on time/on budget and compares them with each other.
- **Budget Tab:** identifies the entire water quality unit budget in terms of vendor budget, change order amount, budget spend rate and projected spend rate. High-level compilation of the water quality unit budget.
- **Riskiest Tab:** identifies the riskiest water quality unit sites and vendors in terms of number of unresolved risks that have occurred on the projects.
- **Risks Tab:** compilation of all the project risks in one tab that is easily sortable. Upper management can quickly review detailed explanations from identified sites in the riskiest tab.

### Table 9

**Risks tab**

<table>
<thead>
<tr>
<th>Sr. #</th>
<th>Date Entered</th>
<th>Risk</th>
<th>Risk Items</th>
<th>Plan to Minimize Risk</th>
<th>Planned Resolution Date</th>
<th>Actual Date Resolved</th>
<th>Impact to Days</th>
<th>Impact to Cost</th>
<th>Entity Responsible</th>
<th>Client Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3/22/2016</td>
<td>1</td>
<td>State Agency stops all work 1) PDBs began being pulled and GW sampled on 3/21/2016. Some samples submitted to the laboratory for analysis. 2) Vendor received an email on 3/22/2016 at 4:34 PM from State Agency that stated “Effective 3/22/16 please stop all work on the groundwater sampling for the following sites: 48th St &amp; IS $42,600</td>
<td>3/22/2016</td>
<td>3/22/2016</td>
<td>0</td>
<td>$0.00</td>
<td>Client</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
- Progress Reports Tab: compilation of the projects last week of progress report entries. This allows management to see at a high level, what all the projects have been doing in the prior week.

The Director’s Report was created to ensure all the projects are performing and can be easily seen together in one spreadsheet. Figure 9 shows the flow of the Director’s Report. Every Friday, each expert vendor was responsible to submit an updated version of their WRR to PBSRG for compilation and copy their State Agency PM. After PBSRG compiled the DR, PBSRG would present it each Monday during a State Agency PM meeting to verify accuracy and identify any issues to be resolved. Following the PM meeting, the DR would be published on the State Agency PBSRG website.

![Figure 9: Director’s Report Flow Chart.](image)

Table 10 shows how upper management was able to use the DR to now identify the major criteria of on time/on budget and major cause of deviation very quickly and compare each vendor.

Table 10

<table>
<thead>
<tr>
<th>Vendor</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original projects budget</td>
<td>$1,257,291</td>
<td>$150,329</td>
<td>$113,800</td>
<td>$1,212,500</td>
<td>$2,151,800</td>
<td>$287,529</td>
<td>$199,905</td>
</tr>
<tr>
<td>Original project duration</td>
<td>1568</td>
<td>624</td>
<td>597</td>
<td>1121</td>
<td>3589</td>
<td>1160</td>
<td>1023</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Projects</td>
</tr>
<tr>
<td>Customer Satisfaction</td>
</tr>
<tr>
<td>% projects on time</td>
</tr>
<tr>
<td>% projects on budget</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average Project Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Over Awarded Budget</td>
</tr>
<tr>
<td>% over budget due to Client</td>
</tr>
<tr>
<td>% over budget due to Vendor</td>
</tr>
<tr>
<td>% Delayed</td>
</tr>
<tr>
<td>% Delayed due to Client</td>
</tr>
<tr>
<td>% Delayed due to Vendor</td>
</tr>
</tbody>
</table>
Additionally, Table 11 shows how upper management can quickly compare each of the vendor’s costs, change orders, projected and actual spend rates, and vendor projection error rates with one another. This quickly allowed the upper management to spot any issues in their budget projections.

