PM World **Journal** *(ISSN: 2330-4480)*
Vol. X, Issue IX – September 2021
www.pmworldjournal.com   Series Article

Developing a Standards-Based PMIS
Part 4: Complete Redesign
by Jeremy Bellah, PhD

Developing a Standards Based Project Management Information System[1, 2]

Part 4: Complete Redesign[3]

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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 process of completely redesigning 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.

Game-Changing Design Change

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, 2021); therefore, the functionality is described according to the content in that standard. The first three articles in my series explained the overall design of the system (Bellah, 2021), project schedule functions (Bellah, 2021), and project cost functions (Bellah, 2021).

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[1] 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.

[2] As this is an ongoing development project, the author would welcome comments, feedback or suggestions. Please email your thoughts or ideas to jbellah@ou.edu

[3] How to cite this article: Bellah, J. C. (2021). Developing a Standards Based Project Management Information System – Part 4: Complete Redesign, *PM World Journal,* Vol. X, Issue IX, September.

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Through the process of building the system, writing these articles, and soliciting feedback from professionals, I recognized opportunities to improve the system. After writing the last article, I decided it was time to do it. While I thought I could make significant improvements, I had no idea how impactful the process would be.

When I redesigned the system, I began with the data model. By analyzing the old model, I noticed that three entities had many of the same attributes. Additionally, each entity had a one-to-many relationship with an entity used to store daily cost information. Figure 1 shows the old model. Attributes were not included to save space.
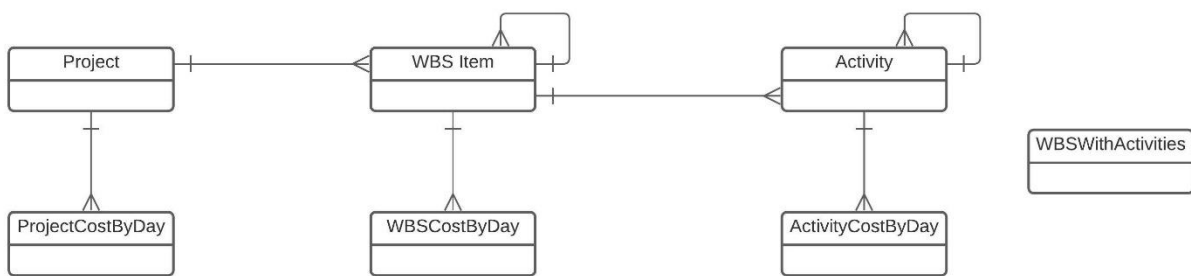

Figure 1: Old data model

In addition to duplicated attributes and entities, I created a non-persistable (exists in memory – not in the database) entity to display performance metrics that included both WBS Items and Activities. This was difficult and inefficient, as I had to write code to create the output in memory rather than pulling from a database table.

The solution – inheritance! Figure 2 shows the new data model. The Project, WBS Item, and Activity entities all inherit attributes and relationships from the Project Item entity. Figure 3 shows the actual Project Item entity to illustrate how many attributes are shared by the three other entities.
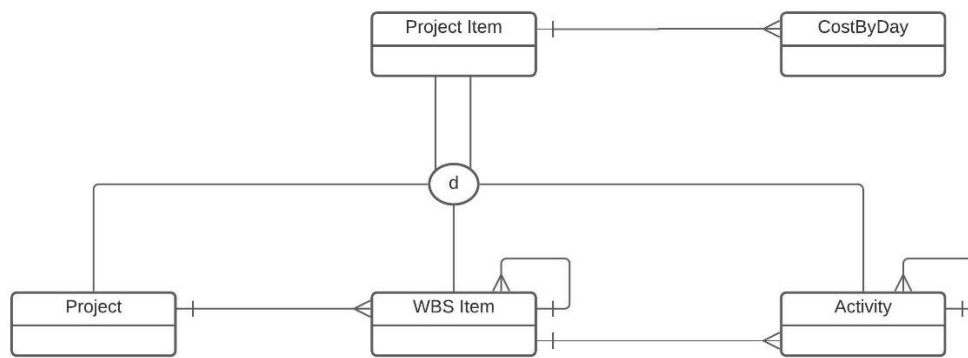
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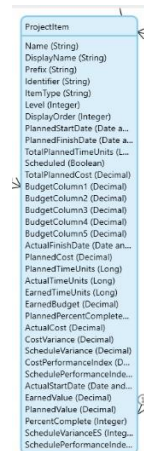
Figure 2: New data model

