Building an Award-Winning, Metrics Based Program Management Office

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Abstract

A unique approach to program and portfolio management that relies heavily on data and metrics to drive program outcomes led to DC Water's IT PMO wining several excellence awards, including the prestigious Project Management Institute PMO of the year award. While the PMO tracks over 70 different metrics for the many areas the PMO is responsible for, this paper focuses on how the PMO utilized and applied metrics to the demand, portfolio, estimation, and risk management disciplines to predict program outcomes and drive results. We discuss both the key metrics tracked in each discipline and how we apply probability density functions of beta and binomial distributions to better forecast and predict the outcomes.

Building an Award-Winning, Metrics Based Program Management Office

Program Management Offices have become essential to organization's business transformation efforts (Dai & Wells, 2003) and are central to ensuring that the work an organization undertakes is aligned to its strategy (Andersen, Henriksen, & Aarseth, 2007). As organizations take on more transformation initiatives, they have come to rely heavily on PMOs to ensure the "right" initiatives are being executed the "right" way so that the "right" business outcomes are realized to make the transformations successful (Bible & Bivens, 2011) .

A key aspect of DC Water IT PMO's approach to ensure these initiatives are successful is to incorporate predictive metrics in each of core process in the initiative lifecycle, from when a request for a new initiative is made and evaluated (demand management), to how its prioritized and funded (portfolio management), to how it is executed (program, estimate, risk, issue, quality, stakeholder management etc.) and, how program outcomes are measured (benefits realization). This paper will focus on the metrics, why they were chosen, how they were applied and how they help drive program outcomes.

Demand Management

The demand management process kicks off when anyone in the company creates a request (aka "opportunity" in DC Water lingo) for some sort of product, service, or assistance. The opportunity is then reviewed by IT managers to ensure that the request is not out of the norm. Once approved, a business analyst from the PMO is paired with the requestor to develop a preliminary feasibility analysis that documents the business need/problem statement, viable solutions, estimated costs, and timelines at a high level to determine if the opportunity is worth pursuing. If promising and exceeds a predetermined threshold, then the business analyst continues to work with the requestor to develop a detailed business case that determines whether the opportunity helps move DC Water's strategic plan forward by mapping its business objectives to the company's strategic objectives and ensuring a return based on a 4.3% hurdle rate over a 5-year horizon. DC Water requires all business cases have objective measures that serve as a benchmark for benefits realization. The Enterprise Steering Committee (ESC)[1] reviews and approves both the preliminary feasibility and business case. Once the business case is approved, the opportunity becomes an official program or project.

Within demand management, there are two types of metrics; (1) operational metrics that measure how efficiently opportunities are evaluated and, (2) strategic metrics that measure whether we the demand management process is selecting the "right" opportunities that realize the stated benefits. Table 1 below lists the key metrics in demand management:

Table 1: Demand Management Key Metrics

Key Metric	Description	Type	Target Value	Current Value[2]
Total time to approve	Median time (in days) it takes to get an opportunity approved as a program/project from initial submission	Operational	45 business days or better	40.4 days
Feasibility approval time	Median # of days it takes a feasibility study to get approved	Operational	14 business days or better	13.5 days

[1] The ESC is comprised of the senior executives who evaluate feasibilities and business cases and approve funding for opportunities. They also set the annual funding thresholds for the PMO program portfolio.

[2] As of March 2020

	or rejected from the time an opportunity is created.			
Business case approval time	Median # of days it takes a business case to get approved or rejected from the time an opportunity is created.	Operational	25 business days or better	23.2 days
% of opportunities rejected	Tracks the % of opportunities that are rejected or cancelled.	Operational	Between 30 - 35%	38%
% of approved programs & programs w/business case and/or feasibility	Tracks the % of approved programs with a business case of feasibility	Operational	75% or better	89%
Demand management effectiveness	% of approved programs or programs that realize 1 or more measurable benefits in 2 years after implementation	Strategic	70% or better	86%
Strategic Alignment	% of approved programs or programs that fully align with at least 3 of the 6 DC Water strategic objectives[3]	Strategic	65% or better	73%

The first three metrics are designed to measure how quick and efficient the process is at getting opportunities approved. The metric that measures the percentage of opportunities that are rejected is intended to calibrate whether the process is weeding out the "wrong" opportunities. We have found the optimal range to be between 30% and 35%. Anything below indicates that the process may be letting through opportunities that it should not while anything above may indicate the ESC is being too aggressive and may be rejecting worthwhile opportunities. The idea behind the metric that tracks the percent of approved programs and programs with a feasibility and/or business case is to gauge the how frequently the ESC exempts opportunities from going through the rigor of the feasibility analysis and/or business case to ensure that the process continues to be followed in most cases and that we have documented the exceptions.

