Using Schedule Data to Improve Project Management[1, 2, 3]

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ABSTRACT

Like many project managers, I faced challenges such as under-estimated costs and effort, timelines and budgets too tight to meet the needs of sponsors, and the inability to make data-driven decisions. In response to these challenges, I developed methods using schedule data to improve the overall management of my projects. In this paper, I will describe my methods and discuss how these methods contribute to specific project management benefits such as:

- Identifying cost efficiencies
- Managing the budget more effectively
- Improving cost estimation and resource planning
- Reducing overall project risk
- Improving transparency with staff and sponsors
- Supporting informed, real-time decision making

INTRODUCTION

My Division

The Demographic Statistical Methods Division (DSMD) of the U.S. Census Bureau operates in a unique environment within the Federal Government. DSMD provides a variety of statistical services, such as sampling, quality assurance, and survey

[1] This paper is released to inform interested parties of ongoing operations and to encourage discussion of work in progress. Any views expressed on operational issues are those of the authors and not necessarily those of the U.S. Census Bureau.

[2] Second Editions are previously published papers that have continued relevance in today's project management world, or which were originally published in conference proceedings or in a language other than English. Original publication acknowledged; authors retain copyright. This paper was originally presented at the 5th Annual University of Maryland PM Symposium in May 2018. It is republished here with permission of the author and conference organizers.

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methodology research in order for the Census Bureau to execute over twenty demographic surveys. The work DSMD performs on all of these different surveys is sponsored by several external government agencies that each have their unique operating styles, needs, and requirements.

Although much of DSMD's work is essential to successfully executing each survey, DSMD also has the capability and staff expertise to perform research and analysis in order to improve surveys leading to cost savings and improved efficiencies. Given the current environment of the federal government, we are constantly at risk of decreasing budgets, and therefore find ourselves competing for our research-type work to take priority and receive the appropriate funding. Additionally, there are risks to operating in a reimbursable work environment, making it essential for DSMD to keep costs low and quality of deliverables high.

Project Server at the Census

The US Census Bureau introduced Microsoft Project Server a few years ago to improve project and portfolio management, as well as, provide required reporting information to the Chief Information Officer and to Congress. Microsoft Project Server is a web-based application that serves as a database of project schedules and associated information, a portal for employees to charge their work hours to tasks on projects, as well as providing customizable reports for resource and schedule management, amongst other useful project management features.

A bureau-wide mandate was put in place for all staff to report their weekly work hours into Project Server to the associated mission-enabling service or survey life-cycle component. At the same time, the need for project management was becoming increasingly realized across Census. Having the project server infrastructure in place allowed Project Managers to execute and manage schedules based on actual work hours charged by project teams. Added benefits to collecting this schedule data are to analyze and use the data to improve planning for future projects, create transparency with our sponsors and survey directors, and improve resource and cost management.

It is important to note that this did not happen overnight or without a few headaches. Developing quality schedules and getting staff to accurately charge their work hours was necessary in order to successfully collect useful data. To accomplish this, the project managers needed to create comprehensive and manageable schedules with tasks that staff could easily understand and charge their work hours through Project Server. This was no easy task. It took the Demographic Statistical Methods Division (DSMD) approximately two years to achieve reportable project schedules.

Once DSMD was able to collect useful schedule data, the Management Operations Office (MOO), the project management office within DSMD, began exploring our options

for using the data to tackle some of our division's challenges and solve some of these recurring problems.

CHALLENGES

To use schedule data to increase DSMD's efficiency and resolve some of our common issues, we first needed to identify these challenges and address the source of our problems. Below are the biggest challenges DSMD needed to overcome.

Poor Schedule Development & Management

Prior to using Project Server to manage our schedules, DSMD was relying solely on the "best guess" of the SMEs to input effort into the schedules. We knew we needed to revise our schedules but developing schedules from scratch is a time-consuming and tedious process and it is often challenging to get staff, especially leadership and SMEs, support and attention when developing schedules. Assisting the project management staff was not considered a high priority. Not only are they busy with their work, it was difficult for staff to fully grasp the benefits of having accurate schedules when, up to this point, they had only witnessed the struggles of trying to maintain over-complicated schedules.

