
A PLANNING PROCEDURE FOR BIM ADOPTION WITHIN AN OWNER ORGANIZATION

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ABSTRACT

This paper presents an overview of preliminary results from an on-going research thrust to create a structured procedure for an owner to develop a detailed Building Information Modeling (BIM) implementation strategy within their organization. The paper documents initial results which define an Owner's Planning Procedure for Building Information Modeling (BIM) and key BIM Planning Elements for Organizations. Through focus group meetings, interviews, work sessions, and literature review, three primary tasks have been identified for developing a detailed BIM execution plan for owner organizations: 1) Conducting an Organizational BIM Assessment, 2) Establishing an approach to the future implementation of BIM, and 3) Developing the BIM transition plan. The BIM Planning Elements identified need to be evaluated and considered during each step in the planning procedure. These planning elements include: a) BIM Mission and Goals; b) Organizational and Project BIM Uses; c) Project and Organizational Processes; d) Information Needs of the Organization; e) Legal Considerations; f) Personnel; and g) Supporting Infrastructure. The procedure and planning elements will continue to evolve as part of an on-going study for the development of an Owner's Guide to BIM which will document a detailed planning procedure for capital facility owners. The procedure and element list will be further evaluated through detailed case studies with at least four large owner organizations.

Keywords: Building Information Modeling (BIM), Execution Planning, Organizations, Operations, Owner.

1. INTRODUCTION

Building Information Modeling (BIM) enables owners and project participants to more effectively manage the information generated on a facility project. BIM has helped improve the processes associated with planning, design, and construction of facilities, through better-managed design reviews, coordination of facility elements, improved site planning, and other tasks. Based on the success related to project implementation, some owners and facility managers are now shifting their attention to investigating methods to effectively extend BIM into their management and operation of the constructed facilities.(Jordani 2010)

Case studies, implemented as part of the development and assessment of the BIM Project Execution Planning Guide (Computer Integrated Construction Research Program 2010), identified essential considerations for successful implementation of BIM on projects and within organizations. Some of these concepts include the need for a BIM champion; owner involvement through the entire planning process; increased project team collaboration; and early planning of the processes to name a few. The BIM Project Execution Planning Guide focuses on a high-level concept of 'begin with the end in mind', which requires the owner to understand the ultimate use of the information and data after the construction of the project is complete. The case studies, however, illustrated a consistent trend that few owners had planned their end goals for implementing BIM within their organizations.

Owner organizations have the most to gain with increased building project and facility operational efficiency. According to a NIST study (Gallaher et al. 2004) owners incur approximately \$10.6 billion of the total inadequate interoperability costs of U.S. capital facility projects (\$15.8 billion in 2002). It is vital that information developed in the design and construction phases is transferred into operations to maximize the advantage to the owners. Through initial research, it has been determined that few owners have identified and defined their actual needs and information to be leveraged in their management systems. To increase operational efficiency, an organization must first evaluate the operational systems inside their organization, determine how BIM can add value to their day-to-day activities, and define how the organization can transition to improved processes. To address these planning tasks, two planning items have been developed:

- 1) Owner's Planning Procedure for BIM, and
- 2) BIM Planning Elements for Organizations.

These provide a foundation toward a structured planning methodology for owners to create a BIM Execution Plan for their organization.

2. OVERVIEW OF OWNER'S PLANNING PROCEDURE FOR BIM AND BIM PLANNING ELEMENTS FOR ORGANIZATIONS

The owner's planning procedure includes three primary steps: 1) conducting an organizational BIM assessment, 2) establishing a BIM approach, and 3) developing a transition plan. Before an owner organization begins the planning procedure they should ensure that all the prerequisites of a BIM champion, a BIM planning committee and management buy-in is obtained. After the completion of the planning process, the organization should document its approach into an organizational BIM execution plan or BIM Roadmap. Figure 1 diagrams the three primary steps of the Owner's Planning Procedure.