The demand management effectiveness measure gets to the core of the process by ensuring that the stated benefits in the business case or feasibility analysis are being met once the program has been implemented. The 70% benchmark was established by reviewing benefit realization rates for completed programs since 2015. The goal is to raise this to around 90% in the next two years. The other core metric is "strategic alignment", which is designed to ensure that the process is driving towards making sure that the opportunities are correctly mapping[4] to strategic objectives. This is how we ensure that we are selecting the "right" work.

[3] See this link for Dc Water's strategic objectives.
[4] Strategic objectives as outlined in the DC Water "BluePrint" strategic plan for FY 2019 - 2024

Portfolio Management

At the beginning of each fiscal year, the ESC allocates CAPEX funds for IT programs through the regular company budgeting process. With the funds allocated, the ESC goes through prioritization of all approved and active programs to determine which ones get funded (AKA "above the waterline"). To prioritize, the ESC uses ranking criteria, developed with the PMO's help, that are based on DC Water's strategic goals, financial return (NPV, ROI, payback period etc.), program performance (schedule, cost, quality, etc.), individual program risk and program cost. Each approved program is ranked against these criteria (via voting by each ESC member) to come up with a ratio-scale, absolute score. This score is what is used to rank the program.

The ESC then allocates funds to the highest ranked programs until they run out. Any program not funded will move to "below the waterline". When a new program is introduced during the fiscal year, all programs that have not started are re-prioritized using the same process. If the new program ranks higher than any program above the waterline, the ESC will either provide additional funding or adjust the priorities to achieve the desired portfolio. This process removes most of the subjectivity that we would otherwise encounter when trying to rank programs. The criteria themselves are weighted and ranked by the Board of Directors.

We use the Analytical Hierarchy Process to rank both the criteria and the programs because it was simple to implement within our PPM software tool and is easily understood by senior management and the board of directors (Saaty, 1980). In addition to prioritization, the PMO ensures that other portfolio constraints such as dependencies between programs (finish-to-start), grouping constraints (e.g., programs), coverage among strategic objectives (i.e., each strategic objective must be fulfilled by at least one program in the portfolio aka "balanced scorecard") and portfolio risk are accounted for.

Once a program is implemented, the PMO works with the DC Water performance management office and the program sponsor to track and measure the key metrics that determine whether the benefits outlined in the business case are being realized. The metrics tracked by the PMO for portfolio management also fall in to the operational and strategic categories. Table 2 below lists the key metrics in portfolio management:

Table 2: Portfolio Management Key Metrics

Key Metric	Description	Type	Target Value	Current Value
% of completed programs with measurable benefits	% of programs that realize 2 or more measurable benefits within 2 years after completion	Strategic	70% or better	67%[5]
% of programs that meet financial return targets	% of programs that meet or exceed their financial performance (NPV & ROI) targets in their business cases 2 year after completion	Strategic	75% or better	73%[6]
Portfolio cost performance	Annual portfolio budget delivered within acceptable range.	Operational	Within ± 5%	1.2% over budget[7]

[5] Starting with FY19 (Oct 2018 – Sep 2019) portfolio
[6] Starting with FY19 (Oct 2018 – Sep 2019) portfolio
[7] For Fiscal Year 2020. Fiscal Year 2019 = 3.7% under budget, Fiscal Year 18 = 7.7% under budget

Portfolio Return	ROI of any given annual portfolio is positive over a 5-year planning horizon	Operational	All portfolios must have positive ROI	No Data
Portfolio Risk	The sum of expected losses for the individual programs in the portfolio compared to the total portfolio planned cost	Operational	8% of total portfolio planned costs or less	6.3%[8]

The goals for portfolio management are to ensure that the "right" programs selected during demand management are objectively prioritized, funded, and various constraints applied to ensure an optimal portfolio (Markowitz, 1952)

The first metric is similar to the demand management metric that measures the % of programs that realize at least one measurable benefit. Here we make the baseline more stringent by requiring at least two benefits be realized.