<table>
<thead>
<tr>
<th>Task Order</th>
<th>Discipline</th>
<th>Estimated Budget</th>
<th>Vendor FFP</th>
<th>Risk $5</th>
<th>CO</th>
<th>Actual Spent</th>
<th>Projected</th>
<th>Actual</th>
<th>Projection Error Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>D1</td>
<td>$4,000,000</td>
<td>$39,838.00</td>
<td>$2,723.00</td>
<td>$9,460.00</td>
<td>26%</td>
<td>24%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>AA</td>
<td>D1</td>
<td>$5,000,000</td>
<td>$9,548.00</td>
<td>$16,540.00</td>
<td>$1,200.00</td>
<td>52%</td>
<td>0%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>AAA</td>
<td>D1</td>
<td>$250,000</td>
<td>$209,266.55</td>
<td>$13,375.00</td>
<td>$1,200.00</td>
<td>50%</td>
<td>35%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>AAAA</td>
<td>D1</td>
<td>$275,000</td>
<td>$432,975.20</td>
<td>$11,856.60</td>
<td>$2,723.00</td>
<td>7%</td>
<td>0%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>AAAAA</td>
<td>D1</td>
<td>$190,000</td>
<td>$287,176.30</td>
<td>$375.97</td>
<td>$22,723.00</td>
<td>60%</td>
<td>8%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>AAAAAA</td>
<td>D1</td>
<td>$495,000</td>
<td>$238,487.84</td>
<td>$362,378.70</td>
<td>$6,483.00</td>
<td>7%</td>
<td>3%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>D3</td>
<td>$200,000</td>
<td>$452,000.00</td>
<td>$68,000.00</td>
<td>$37,249.00</td>
<td>100%</td>
<td>8%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>D3</td>
<td>$45,000</td>
<td>$256,000.00</td>
<td>$10,000.00</td>
<td>$6,585.00</td>
<td>100%</td>
<td>3%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CCC</td>
<td>D3</td>
<td>$65,000</td>
<td>$256,000.00</td>
<td>$45,000.00</td>
<td>$14,000.00</td>
<td>100%</td>
<td>25%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CCCC</td>
<td>D3</td>
<td>$350,000</td>
<td>$255,000.00</td>
<td>$350,000.00</td>
<td>$22,723.00</td>
<td>60%</td>
<td>0%</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

One of the final QA activities performed by the State Agency PM is to use the WRR and DR to differentiate between high and low performers (see Table 2 and 3). Table 2 and 3 are explained in the Utilize Expertise section on page 8.

Out of Scope Coordination

One of the major issues with the traditional project management approach was the lack of preplanning required from each expert vendor. Often a vendor and client PM would not know what to do on the project until they started the work in the field, and still would not know exactly what was required to fully complete the project (Fearnside, 1988; Filipovich, 2001; Esty & Porter, 2005; International Rivers, 2005; Macek, 2006; Rueters, 2009; Bo-Jie, et al., 2010; Fu et al., 2010; Sood, 2011; Buntaine, et al., 2013; Fisher, 2013; IEG, 2013; Miller, et al., 2013; Padgett, 2014; AFP 2014; PBSRG, 2015). This caused a reactive state between the vendor and the client PM. This caused the State Agency PMs to do the following:

- Only work on vendor expectations when told by the vendor.
- Due to inability to know when vendor expectations were needed to be completed, many were delayed and increased costs.

Part of the BV PMM is for the expert vendor to identify “what is in” and “what is out” of their scope of work to the State Agency PM in the clarification meeting upfront before the contract is signed (see Figure 10). This will ensure the State Agency PM knows exactly what the vendor is expecting from all stakeholders, to include any coordination the PM must do in order to stay on schedule. The requirement for the State Agency PM to minimize MDC is to make sure the vendor tells them exactly what coordination and responsibilities they expect from the PM.
Major responsibilities for outside the scope of the expert’s plan is the following:

1. Site access.
2. Community involvement.
3. Dealing with upper management.
4. Resolving any legal issues.

Site access is gained from a landowner, and can often take time and energy. It is typically out of the scope of the expert vendor to request site access from the landowner, therefore, it is important for the PM to ensure site access so work is not inhibited or delayed.

Another major responsibility for PMs is the coordination between multiple stakeholders regarding the community involvement meeting. The community involvement effort includes communication between the State Agency, the expert vendor, and local citizens and city officials, regarding the progress of each site. Delay in community involvement may impede on the progress of the site.

Each PM is also responsible for understanding the requirements upper management expects from each expert vendor, and must coordinate with the vendor on critical dates for deliverable submissions that will be reviewed by upper management to identify any concerns.

Lastly, any legal issues regarding any site will be the responsibility of the PM to coordinate meetings, discussions, and court hearings. The new role of the PM now becomes non-technical and supportive toward the vendor accomplishing their project on time, and on budget.

**Transparency**

Before the implementation of the BV PMM, the State Agency was having difficulty with the following:

- Identifying internal processes and project performance.
- Identifying and utilizing expertise.
• Identifying projected spend rates of program budget.
• Upper management knowing the performance of their PMs.

Using the traditional project management approach, the State Agency was having difficulty with creating transparency and making things simple. This increased the amount of communication and MDC of internal management and external management of expert vendors.