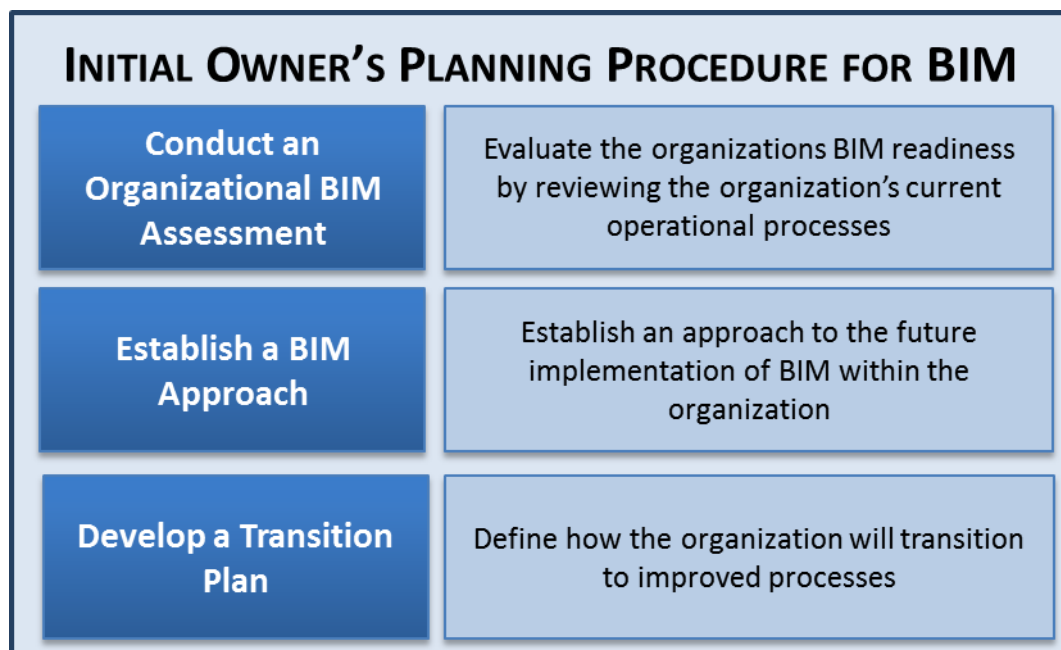


Figure 1: The three primary steps of the Owner's Planning Procedure

A series of categories were identified as elements that must be considered when planning the integration of BIM within an organization. The BIM Planning Elements for Organizations include mission and goals; BIM Uses; processes; information needs; legal; infrastructure; and personal. The categories were identified through working sessions, focus group meetings and detailed content analysis of BIM literature (Eastman et al. 2008, State Architect's Office 2010, Brucker et al. 2006, USACE/Industry BIM Advisory Committee 2011, AIA 2008, Autodesk 2008, US General Services Administration 2006, Dept. of Veterans Affairs 2010, CURT 2010, University Architects Office 2009, Fallon and Palmer 2006). Figure 2 diagrams the BIM Planning Elements for Organizations.

