

# Developing a Standards Based Project Management Information System<sup>1, 2</sup>

## Part 3: Project Cost Functions<sup>3</sup>

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### Introduction

This is one of a series of articles that describes the development of a project management information system (PMIS). Using the design science research methodology, I created an artifact, and that artifact is the research contribution. In the first article, I described the overall development process. In subsequent articles, I describe in depth specific functions in the system. In the following pages, I describe the design of the project cost functions in the PMIS. I conclude with future direction and pending questions. My hope is to spark interest and engage project management practitioners in the project.

To develop the PMIS, I used a low-code development tool called Mendix. This allowed me to develop the functionality much more quickly than I would have been able to otherwise. Additionally, it allows me to show program logic visually in these articles. Key portions of program logic will be displayed where appropriate.

### Processes and Data

The PMIS is designed to mirror the standards in “A Guide to the Project Management Body of Knowledge,” more commonly known as the PMBOK® Guide (Project Management Institute, 2017); therefore, the functionality is described according to the content in that standard. The first article in my series explains the overall design of the system (Bellah, 2021). In that article, I explained how some of the documents (usually inputs and outputs of project management

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<sup>1</sup> This series of articles describes the development of a new standards-based project management information system by prof Jeremy Bellah and student researchers at the University of Oklahoma. Dr. Bellah is director of the Center for MIS Studies at the University and teaches courses on data analysis, web design, information systems and project management. See Dr. Bellah’s background at the end of this article.

<sup>2</sup> As this is an ongoing development project, the author would welcome comments, feedback or suggestions. Please email your thoughts or ideas to [jbella@ou.edu](mailto:jbella@ou.edu)

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processes) are integrated into the system using database tables and custom interfaces. The following documents used in processes in the Project Cost Management knowledge area are integrated in the PMIS:

- Cost estimates
- Basis of estimates
- Cost baseline
- Work performance information

A database supports all of the integrated documents in the PMIS. Figure 1 shows an Entity Relationship Diagram (ERD) of the tables required to implement the functionality for the documents listed above. To save space, most attributes are not included in the ERD.

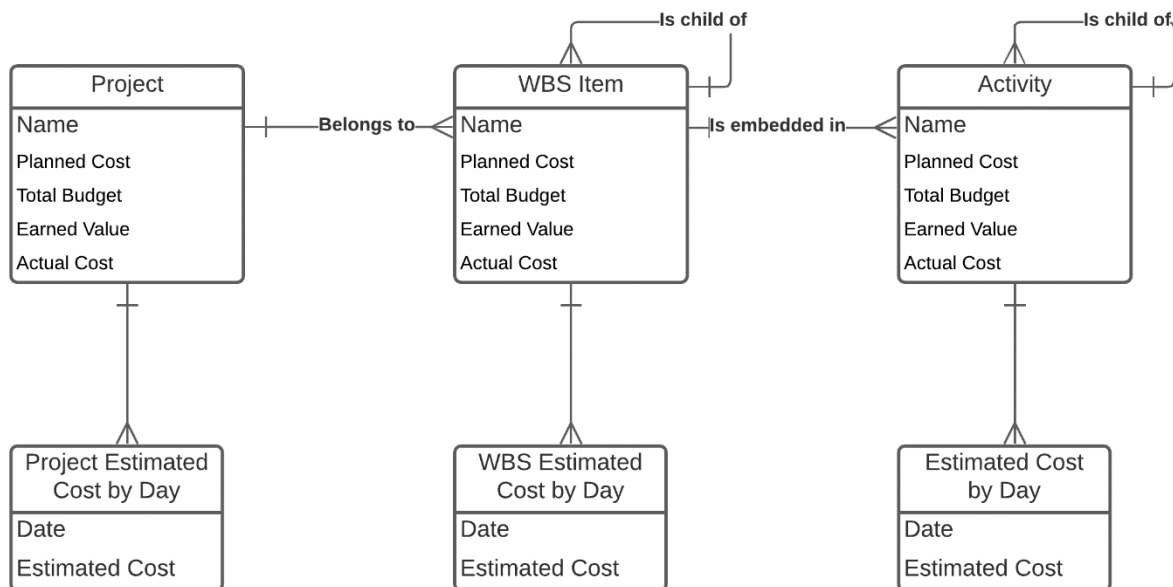


Figure 1: Entity Relationship Diagram

### Cost Estimates

I designed the interface for entering cost estimates directly. In reality, most cost estimates are derived by resource estimates. If one knows how much of a resource will be used and the cost per unit of that resource, the cost is the sum of the products of resource units and costs per unit. I plan to add functionality to estimate resources. I also plan to add functionality for three point estimates so that the system can use the program evaluation and review technique (PERT) to estimate the project costs.