The BV PMM was able to help the State Agency create an environment of transparency and increase the accountability by producing the following:

1. Developed a custom website to post all project information and performance.
2. Developed a custom project report, called the Weekly Risk Report (WRR), which measures deviation of each project in terms of cost and schedule.
3. Developed a custom management report, called the Director’s Report (DR) (see Figure 9), which is a compilation of all water quality unit project performance, prioritizes the projects by risk, budget [spend rate and change orders], and internal reports interpreted from collected data.

Benefits of the new transparent structure:

1. All stakeholders can easily access each other’s documentation and performance.
2. Provides the State Agency management team with accurate vendor performance and water quality unit budget.
3. Provides full access to all BV education and project documentation.
4. Updated the task order selection process with documented performance information.
5. Worked with water quality Business Specialist to simplify water quality unit budget that assisted upper management in financial decision making.
6. Created a dispute system that uses ASU as a non-bias third party to help facilitate and resolve any issues or confusion raised by vendors.
7. Adjusted and simplified change order process. Created new documentation for change order approval and documentation.
8. Simplified invoice process, and educated water quality project managers on system. It also began to identify vendors who were not invoicing the State Agency quickly, and how their project managers could minimize it in the future.

**Figure 9:** Director’s report flow chart.
As stated in the Quality Assurance section on page 18, Figure 9 shows the flow of the Director’s Report, which is a compilation of all project WRRs. It is a unique and simple management tool to quickly determine the progress and performance of all projects in one location.

Creating efficient internal processes

One of the major issues the BV PMM identified was that all the major stakeholders within the State Agency were in silos. Neither silo coordinated with another, which caused the following issues:

1. Programmatic functions were complex.
2. Management and PMs needed a method to streamline the invoice and change order processes.
3. Most of the silos had their own interpretations of internal protocols, and each acted in their own best interest.
4. Management needed a third party non-bias representative to help answer and resolve vendor issues and complaints.
   a. Ensure the State Agency is in alignment and vendors are best serving the taxpayers.
   b. Ensure both parties are not being cheated.

Once the projects began work during late November 2014, management became aware that their internal invoice and change order processes were not well understood or practiced by all the silos. In order to resolve this issue, PBSRG did the following:

- Worked with the business specialist in the water quality unit, the State Agency PMs, and procurement officers, to identify the current understanding of each party’s interpretation of the processes.
- Identified the major components needed by each party.
- Streamlined the processes and mapped out the new processes.
- Presented the new process to each party and received final approval from management to adjust the old process to the new streamlined process.
- The State Agency has not had any new issues regarding the flow of either process since it was corrected.

During the course of the FY14-15, management needed a way to communicate with the vendors to help answer and resolve any issues that arose. PBSRG acted as the third party, and helped the State Agency by the following:

- Used the BV PMM as a logical framework to identify issues and complaints.
- Assisted the State Agency in using performance information to resolve issues and complaints.
- Documented all proceedings and posted online.

As long as both the vendor and the State Agency used PBSRG as a third party channel to resolve issues, each party was fairly treated and came to positive resolutions. The opposite also remains true.
Windfall Effect of Transparency

With the change of Governor in 2015, the State Agency’s budget was heavily scrutinized. The water quality unit being the largest unit at the State Agency, was under the most pressure by the Governor’s office to spend the entire budget, with a threat of receiving budget cuts. Up until FY14-15, the water quality unit has only spent up to 50% of their budget, and have had a constant uncertainty to the amount it would receive each fiscal year. The water quality unit needed a way to show their entire budget could be entirely spent for future funding opportunities. In order to help the State Agency, achieve this goal, PBSRG did the following:

- Required all vendors to submit price schedules in their clarification documents for accurate budget projections. Placed the price schedule in the WRR for weekly updates.
- Helped the water quality unit business specialist [person in charge of water quality unit finance tracking] develop a simplified budget overview.
- Customized the Director’s Report to include a high-level budget overview of the entire water quality unit budget. It also included an updated monthly spend rate and projections to end of fiscal year.
- The DR previously only tracked the majority portion of the water quality unit budget.
- When the entire water quality unit budget was incorporated into the DR within the first three months, the State Agency noticed they were able to accomplish a budget projection spend rate of 100%.
- This was also the first time the State Agency was able to see the entire water quality unit budget on one screen in an understandable form.
- It was also the first time all the PMs were able to see the progress and budget of all the projects in one spreadsheet.