Figure 3: Project Item entity

So far, I have 35 attributes in the Project Item entity. In the old data model, that would have been 35 X 3 = 105 attributes across 3 entities. Additionally, it is much easier to display information from all entities in the same place because the relevant information is in only one entity. So when I display earned value information (Earned Value, Planned Value, Actual Cost, Cost Performance Index, Schedule Performance Index, etc.), all I need is the Project Item entity because it has all of the attributes necessary to display the information. Recognizing the opportunity to use inheritance to simplify the data model was a game-changer.

Improved User Interface

In addition to improving the data model, I also improved the user interface when redesigning the system. Because I decided to use the system primarily as a teaching tool, I simplified the interface. In the Project Management interface, I decided to organize the functions by the processes in the PMI standards (Project Management Institute, 2021). Figure 4 shows the Project Management interface.
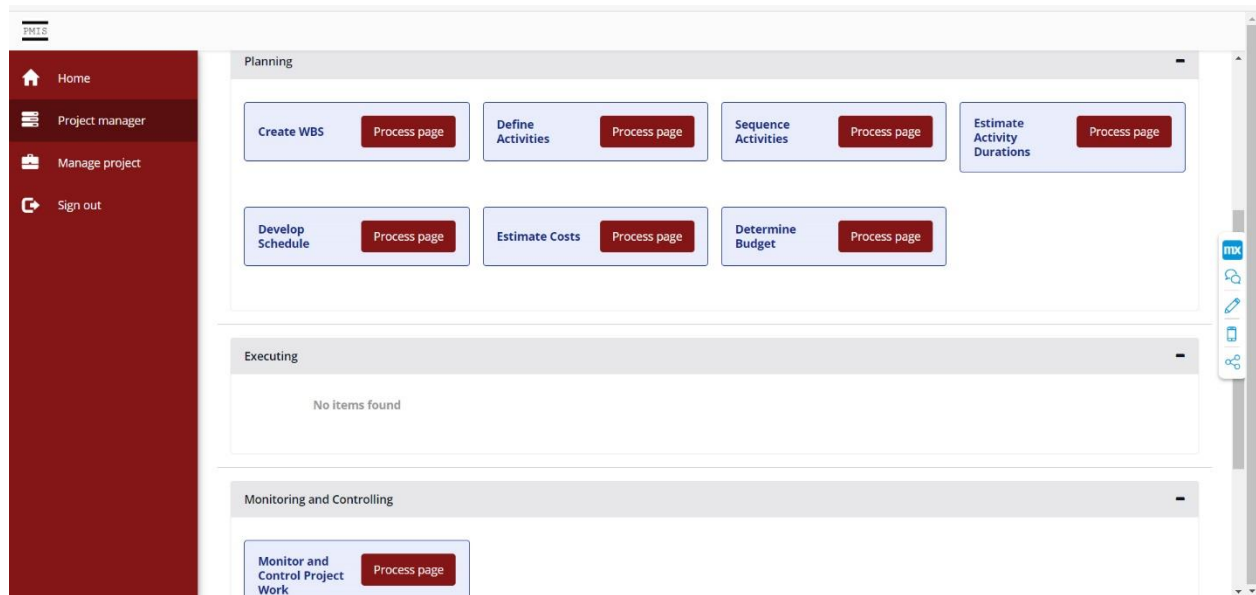
Figure 4: Project Management interface

Processes are displayed with a blue background if they are completed and with a green background if they are not completed. So far, I have interfaces for the following processes:

- Identify Stakeholders
- Create WBS
- Define Activities
- Sequence Activities
- Estimate Activity Durations
- Develop Schedule
- Estimate Costs
- Determine Budget
- Monitor and Control Project Work

The most important functions in the system are related to earned value management (EVM). From a teaching perspective, I want my students to be able to plan their budgets and schedules and then evaluate project performance using EVM. The implemented processes support this objective, and that is why I implemented them first.