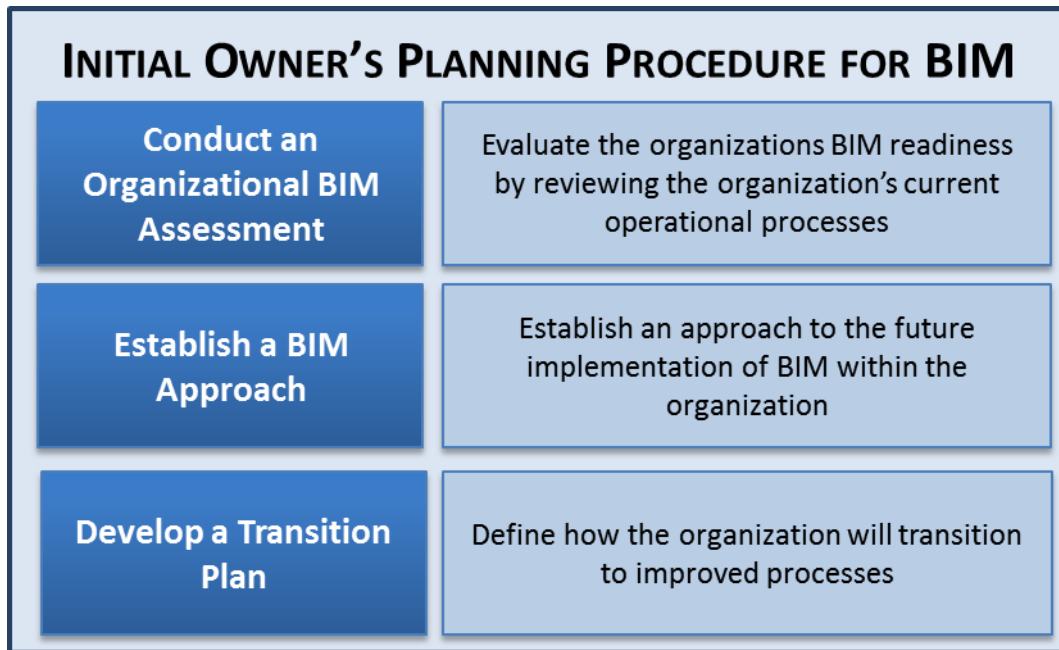


Figure 2: The BIM Planning Elements for Organizations

3. METHODOLOGY USED TO CREATE PLANNING PROCEDURE AND ELEMENTS

The creation of an Owner's Planning Procedure for BIM along with the identification of the BIM Planning Elements is part of a larger research project to develop a BIM guide for owner organizations. The goal of the guide is to provide a structured procedure for owner organizations to develop a strategy for integrating BIM use throughout their organization. The guide will focus on at a minimum: defining standard BIM Process and Practices; designing information integration strategies, and identifying contract requirements. At the conclusion of the research project, the research team will have created an owner's guide to implementing BIM, organizational BIM planning templates, and documented organizational case studies with lessons learned.

A number of methodologies are being used to complete the objectives of the research project. The research team is currently collecting information about the current state of the industry's owner BIM implementation. This is being completed through content analysis of BIM literature, industry interviews, and organizational case studies. The initial planning procedure was generated using a focus group meeting and further developed through a workshop with industry experts. Moreover the initial planning elements were developed through content analysis of leading BIM literature and focus group meetings.

The procedure and planning elements will be further developed through organizational case studies that document the BIM planning process for each of these large organizations. After the organizational case studies are concluded, the initial planning elements and procedure will be finalized through industry interviews and focus group meetings. A draft version of the procedure and guide will then be released for public review and comment. The procedure validation will be achieved through implementation within owner organizations along with surveys, focus groups, and industry feedback. Based on the validation, the procedure will be adjusted as necessary. Throughout the course of the project, the efforts of the research project team will be reviewed by an advisory board of industry experts. Figure 3 diagrams the research methodology being used to conduct the Owner's Guide to BIM Research Project. The remaining portions of this paper focus on the interim results of that research project.

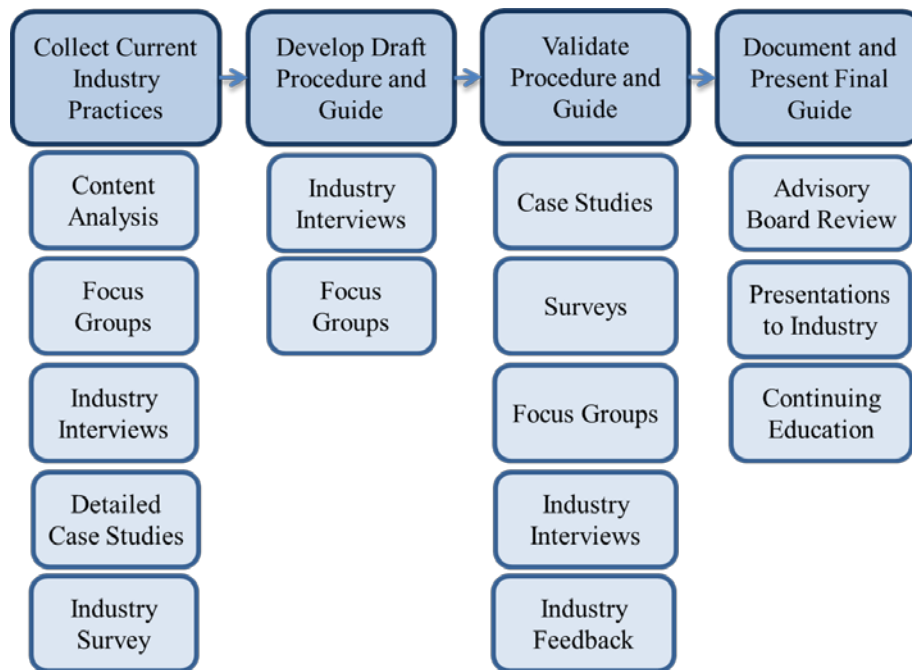


Figure 3: Research Methodology of the Owners Guide to BIM Research Project

4. PREREQUISITES TO ORGANIZATIONAL BIM PLANNING

To successfully plan for BIM execution within an owner organization, a three step planning procedure has been developed which includes:

- 1) Evaluate the organizations current processes,
- 2) Determine the desired future level of BIM implementation within the organization, and
- 3) Design a method to integrate BIM within the organization's operations.