When staff began charging their work hours to schedules, we realized that we were mostly receiving unusable schedule data due to over-complicated and/or inconsistent format of schedules. The schedules we developed had too much detail resulting in confusion and too high burden on staff to actually report their time accurately each week. This lead to staff often charging to overhead or non-scheduled tasks when they did not understand the tasks or did not have the appropriate tasks available on their timesheets.

Underestimation of Costs & Poor Budget Management

Prior to collecting schedule data via Project Server, the MOO relied solely on the "best guess" of the SMEs to input effort into cost estimates. We also experienced numerous other issues when developing cost estimates because of our lack of consistent and documented procedures, not properly accounting for risk and uncertainty, not incorporating enough time for training, on-boarding, knowledge sharing, leave, and other non-project related staff time.

We were often underestimating costs because of the desire to produce "low" cost estimates in order to compete against contractors or other agencies to improve the likelihood that our proposed work, typically research projects, would be approved by our sponsors. We quickly realized that these low-ball estimates just ended up hurting DSMD. We often did not have enough funding to cover our staff or we ended up with budget deficits because we did not originally request adequate funding.

DSMD often would not anticipate how much our sponsors and survey directors would be involved in our work. We would regularly go over budget on work hours solely from addressing sponsor or survey director's feedback and comments on deliverables. Also, DSMD did not have a proper change management protocol in place, making it much more common for the sponsors and survey directors to ask for additional work without providing more funding. Obviously, this often lead to scope creep and budget overruns.

As mentioned before, staff were charging their time to overhead or non-schedule tasks when they did not understand the tasks or have the appropriate tasks on their timesheets. This made it challenging to manage the budget because, when looking at the schedule, it would seem as if the project was adhering to the baseline, or even ahead of schedule and under budget. In reality, the staff overhead/non-schedule charges were negatively impacting the budget, with a delayed realization of the effects due to lack of insight into these non-scheduled tasks. Even when realizing there were budget concerns, it was often difficult to pinpoint the source of the issue. The PMs monitored the budget using the standard monthly reports received from the budget office. These high-level reports were not easily understood without a background in finance and did not provide enough detail to properly manage the budget. Additionally, management was not as invested in budget monitoring and management as they should have been.

Lack of Transparency, Understanding, & Communication

DSMD performs complex statistical work that can often be difficult for the sponsor/survey directors to understand. As a result, it is challenging for them to fully grasp the importance of the work. Our overly-detailed schedules would often create confusion instead of helping survey directors to learn our processes. Staff charging to non-scheduled tasks/overhead made it almost impossible to determine what they were actually working on, adding to the difficulty of keeping survey directors and sponsors up-to-date on projects.

Also, without a risk management process in place, DSMD tended to realize issues before even identifying them as possible risks. At times, this lead to unanticipated budget and schedule issues, making it hard to defend our requests for more time or funding on projects.

Not only did DSMD often struggle to maintain good communication and transparency with our survey directors and sponsors, we also needed to improve our internal communication and transparency with staff and leadership. DSMD management were minimally involved with the budget and schedule formulation and monitoring and the MOO PMs were often delivering information in a format that was not easily comprehensible to those outside of the project management discipline. We did not have

standard reports to communicate budget or schedule updates to DSMD management or to our sponsors and survey directors.

Insufficient Funding and Poor Resource Allocation

In this time of decreasing federal budgets, DSMD occasionally receives insufficient funding for projects making it difficult to support a full staff. As a result, DSMD is forced to make tough decisions about how to prioritize work and make appropriate staff assignments, as well as, determining whether we will be able to fill vacancies.

DSMD underwent a reorganization, moving to matrixed, pooled-staff structure in order to better address the ebbs and flows of work on different surveys by having the flexibility to move staff around, to promote knowledge sharing and staff development. This allows staff the opportunity to work on different surveys depending on the needs of the project, as well as the interest and expertise of individual staff. In order for this structure to function successfully, DSMD needed to put in place strong resource management processes. It took DSMD managers some time to move on from being territorial over their staff and be willing to utilize the matrixed structure.