Within one month following the new transparent water quality unit budget, the State Agency identified the following:

- The State Agency overspent. There was not enough money left to cover basic expenses if they continued with their plans.
- Needed to begin de-scoping projects immediately, in order to recover enough money to cover expenses.

In order to assist the State Agency with this new impending issue, PBSRG did the following:

- Held a meeting with water quality unit management to discuss a logical progression of steps.
- PBSRG identified the water quality unit must first identify a priority list of projects.
- PBSRG identified the water quality unit will need to speak with vendors on the lower priority list in order to identify what could be de-scoped without affecting the progress of their work.
- Educated vendors on accuracy of price schedules, in order to accurately identify the amount needed to de-scoped lower prioritized projects.
- Created comparison reports of all project costs on one sheet.
- PBSRG compiled reports and presented to the State Agency’s water quality unit, and identified the vendors were not cheating the State Agency.
The State Agency was satisfied with the reports and costs of all projects.

Following the initial comparison reports, the State Agency decided to empower its PMs to select work they felt was not needed to be completed in the upcoming FY15-16, and began telling vendors to de-scope it. This led to the following issues:

- The State Agency did not have a priority list of projects for targeted de-scoping.
- The State Agency implemented MDC to de-scope what work on the project they felt was not important.
- Vendors became highly upset with the State Agency for not utilizing their expertise to identify what should and should not be de-scoped on their projects.
- Vendors claimed the State Agency caused them to do more work from de-scoping work that was needed in order to complete baseline milestones.
- Vendors identified how they lost faith in the best value process, due to the State Agency overriding it and replacing the utilization of expertise with MDC.

Despite the State Agency overriding the best value process and implementing MDC to cause the vendors more work, the overall program fared well with high performance to compensate for the latter.

**BV PMM Case Study Results**

Table 12 identifies the transformation of government, after 8 months (November 2014 – June 2015) of implementing the BV PMM on the water quality unit IDIQ contract. One of the major accomplishments was the State Agency’s ability to spend the entire budget, which has never been done in its history (PBSRG, 2016).

<table>
<thead>
<tr>
<th>Paradigm shift</th>
<th>Traditional PMM</th>
<th>Best Value PMM</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDC</td>
<td>Utilize Expertise</td>
<td>Non-Technical</td>
</tr>
<tr>
<td>Technical</td>
<td></td>
<td>Non-Technical</td>
</tr>
<tr>
<td>Communication</td>
<td>No Communication</td>
<td></td>
</tr>
<tr>
<td>No Pre-planning (reactive)</td>
<td>Pre-planning (proactive)</td>
<td></td>
</tr>
<tr>
<td>Complex</td>
<td></td>
<td>Simple</td>
</tr>
<tr>
<td>Quality Control</td>
<td>Quality Assurance</td>
<td></td>
</tr>
<tr>
<td>No use of metrics (trust)</td>
<td>Use of metrics (no trust)</td>
<td></td>
</tr>
<tr>
<td>Relationships</td>
<td>No Relationships</td>
<td>Non-transparent</td>
</tr>
<tr>
<td>Non-transparent</td>
<td></td>
<td>Transparent</td>
</tr>
<tr>
<td>Spent up to 50% of budget</td>
<td>Spent 100% of budget</td>
<td></td>
</tr>
<tr>
<td>Lack of vendor accountability</td>
<td>Increased vendor accountability</td>
<td></td>
</tr>
<tr>
<td>Inability to filter out non-experts</td>
<td>Process to filter out non-experts</td>
<td></td>
</tr>
<tr>
<td>Inability to track and measure project performance</td>
<td>Measures internal and external performance (DR/WRR)</td>
<td></td>
</tr>
</tbody>
</table>
The water quality unit Manager, identified the BV PMM as a success. Due to the State Agency’s Lean initiative to introduce new models like the BV PMM, it helped support the improvement of internal processes and create transparency. Table 13 compares the overall performance of the State Agency’s traditional and best value implementations. Although the State Agency attempted to implement the BV PMM on their projects, management, direction, and control was still a factor. The BV PMM approach assisted the State Agency with the following:

- Reduced the amount of preparation needed to select and monitor vendors.
- Reduced the risk of the State Agency’s management, by implementing a decision-less structure to identify the level of the expertise of competing vendors.
- Forced the expert vendor to become accountable and identify their level of expertise.
- Required the expert to make things simple enough that even non-experts can understand.
- Required the expert vendor to take control over their project, which was to their benefit in the end by reducing client MDC.