However, before an owner organization begins a detailed planning procedure, the organization should perform the following prerequisite tasks:

- **Identify the BIM Champion(s)** – An organization should have at least one BIM Champion with a strong desire to implement BIM within the organization. A "BIM Champion" is an industry leader who is technically skilled and motivated to guide an organization help improve their processes by pushing adoption, managing resistance to change and ensuring implementation of Building Information Modeling. It is their responsibility to take the planning process through to its conclusion and share its value with others to ensure that the proper amount of resources (time, personnel, and effort) are given to planning.
- **Organize a BIM Planning Committee (or BIM Leadership Team)** – To properly plan for organizational BIM implementation, a cross-functional leadership team or committee needs to be established (Computer Integrated Construction Research Program 2011). The committee should include at least one member from each operating unit of the organization. Committee members should be willing to learn and think outside of traditional methods of operation. Additionally, while the committee members do not have to be the most senior members of the operating unit, they will have to speak for the needs of the entire unit and share the thoughts of the BIM Planning Committee with their operating unit.
- **Gain Management Buy-In** – It is essential to have management bought-in to the concept of using BIM to improve operations to ensure a successful planning process. Management must understand the resources necessary for successful implementation including time, personnel, and effort to properly plan owner organizational BIM adoption and ensure that these resources are made available. Establishing a BIM Sponsor within the management team is often helpful toward this end.

Once the organizational prerequisites are accomplished, the BIM Planning Committee should establish the BIM planning process goals and develop a schedule for the planning process.

5. CONDUCTING AN ORGANIZATIONAL BIM ASSESSMENT

The first step in the Owner's Planning Procedure for BIM is to evaluate the organization's status and the current operational processes. The goal of this step is to determine the need for information integration and locate inefficiencies within the organization. By evaluating the organization, the planning committee can determine high value areas that will be most affected by BIM implementation.

The BIM Planning Committee should evaluate their organization on each of these categories:

- **Mission and Goals** - Evaluate the organization's mission and goals to understand if and how BIM implementation supports the organization's overall mission.
- **BIM Uses** – Evaluate and document how the organization currently uses BIM. This should include both project level and organizational level uses of BIM.
- **Processes** – There are multiple levels of the process of an organization that should be considered during the evaluation phase. Evaluate the organizational process at a high level and how each individual business process is completed. Moreover consider how current building projects are completed at both a high level and detailed level. These processes should be mapped using Business Process Mapping Notation so that they are easily understood by the planning committee and the organization as a whole.
- **Information Needs** – Document the facility information that is captured, stored, and reused within each operating unit of the organization. The documentation should include level of detail, data structure, data quality, security, and format.
- **Legal Considerations** – Evaluate current project contract language related to BIM along with any delivery method implications related to BIM.
- **Personnel** – For employees who are working on tasks related to BIM, document their current roles and responsibilities, staff allocation, level of BIM training, and organizational hierarchy.
- **Infrastructure** – Take an inventory of the organization's infrastructure assets related to BIM implementation. This could include computer software, hardware, and physical spaces that may be used as collaborative environments.

This evaluation will require the participation of each of the members of BIM Planning Team. It will also require the planning team to interview a number of personnel from each of the organization's operating units.

6. ESTABLISHING AN APPROACH TO FUTURE IMPLEMENTATION OF BIM

After the planning committee has successfully evaluated and documented the organization's current level of implementation, the committee should develop a clear vision for the desired future level of BIM implementation. The goal of this step is to establish the ideal state of the organizational implementation. The planning committee should revisit each of the planning elements to accomplish this task; however, the goal will be to identify the future desired state for each planning element.

The planning team will need to determine the organization's approach to the following:

- **Mission and Goals** – The organization should define a mission for BIM integration that coordinates with overall mission and goals of the organization. The goals for BIM implementation based upon the evaluation of the organization must be developed and documented.
- **BIM Uses** – Based on the goals established and the evaluation of current BIM Uses, determine which additional BIM Uses may be beneficial to implement within the organization. This may include specific use cases such as receiving a final design model to allow for future renovation design, transferring data from a construction model to a facility management software application, or using the facility data to populate other data management systems

within the owner organization. Also note that it may be deemed that certain applications of BIM are no longer appropriate for the organization.