## Basis of Estimates

This document was easy to implement, as it required only an extra attribute in the Activity entity.

## Cost Baseline

For the cost baseline interface, I tried to balance power and flexibility. Figure 2 shows the interface for allocating daily costs. For earned value calculations to work correctly, I decided to allow the user to distribute costs appropriately. For example, in a home building project, it is common to pay a subcontractor at the completion of the work. So actual costs are not incurred until the last schedule day of the activity. If estimated costs are spread out evenly across the duration of the activity, the earned value will be greater than actual costs for all but the last schedule day of the activity, giving a misconception that the activity is under budget. By allowing the user to assign the daily costs appropriately, this can be avoided.

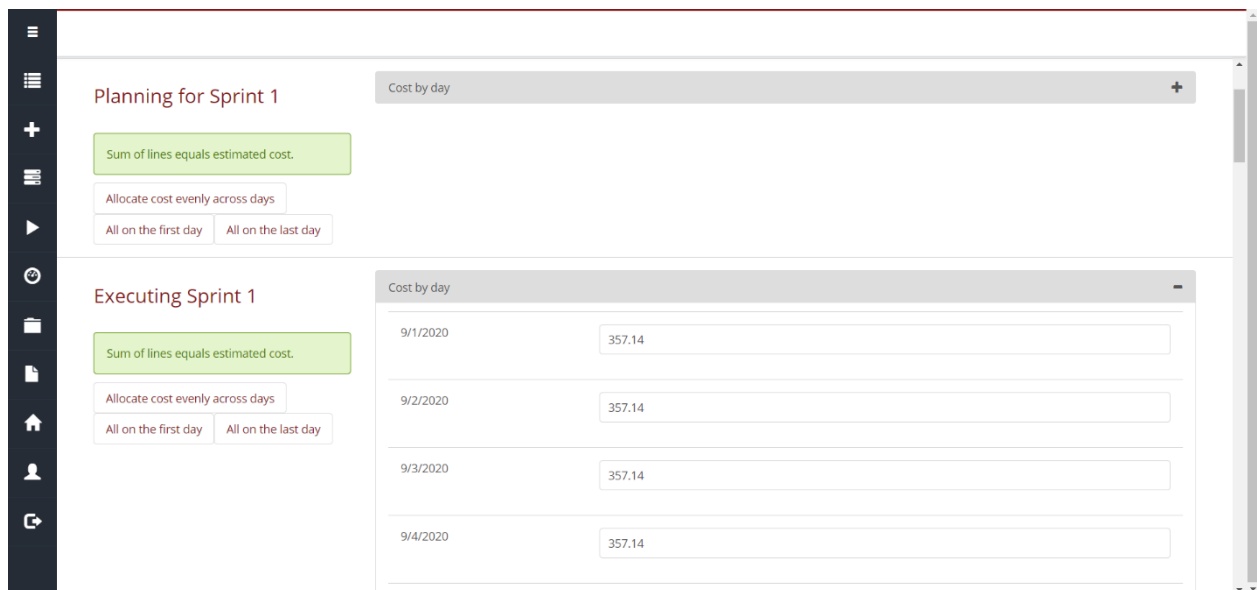
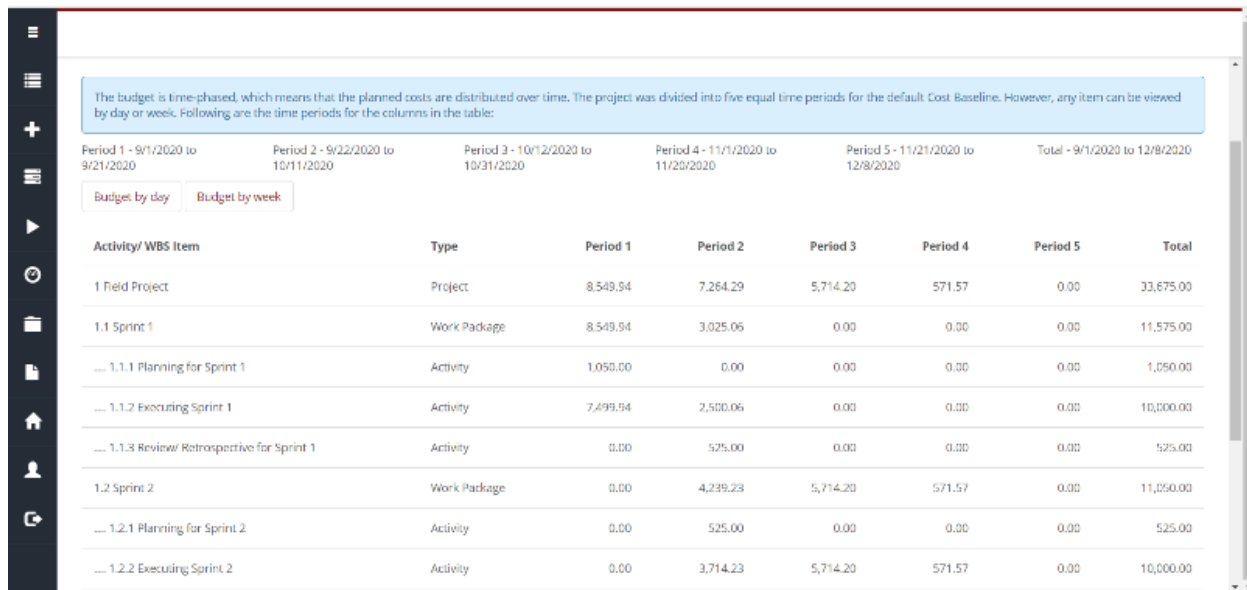