Table 13

<table>
<thead>
<tr>
<th>No.</th>
<th>Criteria</th>
<th>Traditional</th>
<th>Best Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total # of projects</td>
<td>69</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>Total cost of projects</td>
<td>$5.5M</td>
<td>$5.6M</td>
</tr>
<tr>
<td>3</td>
<td>% of projects SOW completed in fiscal year</td>
<td>50%</td>
<td>99%</td>
</tr>
<tr>
<td>4</td>
<td># of State Agency PMs to manage projects</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Customer satisfaction of vendor performance</td>
<td>6.9/10</td>
<td>8.4/10</td>
</tr>
</tbody>
</table>

*Data was adjusted due to project de-scoping (24 projects, $1.2M (17.32%), 355 days (10.14%). State Agency PMs were reduced by 2, due to leaving State Agency.

Tables 14 shows the overall water quality unit program performance. After 8 months of implementing the BV PMM, the author identified the following dominant observations:

- State Agency PMs increased work capacity by 22%.
- Vendors performed 102% more work in 33% less time.
- State Agency customer satisfaction increased by 22%.

Table 14

<table>
<thead>
<tr>
<th>Detailed Project Performance</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Over Awarded Budget</td>
<td>0.17%</td>
</tr>
<tr>
<td>% over budget due to Client</td>
<td>0.30%</td>
</tr>
<tr>
<td>% over budget due to Vendor</td>
<td>-0.13%</td>
</tr>
<tr>
<td>% Delayed</td>
<td>-0.95%</td>
</tr>
<tr>
<td>% Delayed due to Client</td>
<td>-0.09%</td>
</tr>
<tr>
<td>% Delayed due to Vendor</td>
<td>-0.86%</td>
</tr>
</tbody>
</table>

Consistent with the documented results of numerous BV PMM implementations in the past, Table 14 identifies the cause of budget deviations where primarily due to the client (though
minimal), despite MDC minimization. Even though the vendors still experienced client MDC, they overall performed better than in previous years and had a budget and schedule deviation rate of less than 0%.

**Analysis**

This research effort is using the deductive approach (confirmatory) instead of the inductive approach (exploratory). The success of the State Agency Unit implementation was determined by measurements of observation, which minimized subjectivity as much as possible.

The following lessons were learned when implementing the BV PMM:

1. BV PMM system is difficult to implement in an organization.
2. Need to have visionaries in the organization to become successful.
3. You cannot expect people to change.
4. The structure (rules and metrics) are critical.
5. Transparency creates vision and people doing the “right” thing.
6. Project manager of the future is a leader who aligns resources and utilizes expertise.
7. WRR was a significant tool used to help create transparency on all task orders.
8. Education is an important element in assisting environmental professionals to use the BV system.
9. Requiring vendors to pre-plan and explain their plan from beginning to end in the clarification period is the most important time in the BV system.
10. The BV documentation and website helps to minimize blame and quickly resolve issues.
11. The risk from the BV system is political and not environmental service related. The political risk is from individuals who are not ready for change to become more efficient.

The BV PMM has identified the following observations:

1. Best value application has been a total success by providing transparency.
2. Third party expertise (PBSRG | ASU) should be utilized.
3. Expertise lowers costs and increases performance.
4. An expert vendor can accurately identify a project’s scope and cost.
5. Measurement brings transparency and minimizes decision-making.
6. BV PMM has been identified by the State Agency as a proven method to transform its agency’s environment from a management, direction, and control to a best value, alignment, win-win, and leadership based environment.
7. A visionary core team has been organized that is optimal in terms of a high-ranking visionary leader, and visionary project management and procurement components.
8. For the first time, strategic plans have been developed by the State Agency to increase government funding for future fiscal years based on the successful BV PMM implementation results.
Conclusion

The State Agency is implementing an advanced and theoretically sound best value project management model (BV PMM) to transform the traditional approach of project management from a price based to a best value environment. The major objectives included minimization of management, direction, and control, the transfer of risk and control to vendors who can minimize the risk, measurement of performance of the vendors and the State Agency, and to measure an increase in performance and value of the services being delivered. A core group of visionaries are attempting to transform the organizational approach from one of management of personnel to a systems management, where performance measurements drive alignment of resources. This BV PMM has aligned well with the State Agency’s ongoing internal process improvement initiatives.
References