- **Processes** – Since the various new applications of BIM have been established, determine how those uses will integrate within the organizational and project processes. This will require establishing process maps from both a project and organizational perspective. For example, if an owner decides to require a BIM record model submission for specific elements of information from the model, then it would be important to evaluate the record submission requirements and standard process to ensure that unwanted duplication of tasks or submissions is not occurring. Each business process that will include the use of BIM should be mapped.
- **Information Needs** – Based on the evaluation of information needs and the newly established BIM Uses and processes, an organization can determine what information is necessary to support the various operating units. To the extent possible, the information should be documented using a standard data structures to allow for interoperability of data across systems. Additionally, the various sources of the information should be determined. The information may come from within the organization or from external organizations, particularly for project related information. In the case of a project, the format of each exchange including the data type, structure, standards, quality, security, level of detail should be determined and documented.
- **Legal Considerations** – New contract language should be created that incorporates the information needs of the organization as well as BIM Use requirements. Moreover, the contract language should include a requirement from the contractor for a BIM project execution plan in which the contractor demonstrates how they will meet the information needs of the owner. Another consideration is the possibility of adopting more integrated delivery methods for projects that better support the needs of the organization and the BIM process.
- **Personnel** – Based on the evaluation of the organization’s personnel roles and responsibilities, determine if any new BIM roles need to be added. It may also be possible to simply add the additional responsibilities to current roles. In such a case, additional training may be necessary to ensure that the personnel have the skills necessary to successfully implement BIM. It may be necessary to create organizational manuals and instructional documents to help facilitate that training and ensure that all personnel are held to the same standard. Additionally it may be necessary to modify or adopt a new organizational hierarchy to allow for an effective use of BIM within the organization. This structure should be designed to increase the collaboration between operating units and to increase the overall productivity of the organization.
- **Infrastructure** – The organization will need to determine what additional infrastructure is required to support BIM. Additionally, it may be necessary to reallocate physical space, reorganize workstations, or create new collaborations spaces based on the new roles and responsibilities and organizational hierarchy that has been designed.

To determine the approach to BIM, the planning team should work together to determine what is best for the organization as a whole. This may require some operating units to take on additional responsibilities. After the approach has been determined by the Planning Committee, it should be reviewed by the management team and each operating unit to determine if any major changes are necessary.

7. DEVELOPING A BIM TRANSITION PLAN

After the planning committee has established a direction and approach as to how the organization will use BIM, the planning committee should design a method for the organization to transition to BIM enabled operations. It is not enough for an organization to simply require the use of BIM, but rather it should develop a deployment plan on how exactly to integrate BIM into the daily operations of the organization. The organization must also develop a clear transition plan which defines the strategy for transitioning from the current status to the desired goal state. To develop this transition plan, the planning committee should revisit the planning elements with a specific view to create a prioritized action plan for each element with clearly defined timelines. The timelines for each planning element

may be dependent upon other categories. For example, the implementation of BIM within certain process may be dependent upon personnel plans such as training or hiring additional staff.

Aspects that should be considered during the assessment of each planning elements are:

- **Mission and Goals** – After the BIM mission and goals are established, metrics and milestones should be established to set clear targets for achieving the goal. The goals should be modified if they are unable to be tracked using metrics. A timeline for when the goals need to be accomplished should also be set. This timeline should be no more than 3-5 years or the goals may be too far reaching.
- **BIM Uses** – After the BIM Uses have been determined, the planning team should determine a priority for the Uses and clearly define timelines for implementation.
- **Processes** – Along with determining a priority for each BIM Use, a clear process for integrating the BIM Uses into the standard practices of the organization should be developed. In other words, how will the organization transition from its current business processes to BIM enabled processes? The process of integrating and developing each new BIM Use within the organization should be documented, and this may be a multi-phases approach. For example, if the owner plans to implement BIM for estimating lifecycle costs, they may initially perform a series of experimental case studies using multiple validation approaches, and then transition to a new process once the appropriate workflows and validation of the process have been achieved.
- **Information Needs** – It is important to define a strategy to obtain the necessary information. Additionally, the planning committee should develop a strategy on how the organization will manage the information that they collect. This will also need to include methods to ensure the accuracy and quality of both the internal information and the information received from projects.
- **Legal** – Once defining the contract strategies that are desirable, it is necessary to develop a specific plan for transitioning from the current standard contracts to the desired contracting approaches. This could include a series of contract revisions. It may be desirable to start with some initial subset of the final desirable BIM requirements for initial projects. Alternatively, the organization may decide to make a sudden shift in requirements depending upon the expertise of the project team members and internal staff. This decision depends largely on the organization's needs from BIM and the size of the organization.
- **Infrastructure** – After defining the desired state of the infrastructure to support BIM, it becomes necessary to create a detailed implementation plan for developing and procuring the resources. Decisions regarding the acquisition of the software, hardware, network capacity, and space will need to be made.
- **Personnel** – If it was determined that new personnel are necessary, determine how and when to hire them. However, more importantly, if it was determined that new responsibilities and a new organizational hierarchy are required to successfully implement BIM, a method to transition to the appropriate organization roles and responsibility is necessary. The best method will depend on the structure of the organization and the extent to which that structure will be altered.