Figure 2: Cost allocation interface

The user can edit the daily cost of each activity manually or use the buttons to save time. The buttons allow the user to: 1) allocate the cost evenly across all days, 2) allocate all of the cost to the first schedule day, or 3) allocate all of the cost to the last schedule day. Because the sum of the daily costs must equal the total cost of the activity, the system does a check to verify this. The notification on the left side will be green if the sum of the daily costs equals the total cost. It will show yellow if they do not match. The cost baseline cannot be approved until all notifications are green.

After the cost baseline is approved, it can be viewed. Figure 3 shows the default cost baseline view. All estimates are entered for activities. Estimates are aggregated up to activity groups,

work packages, WBS items, and to the overall project. Because the cost baseline is time-phased, it can be viewed according to specific time periods. In the default view, the project is divided into five equal time periods so that everything will fit on the screen. The user can examine any item by day or by week. To do this, the row is selected and the appropriate button is clicked: Budget by day, or Budget by week.



The budget is time-phased, which means that the planned costs are distributed over time. The project was divided into five equal time periods for the default Cost Baseline. However, any item can be viewed by day or week. Following are the time periods for the columns in the table:

Period 1 - 9/1/2020 to 9/21/2020	Period 2 - 9/22/2020 to 10/11/2020	Period 3 - 10/12/2020 to 10/31/2020	Period 4 - 11/1/2020 to 11/20/2020	Period 5 - 11/21/2020 to 12/8/2020	Total - 9/1/2020 to 12/8/2020		
Budget by day		Budget by week					
Activity/ WBS Item	Type	Period 1	Period 2	Period 3	Period 4	Period 5	Total
1 Field Project	Project	8,549.94	7,264.29	5,714.20	571.57	0.00	33,675.00
1.1 Sprint 1	Work Package	8,549.94	3,025.06	0.00	0.00	0.00	11,575.00
... 1.1.1 Planning for Sprint 1	Activity	1,050.00	0.00	0.00	0.00	0.00	1,050.00
... 1.1.2 Executing Sprint 1	Activity	7,499.94	2,500.06	0.00	0.00	0.00	10,000.00
... 1.1.3 Review/ Retrospective for Sprint 1	Activity	0.00	525.00	0.00	0.00	0.00	525.00
1.2 Sprint 2	Work Package	0.00	4,239.23	5,714.20	571.57	0.00	11,050.00
... 1.2.1 Planning for Sprint 2	Activity	0.00	525.00	0.00	0.00	0.00	525.00
... 1.2.2 Executing Sprint 2	Activity	0.00	3,714.23	5,714.20	571.57	0.00	10,000.00

Figure 3: Cost baseline view

## Work performance information

The system allows users to enter information needed for earned value management. Specifically, actual cost and percent complete can be entered for each activity. Each day, an algorithm runs to update the planned values of activities. All of the information is aggregated up through the project structure so that earned value information can be calculated at every level.