DSMD had insufficient information regarding staff work assignments prior to capturing all of our division's work on schedules. It was very difficult to determine which staff were over or under allocated other than by asking them or their supervisors and hoping they were aware of their staff's full workload. This made staffing decisions on projects much more challenging and subject to more risks. Also, DSMD had a difficult time evaluating staff performance on specific types of tasks or skills without usable schedule data.

SOLUTIONS

After identifying our challenges and understanding the causes, we were able to start developing solutions for these problems. A common cause across DSMD's issues was simply a lack of information that lead to misunderstanding and inability to make informed decisions. As we started to collect quality schedule data, we realized that this information could be used to solve a lot of our common challenges. Below are some of the methods we developed.

Improved Schedules

The MOO PMs worked tirelessly with SMEs and project teams to develop and continuously revise schedules until finally landing on a suitable breakdown of the work without overburdening staff with excessive tasks. The MOO used past schedules and staff input to compile a list of products and tasks that the division worked on across all surveys and projects. We then analyzed, consolidated, and standardized the list of products to achieve a comprehensive suite of DSMD work. This led to the development

of a standardized work breakdown structure that can be applied to most surveys and projects, Figure 1 below.

Figure 1. DSMD Work Breakdown Structure.

1. **LEVEL 1: DIVISION**
1.1. ***LEVEL 2: PORTFOLIO***
1.1.1. **Level 3: Program**
1.1.1.1. Level 4: PROJECT-TYPE
1.1.1.1.1. Level 5: Project
1.1.1.1.1.1. Level 6: Product
1.1.1.1.1.1.1. Level 7: Work Package
- Resources/Cost Estimates/Budget Actuals/Schedule are reported at the Work Package Level
- MOO and SDs neither have nor need visibility below the Work Package Level

1.1.1.1.1.1.1.1. Level 8: Activity
- Activities and Sub-Activities (at levels 9 and lower) are not included in the Project-Type standard WBSs
- Activities and Sub-Activities are created by each project as needed for project-level cost estimation and project control
- Resources, cost estimates, budget actuals, and schedule are rolled from Activities and Sub-Activities to the Work Package level for reporting

As a result, we are able to maintain consistency of task names and meanings across surveys and project schedules making it easier for staff understand the schedules and to report their time accurately. The MOO also created standardized procedures for incorporating non-project work hours on schedules in order to capture majority of staff's time on schedules. For example, we developed a division-wide training schedule that staff charge to when they participate in self-administered or classroom training. After DSMD implemented the improved schedules, staff charging to overhead decreased from 56% in fiscal year 2016 to 31% so far in 2018[4].

When Project Server became available to use there was a long learning period for both the PMs and the rest of the staff. Once the MOO was up-to-speed on the software, we began uploading and activating our schedules for staff to charge to within Project Server. The MOO developed standard, documented guidelines and began educating staff on how to report their time properly in Project Server. Staff now are more comfortable with the Project Server software and schedules. For Example, they pay attention to their remaining hours and communicate to the PMs when they think they might need more time on tasks. By reviewing the schedule at the regular team meetings and by frequently communicating with staff, the PMs ensure the schedules are always up-to-date and that staff are engaged with the schedule monitoring process.

Not only does the reliable data improve the overall monitoring of schedules and project performance, it also has greatly enhanced future planning. The standardized list of DSMD products allows for schedule data from specific tasks to be directly comparable across surveys and projects leading to improved task duration and effort estimation on future projects. When drafting a schedule, we can access the data from completed schedules of similar projects or prior survey cycles for new estimates leading to more

[4] These statistics do not include DSMD admin or project management staff.

accurate schedules. As the quality of our schedules continuously improves, projects begin adhering closer to their baselines making it easier for the teams to anticipate the risk of possible deviations from the baseline.

Streamlined, More Accurate Costs Estimation

Using actual effort charged to schedules to formulate costs on future projects greatly improved the accuracy of DSMD's cost estimates. We no longer need to rely solely on SMEs "best guess," instead the MOO PMs provide the schedule actuals to staff to support and guide their estimates for future work. To assist with the estimation of effort, I linked completed task data to the list of DSMD standardized products in order to determine average effort required for each product. Table 1 below shows the average effort based on project type for some of DSMD's deliverables where data is available at this point. This information is intended to serve as a foundation for which effort and duration estimates are based and as check to ensure our estimates are reasonable. As a result of this data, DSMD Leadership and SMEs are now more comfortable and efficient with the cost estimation process and more accurate with their estimates.