The financial return metric is straightforward as it requires that 75% of programs meet or exceed their NPV and ROI targets set in their business cases within 2 years. We picked these two measures because they are the gold standard for evaluating investment performance (Baker & English, 2011). The portfolio cost performance metric is also straightforward in that it requires that the actual cost of the portfolio come within the acceptable range.

The portfolio return metric measures the ROI of the *entire* portfolio and requires it to be positive over the 5-year planning horizon. This is one of the key portfolio management metrics as it measures how well the PMO is managing DC Water's investment dollars. The portfolio risk metric is another key portfolio management metric in that it measures how risky the combination of programs in a portfolio are. Through quantitative risk analysis (Ekelhart, Fenz, Klemen, & Weippl, 2007) on individual programs and our ability to utilize our historical risk database, we can calculate the expected losses[9] for the entire portfolio based on the risk profiles of the individual programs in the portfolio.

The PMO also tracks other metrics related to how well the portfolio is resourced and metrics that compare how well induvial portfolios perform against each other.

Estimate Management (Schedule & Cost)

Most PMOs approach cost and schedule estimation in a linear fashion, i.e., review the scope of work and provide a discrete estimate. But our experience shows that rarely does this estimate materialize. At DC Water, we introduced probabilistic estimation where the program teams provide an estimate along with the confidence level (usually at 95% or better) on which the estimate is based.

To enable probabilistic estimation, we collect data on actual durations, effort hours and costs for programs, projects, and tasks in our estimates database. We also categorize by measures like project/program type (COTS, Infrastructure, App Dev or Business Process), program size (<$100K, $100 =< x =< $500K, $500 =< x =< $1M, and >$1M), methodology (Agile, Waterfall, Hybrid), risk profile (sliding scale of expected vs actual loss), task phase, and task technical complexity. We also collect estimates developed by the team in the database and those are categorized the same way. We can produce β-distributions[10] for durations, costs and work

[8] For Fiscal Year 2020. Fiscal Year 2019 = 9.1%, Fiscal Year 2018 = 12.3%

[9] P ×Estimated Loss=Expected Loss where p = probability of a risk occurring

[10] Research has shown that β-distributions (as opposed to normal distributions) are better representations of durations, costs, land effort hours because most projects and programs rarely come in under budget or ahead of schedule

effort that we can further drill down by the categories above. Figure 1 below is a β-distribution of actual durations for App Dev programs and projects (n=108):