## Conclusion

In this article, I described the cost functionality in the PMIS. By using a database to connect information from different project management processes and documents, the system is able to provide power and flexibility in the cost domain. At the end of each article in this series, I invite feedback from readers. The hope is that this process will lead to better design decisions. The process is working. I am planning a complete redesign of the system to implement the ideas generated through the first three articles. Following are the basic ideas behind the redesign:

- I plan to return to my original motivation. I want the system to be a teaching tool. That means there will be much more guidance for users. I will design it in such a way that it will help my students learn about project management processes by using the system.

- Each process page will be designed individually. Instead of trying to make each one exactly the same, I will take advantage of the opportunity to create each page in the way that makes sense. I will still make use of the inputs and outputs sections to link to documents, but I will also integrate tools and techniques when it makes sense to do so. When performing a process, the user will be guided through a series of pages that walk through the appropriate steps.
- The standards in the PMBOK® Guide (Project Management Institute, 2017) recommend choosing which processes to perform on a project. I envision an interface where the user can select which processes to use when beginning the project. Then the system will recommend the order of processes based on linkages through documents. By providing this level of guidance, the user will know when it is appropriate to begin, or to revisit, a project management process.
- I will make use of the program manager interface to handle Enterprise Environmental Factors (EEFs) and Organizational Process Assets (OPAs). The program manager will be able to assign specific items as inputs for specific processes. That way, when the project manager is performing a process, the appropriate items will show up as inputs. This makes more sense than defining EEFs and OPAs at the project level, because they are likely the same for all projects.
- I will use an Agile process to redesign the PMIS, and I will write my series articles at the same time. I will work in defined time increments, and the scope I will complete will vary. I don't know what will be in the first increment, but I expect to focus on the administrator interface early so that I can get processes and documents into the system.
- Feel free to use the system. Following is the URL: <https://trjproject-sandbox.mxapps.io/index.html?profile=Responsive>

Remember that the system is still being developed, so there could be errors. You can email me if you encounter errors, and I will try to resolve them.

I hope you enjoyed reading about the development of the PMIS. I look forward to hearing back from you. Please email me at [jbella@ou.edu](mailto:jbella@ou.edu) with feedback related to my specific questions or with general feedback. In the next article, I plan to describe the redesign of the PMIS. I will document what I develop in the first increment.

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## References

Bellah, J. C. (2021). Developing a Standards Based Project Management Information System – Part 2: Project Schedule Functions, *PM World Journal*, Vol. X, Issue III, March. Available online at <https://pmworldlibrary.net/wp-content/uploads/2021/03/pmwj103-Mar2021-Bellah-Developing-Standards-Based-PMIS-schedule-functions-series-part2.pdf>

Bellah, J. C. (2021). Developing a Standards Based Project Management Information System – Part 1: Motivation, History, Design; Series, *PM World Journal*, Vol. X, Issue I, January Available online at <https://pmworldlibrary.net/wp-content/uploads/2021/01/pmwj101-Jan2021-Bellah-developing-standards-based-PMIS-1-motivation-history-design.pdf>

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## About the Author



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**Jeremy Bellah** serves in a teaching position at the University of Oklahoma's Price College of Business. He teaches classes related to programming, web development, data analysis, and project management. Through an experiential learning teaching style, he coaches and mentors students to develop into successful working professionals. He also serves as the Director of the Center for MIS Studies, an industry-academic partnership within the MIS Division. In this role, he interacts with industry partners of the Division to facilitate input on curriculum, collaborative research projects, and engagement with students.

Prior to earning a Ph.D. and pursuing academic positions, Jeremy developed information systems professionally. Most of the systems were custom applications built for small- and medium-sized businesses. This experience gives Jeremy the ability to relate to industry professionals and to teach from a perspective of practical expertise, rather than academic training. Dr. Bellah can be contacted at [jbella@ou.edu](mailto:jbella@ou.edu).