Table 1. SM Standard Products - Average Effort by Project Type and Grade.

ID	Deliverable/Product	Analysis of Existing Data			Experiment			Contact Optimization		
		GS-12	GS-13	GS-14	GS-12	GS-13	GS-14	GS-12	GS-13	GS-14
SM-5	Report	270	57	29	65	48	8	94	12	7
SM-6	Recommendations	0	0	0	0	0	0	0	0	0
SM-7	Analysis	420	99	22	74	38	7	213	106	28
SM-8	QA	0	0	0	10	7	2	0	0	0
SM-9	Proposal Development	0	0	0	0	0	0	0	0	0
SM-10	Operations Plan				0	0	0			
SM-11	Analysis Plan	76	10	24	113	0	17	92	22	3
SM-12	Expert Review									

A second improvement to the costs estimation process was to standardize our procedures for incorporating non-deliverable related work hours into the cost estimates. We did this to ensure we are appropriately capturing costs for time expended on training, onboarding, leave, project support, and other non-deliverable related tasks. For example, we will add three days of training and $1,500 for each full time employee to account for training that may occur throughout the year.

When estimating effort and costs for research proposals and projects that tend to have more uncertainty, additional steps are taken to account for risk. Table 2 shows a simplified version of the cost estimate data gathering steps used to incorporate risk and uncertainty.

Table 2. Cost Estimation Data Gathering Process.

Determine scope	**Work with sponsor/survey director to determine project requirements.**
Gather data	PM develops data gathering spreadsheet for Lead Scientist (LS) and provides average effort from similar completed projects for reference.
Estimate effort	LS develops 3-point effort estimates (optimistic, most likely, and pessimistic) for tasks based on project requirements and historical data. The LS also assigns a level of confidence in estimates for each task (guesstimate, low, medium, or high).
Build in risk/uncertainty	PM runs the 3-point estimates through a model that uses the PERT formula, a normal distribution, and confidence level to calculate effort estimates with uncertainty built in.
Estimate costs	PM inputs effort estimates through cost estimation worksheet.
Review estimates	LS reviews cost estimate.

With schedule data to support our estimates, DSMD can provide the sponsor with solid, defensible estimates that lead to realistic project budgets and schedules. This gives DSMD a competitive advantage by enabling high quality work that will meets the sponsor's need and comes in on schedule and on budget. Additionally, if the sponsor pressures DSMD to lower our costs, we can have a data-supported conversation with them on where to cut project scope.

Better Budget Formulation & Monitoring

DSMD uses schedule data to understand how all the projects and surveys fit together at the division level. The data provides resource usage for past and currently active projects that is useful for budget formulation. To do this, the MOO PMs use past and present schedule data to determine the appropriate level of staff they should allocate to each survey or project for that fiscal year. We then compare that to a top down estimation approach to determine the adequate level of funding to cover our staff. This simplifies our resource allocation and budget formulation process for current and out year planning. Table 3 is an example of DSMD's budget planning documents (BPD) showing how a resource's paid days are split across multiple projects.

Table 3. Fiscal Year 2019 DSMD BPD Sample.

Project Code	Resource- Branch	PayGrade	PayPlan	Series_	Tour_	EmployeeType	Paid Days
0902087	Resource 1 - Branch 02	12	GS	1530	FullTime	Permanent	260
Project View	Resource 1 - Branch 02	12	GS	1530	FullTime	Permanent	260
0906000	Resource 2 - Branch 20	11	GS	1530	FullTime	Permanent	25
0957000	Resource 2 - Branch 20	11	GS	1530	FullTime	Permanent	30
0959000	Resource 2 - Branch 20	11	GS	1530	FullTime	Permanent	38
0976000	Resource 2 - Branch 20	11	GS	1530	FullTime	Permanent	25
1465X01	Resource 2 - Branch 20	11	GS	1530	FullTime	Permanent	27
7370019	Resource 2 - Branch 20	11	GS	1530	FullTime	Permanent	45
7421019	Resource 2 - Branch 20	11	GS	1530	FullTime	Permanent	70
Project View	Resource 2 - Branch 20	11	GS	1530	FullTime	Permanent	260