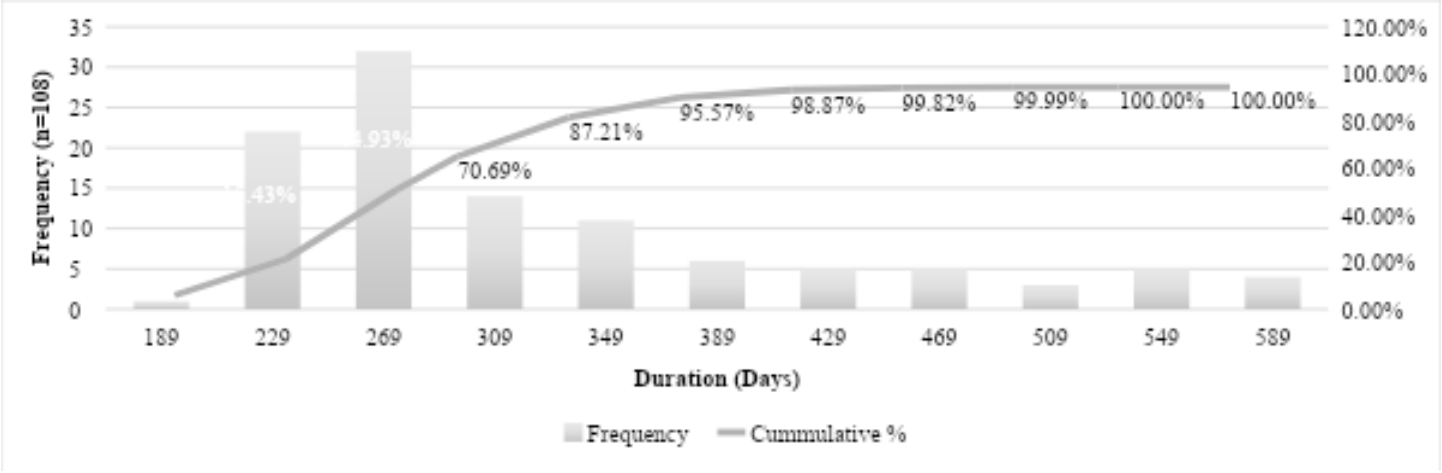

Figure 1: Frequency Distribution of Program Durations

The mean duration is 308.42 days, standard deviation is 102.63 and median duration is 267 days. Our PPM tool tracks the cumulative % for any subset of the data and can calculate how reliable an estimate is based on this. For example, using the above dataset, if an App Dev program or project has a total estimated duration of 269 days, the data tells us that the probability of that estimate coming in at 269 days (or less) is about 45%, or slightly worse than a coin toss. If this is a critical program, these are not good odds. Increase the estimate by 80 days and the odds go up to 87% which is better but not where you want to be for a critical program (90 – 95% is the standard for DC Water).

Not only is this a good tool for a PMO to use to guard against unreasonable or arbitrary deadlines, but it also serves as a baseline for the PMO that can be continuously improved upon. The goal is to reduce the "long right tail" to the point where the cumulative % is much closer to the mean by working to reduce the durations of individual programs, in other words, managing programs better. Figure 2 below is a β-distribution of actual costs for COTS programs and projects (n=125):

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and more often are behind schedule or over budget, hence the "long tail" of the distribution (Kim & Reinschmidt, 2009), (Hahn & Lopez Martin, 2015)