Each process page was designed individually. Instead of trying to make each one exactly the same, I took advantage of the opportunity to create each page in the way that makes sense. I made use of the inputs and outputs sections to link to documents, but I also integrated tools and techniques when it made sense to do so. When performing a process, the user is guided through a series of pages that walk through the appropriate steps. Figure 5 shows the process page for the Determine Budget process.
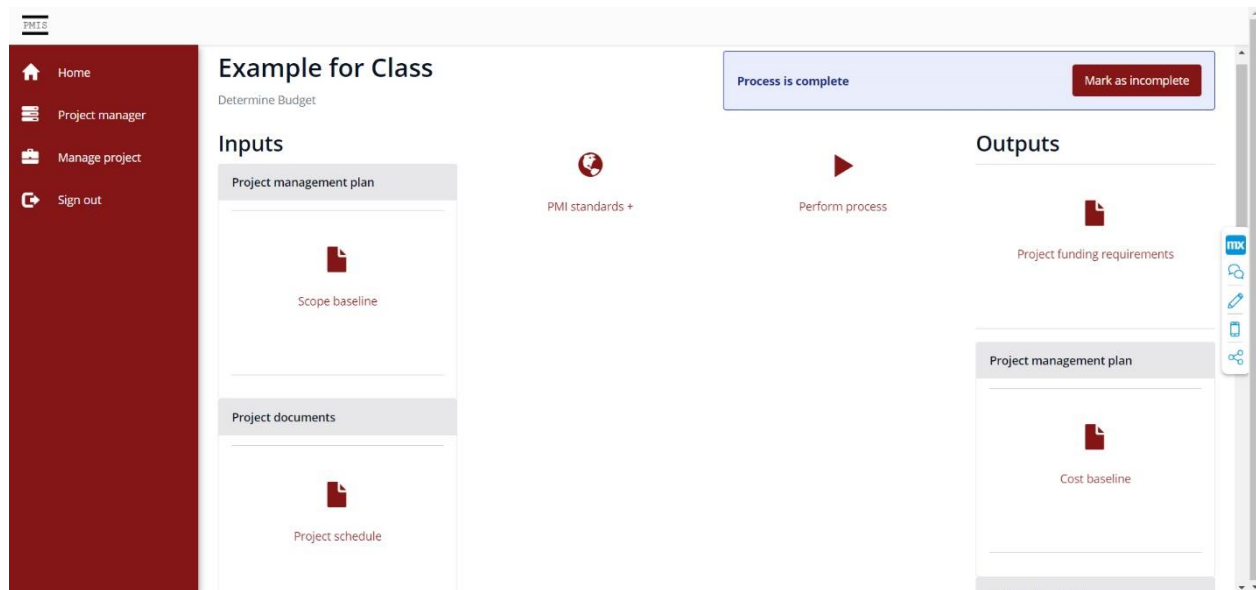
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Figure 5: Determine Budget process page

Conclusion

In this article, I described redesign of the PMIS. Having designed and redesigned this system multiple times, I find that I improve the backend design and functionality every time. This time was not different. The game-changing data model change allowed me to program interfaces much more easily. The changes to the interface made the system much easier for my students to use for class projects. 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. Following are the specific items about which I would like feedback:

- The standards in the PMBOK® Guide (Project Management Institute, 2021) 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 want to begin implementing this functionality, but I am not sure where to implement it. Should I make this part of a Program Management interface? Should I have a default set of processes that are activated but allow the user to customize them at the project level?

- 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

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makes more sense than defining EEFs and OPAs at the project level, because they are likely the same for all projects. Is this an appropriate way to link EEFs and OPAs?

- Feel free to use the system. Following is the URL: https://pmis-sandbox.mxapps.io/

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 jbellah@ou.edu with feedback related to my specific questions or with general feedback. In the next article, I plan to continue the redesign of the PMIS. I will document what I develop in the second increment.

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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.

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