Management is now more invested in budget monitoring because the MOO PMs began creating monthly budget variance reports and other custom reports that are more easily understood than the reports that admin provides. The schedule data allows us to provide more detailed project-level cost information, instead of just program-level information found in the admin reports. I meet with management monthly to review these reports and discuss any budgetary concerns. As a result, we are able to pinpoint the specific cause of budget concerns more easily and anticipate potential budget issues before they occur. Below is a list of the reports I provide management.

1. Monthly Budget Variance Report
    - Update monthly, at least two days prior to monthly budget meeting
    - Fiscal year (FY) specific report showing a budget snapshot of all projects and surveys worked on in the given fiscal year
    - Compares original operating plan, current operating plan, and actual expenditures
    - Updated based on financial monthly report (FMR) data, schedule data, and Census Data-Warehouse cost information

2. Survey Specific Budget Reports
    - Update monthly, at least two days prior to monthly budget meeting
    - Project specific costs by fiscal year
    - Expended funds based on the actual work reported to schedules
    - Cost Estimates of remaining work
    - % of work completed and % of duration completed on the project
    - Original cost estimate and revised/current cost estimate (if applicable)
    - Baseline effort
    - Monthly FMR data (i.e. total allocation, expenditures, remaining funding, etc. by project code)

3. End of Fiscal Year Budget Report
    - Total FY expenditures by project code and project
    - Original FY allocations
    - Funding adjustments and associated justifications
    - Percentage of staff covered by project code

The goal has always been for DSMD schedules to be developed and baselined to match the effort and timelines used to produce our cost estimates. Now that the MOO PMs are more easily able to achieve this, monitoring the budget is directly linked to schedule performance. With staff knowledge of this, they are more cognizant of the hours they are spending on tasks leading to more accountability and improved performance.

Improved Communication & Transparency

With regular meetings, improved team communication, and up-to-date, accurate schedules, it is much easier to communicate status updates to our sponsors and survey directors at a moment's notice. The MOO PMs work with survey directors and DSMD management to determine the best way to present schedule and budget data in a routine and timely manner that will suit their needs. In some cases, that means linking our schedule to the survey director's schedules in order for them to monitor our work in real-time without having to reach out for a status update.

For internal bi-weekly team meetings, I have schedule snapshots and status reports available for staff to review prior to the meeting. The status reports are created using data pulled from the schedules, see Table 4 below. During the meetings we go over this information in order to make updates to the schedule, identify new risks, status on current risks, create action plans for issues, and discuss general project progress.

Table 4. Status Report for 2018 NSCH Review of Mailed Correspondence.

PROJECT NAME: 2018 NSCH REVIEW OF MAILED CORRESPONDENCE		
Meeting Date: 3/19/18	Project Code:	
Project Manager: Anne Johnson	Project Lead:	
PROJECT INFORMATION		
Description of Project: Conduct an expert review of the NSCH contact materials that are currently planned for use in the 2018 survey.		
Project Start Date: 3/1/18	Project End Date: 4/18/18	% Work Complete: 26%
SCHEDULE STATUS		
This project is ahead/behind schedule: On Schedule		
Drivers causing schedule variance:		
Planned Hours: 373.5hrs (updated to include CR hours)	Schedule Hours: 366.25hrs	Reserve Hours: 7.25hrs
PROJECT UPDATES		
3/14/18 CR for additional follow-up postcard approved by ADDP. They would like this task completed by 4/6/18.		
PROJECT ISSUES		

By continuously monitoring schedules to identify potential risks before they are realized, we have improved our risk management ability. We have increased our capability to make data-driven, real-time decisions based on the schedules that are updated and published weekly.

With our new standardized WBS, the schedules are more easily understood and embraced. By capturing more work on schedules and reducing overhead charging, we are now able to fully understand what staff are actually working on.