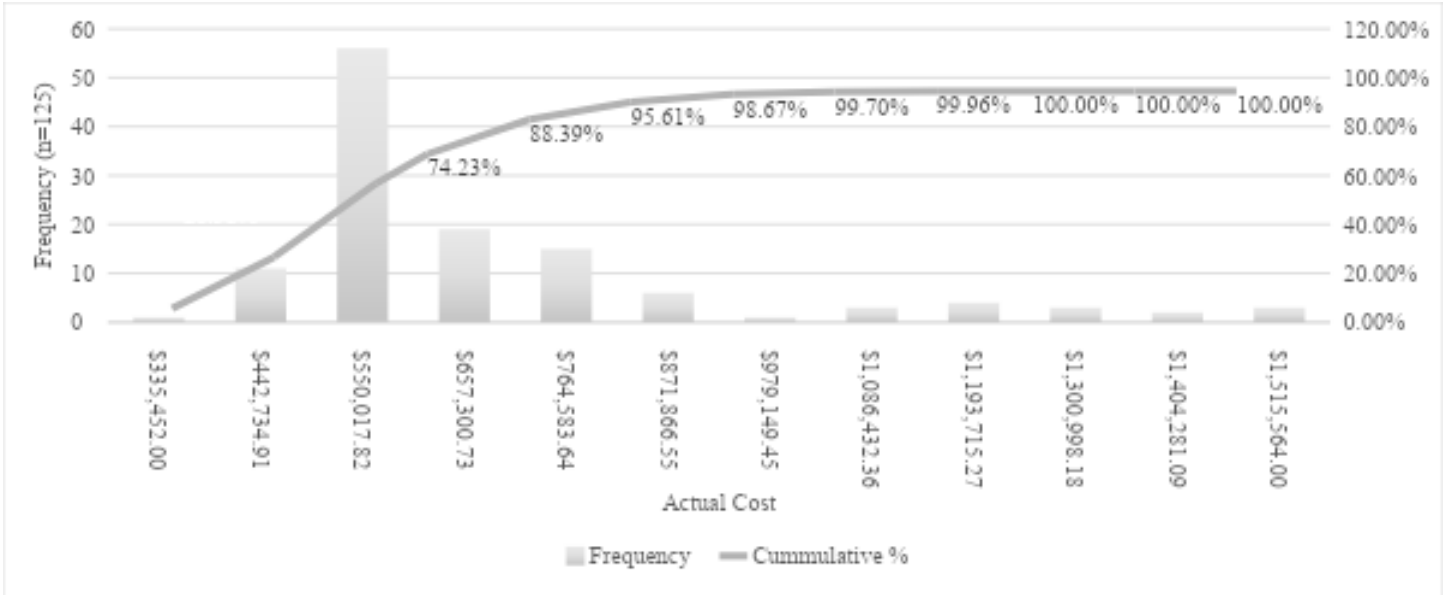

Figure 2: Frequency Distribution of Program Costs

The mean, standard deviation and median are $633,762.57, 259,427.28, and $540,431.00, respectively. We see a similar pattern as in figure 1 where the distribution has a long right tail and the highest frequency data is concentrated to the left. Like durations, this is a great tool to validate estimates and as mentioned before, the PPM tool used by the PMO automatically calculates the cumulative % for any subset of the data and can calculate how reliable a cost estimate is based on this dataset. The PMO applies the same procedure to the phase or task level in a program's work breakdown structure to estimate how much certain tasks should cost and how long they should take to complete.

The PMO also tracks the error (variance) between estimates and the actuals to determine how severe estimate misses are. The goal is to reduce this error to no more than 10% (i.e., 90% accuracy at the project or program level). The current error as of the end of fiscal year 2020 is 37%, so we have ways to go.

Risk Management

Like schedule & costs management, the PMO has a risk database that contains all risks that occurred (fired) and did not. We have this data on active, completed, and cancelled programs. These risks are categorized in a hierarchy with the top level consisting of four categories (external, organizational, program management and technical), each with several sub-categories. During qualitative risk analysis (Emblemsvag & Kjolstad, 2006), the program team reviews the database of risks that fall into the same category as the risk being analyzed to determine the probability of firing. Like schedule and cost estimation, the PPM tool is configured to calculate the confidence level of the likelihood of the risk firing using the underlying risk database. The process is like the one discussed in the estimation management section of this paper with the difference being the distribution function (binomial vs. beta). This is because risks have two mutually exclusive outcomes, either they fire, or they do not.

During quantitative analysis (on risks with high probability as determined by the process above and high impact as determined by the program team), the program team estimates the loss (in dollars) the risk might have to the program if it were to fire, then they multiply that by the probability determined in qualitative analysis to come up with an expected loss. The PPM tool adds up the expected losses of all the risks on the program and then discounts that by an error factor that corresponds to the number of risks that have fired historically compiled from the risk database. The result is a risk rating (in dollars) for the program that is used by the PMO

to compare amongst programs as well as to set contingency budgets. The expected losses for the multiple programs managed by the PMO are rolled-up to the portfolio which is combined with other factors to calculate the portfolio risk rating and to help set portfolio contingency. Table 3 below lists the key metrics we track for risk management:

Table 3: Risk Management Key Metrics

Key Metric	Description	Type	Target Value	Current Value
Program risk rating	The program expected loss as a percentage of the total budget.	Operational	6% or less	Varies by program
% of programs that within risk rating thresholds	% of programs that are within the 6% risk rating threshold	Operational	70% or better	79%
% of program risks with "high" rating	The % program of risks with a score of 3.20 or above on a scale of 0.00 to 5.00	Operational	15% or less	Varies by program
% of programs that within "high" risk rating thresholds	% of programs that are within the 15% "high" risk threshold	Operational	20% or less	13%
% of program risks with "high" rating attached plans	% of program risks with "high" rating that have a contingency and/or mitigation plan with assigned resources	Operational	3% or less	Varies by program

The program "risk rating" metric is the most important for the PMO to measure risk because it quantifies the potential losses to the program and the organization. It is much easier to have a conversation with senior executives about program risks because the PMO can show exactly how much is on the line if risks fire. We have found that programs with a cumulative expected loss that is 6% or less of the program's budget usually have better outcomes in our environment. Other studies have shown that quantifying risks and setting thresholds is the ideal way to correctly manage risks on programs and in other settings (Basak & Shapiro, 1999).

The program risks with "high" rating metric track the number of risks that require quantitative risk analysis and ensuring creation of contingency and mitigation plans for these risks. While this metric is intended to drive down the number of risks in this category, program teams are incentivized to identify risks that fall into this category to ensure that the PMO can focus on the most important risks.

Final Thoughts

The DC Water IT PMO is at the forefront of innovation around applying statistical methods to traditional program and portfolio management. In addition to the metrics and methods discussed in this paper, the PMO is applying similar principles to program and product quality management, stakeholder management, resource management, procurement management, lessons learned and continuous process improvement disciplines. The PMO will continue to innovate in these areas to further drive program outcomes and positively contribute to DC Water's continued success.

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