The planning team should consider the use of pilot projects and test cases for each of the major changes within the organization. This will allow for testing of the proposed changes to the organization before the widespread adoption. The Planning Team should then evaluate the successes and failures of test projects and adjust their plans accordingly. The piloting process can also be done on a smaller scale for each of the elements or even a part of the element to ensure that each element has been thoroughly thought through by the planning committee. Moreover, in planning the transition process it is vital that the planning committee establish milestones for the organization to meet during the transition period. This will give the organization a clear goal to reach.

8. DOCUMENTING THE PLAN

At the conclusion of the planning process, a roadmap document or Organizational BIM Execution Plan should be created to share the plan throughout the organization. It is important that the plan be made available to the employees throughout the organization and that it clearly defines the reasons behind a transition to BIM. The document should also include the status of the organization, the end goals and approach the organization will take to BIM, and how they will transition to BIM enabled operations. To gain a broad participation, additional insights and suggestions can be obtained from circulating an initial draft of the document prior to finalizing the plan.

The roadmap should include all the necessary elements from the planning process along with several others. The sections that should be contained in the roadmap are:

- **The Mission and Goals of the Organizational BIM Execution Plan** – This section outlines the reasons for the creation of the Organization BIM Execution Plan. It should include goals of the planning process, a brief description of the process that was used to create the documents and members of the organization involved in the Execution Plan creation.
- **BIM Adoption Justification** – This section conveys the reason the organization is transitioning to BIM enabled operations and how the organization will benefit from that transition. It can also be used to overcome initial resistance to the BIM process, if deemed necessary.
- **Organizational Evaluation Summary:** This section should include all the major findings from the evaluation steps in the planning process. This includes current implementation of BIM, and current business processes. It should also document the current deficiencies within the organization.
- **Organizational Approach to BIM:** This section will convey how the organization will address each of the major elements necessary considered when planning for organizational implementation and adoption of BIM.
- **The Organizations Transition to BIM** – This section will include how the organization will transition to BIM enabled operations and how it will achieve the goals and targets established in the organization's approach to BIM. It should include a timeline of milestones for BIM adoption.
- **Summary and Conclusions** – This section summarizes the document through reiteration of the major reasons for BIM adoption, the major milestones and major changes brought forth through BIM adoption.
- **Additional Resources** – This section will provide the location for additional resources of value to the employees.

9. CONCLUSIONS AND FUTURE WORK

This paper outlines the initial results focused on the development of a planning procedure for owners to plan the adoption of BIM within their organizations. The two items defined in the paper include the development of an Owner's Planning Procedure for Building Information Modeling (BIM) along with the documentation of the Organizational BIM Planning Elements. The three-step planning procedure is designed to assist an owner when evaluating their status, designing their organizational approach and developing a transition strategy to the organization's end goals. Additionally, the planning committee must analyze each planning element identified during each step in detail to effectively plan the adoption and implementation of BIM. Ideally, for an organization to implement their respective ideas, the BIM uses and processes should be reviewed through pilot projects and test cases documenting their process into a roadmap for the organization wide adoption and implementation of BIM.

The research team will continue to develop and validate the core principles embedded into the Owner's Planning Procedure for BIM. This will be accomplished through performing four detailed case studies of large owner organizations by using the draft planning procedure. The lessons gained from these case studies will be clearly documented with a focus toward validating the process, and

assessing the appropriate planning elements. Detailed description of each of the planning elements will also be developed through the course of the research project. This will ultimately provide a clear process, along with template planning resources for owner organizations who wish to develop a detailed execution plan within their organization. The results will be documented through the development of an Owner's Guide to BIM.

ACKNOWLEDGMENTS

The authors of this paper would like to acknowledge the contributions of the sponsors, the research team, and the advisory board members. The project is sponsored by The Charles Pankow Foundation, The US Department of Defense Military Health System, Kaiser Permanente, US Department of Veterans Affairs, The Penn State Office of Physical Plant, and The Partnership for Achieving Construction Excellence (PACE). We also wish to thank additional research team members including Chimay Anumba, Robert Leicht, and Eric Nulton along with our advisory board members.

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