Enhanced Resource Management

Now that DSMD captures nearly all of staff work on schedules, including project and non-project time, we are able to analyze an employees' availability, or lack of, in order to make informed assignments to project work. Using Project Server resource reports that pull information from our current schedules, we can see the full suite of work staff are assigned to in order to determine which resources have the availability to take on additional work. Providing resource capacity and availability reports, see Table 5 below, to management on a monthly basis allows us to easily decide how to shift work amongst resources if needed, fully utilizing our matrixed structure. For example, analyzing resource reports helped DSMD realize that, with the current set of projects, there is an increasing need for staff with skills in questionnaire design and development. At the time, only a few staff members had expertise in this skillset and were therefore assigned

to more work than they had the capacity for. We used this information as an opportunity to cross-train staff on questionnaire design and development to avoid over-allocation of resources in the future.

Table 5. SM Resource Capacity vs. Availability Report.

Resource Name	Project	February	March	April	May	June	July
Resource A	**Capacity**	**148**	**176**	**168**	**176**	**168**	**168**
Resource A	**Availability**	**13.04**	**-4.5**	**47.24**	**70.41**	**93.23**	**165.96**
Resource A	DSMD 2018 Conference Papers	13.06	15.53	14.82	8.65	0	0
Resource A	DSMD_Customer Satisfaction Survey Development	18.85	34.63	34.26	41.18	18.57	0
Resource A	DSMD_FY18_Training and Knowledge Sharing Schedule	3	3.57	3.4	3.57	4.46	2.04
Resource A	DSMD_RP17_NSCG_Paradata Analysis	48.47	51.58	36.13	27.69	20	0
Resource A	DSMD_RP17_NSCG_Web Enhancement and Mobile Optimization	4.58	0	0	0	0	0
Resource A	DSMD_RP17_NSSRN_Questionnaire Design	12.44	22.68	0	0	0	0
Resource A	DSMD_RP18_NSCH_Questionnaire Design	34.53	52.51	32.14	24.5	31.74	0

Time Available (%)
38%

Analyzing schedule data provides insight into specific strengths and skills sets of staff allowing us to make more informed resource decisions on projects and has made it easier for management to assign work. For example, one team member may take half as much time as another to write an analysis plan, so if a project has a tight schedule, it would be in our best interest to assign the work to the team member that is capable of working faster.

CONCLUSION & NEXT STEPS

DSMD now has a wealth of new and improved project management methods in place made possible because of the collection and analysis of schedule data. We have improved our relationships and trust with our sponsors and survey directors, increasing their willingness to utilize our services and initiate future work. DSMD leadership and staff have enhanced their understanding and recognized the benefit of our project management processes. We are now able to make data-driven, real-time decisions helping us to more effectively manage our resources, budget, and schedules. In order to stay on this path of progress, DSMD will need to execute the following next steps.

- Continue to find innovative ways to use schedule data to improve our processes. With the burden imposed on staff to report their time each week, we should always be making an effort to use the data collected to improve the efficiencies of the division ensuring their efforts are worthwhile.
- Maintain an up-to-date Project Management Plan. The PM plan ensures accountability and is crucial in order to pull all of these new methods and procedures together so they can be utilized consistently and effectively.
- Collecting ongoing lessons learned is essential in order to continuously improve our processes, projects, and schedules.

About the Author

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Anne Johnson graduated from the University of Pittsburgh with a Bachelor's of Science in Mathematics and Economics in 2012. Shortly after graduating, Anne began her career at the US Census Bureau working in the Economic Directorate as an analyst on the Service Annual Survey and the 2012 Economic Census.

Anne joined the Demographic Statistical Methods Division as a project manager in February of 2015. She has provided project management support to the American Housing Survey, National Survey of College Graduates, the Current Population Survey Supplements, and Survey Methodology research projects. In this role, Anne has developed and managed over 50 project schedules, produced cost estimates for survey work and research projects, monitored the budgets for reimbursable projects, created reports to assist management with resource allocation and budget management, developed training materials, and managed contracts as a COR.

Anne received a Master's Certificate in Project Management and her PMP certification in 2016 and her COR certification in 2017.

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