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Integrated Technology Solutions: Driving the AEC Revolution

Introduction

The Architecture, Engineering and Construction (AEC) industry remains fragmented prohibiting efficient collaboration essential for profitable delivery of projects and programs. This white paper will discuss how organizations can enhance collaboration and effective project management through

- Scalability of AEC technology across all projects and programs
- Interoperability of technology and eliminating silos of data to make effective business decisions

AEC firms need to evaluate their technology strategies along with their processes and personnel to ensure they have appropriate systems in place to best serve their organizational needs.

Fighting Fragmentation

Capital asset delivery projects and programs of all sizes and types continue to suffer from low productivity and high failure rates. The architecture, engineering, and construction (AEC) industry remains fragmented, and even with preferred vendor programs, each project features a new blend of players. This fragmentation hinders development of standardized processes for an integrated capital asset supply chain based on effective and efficient collaboration. Project risk avoidance, rather than maximizing the lifecycle value of a capital asset, remains the paradigm for the majority of the AEC industry. Many industry players adopt a “hunker down” approach — especially during a downturn — that further reduces efficiency and productivity on project delivery, and takes the focus off enhancing capital asset value.

In a 2009 report, “Advancing the Competitiveness and Efficiency of the U.S. Construction Industry,” the National Research Council of the National Academies (NRC) identified five interrelated activities for capital facilities and infrastructure that will help achieve the following:

- overcome fragmentation by requiring greater collaboration up front among project stakeholders
- lead to more efficient use and better integration of people, processes, materials, and equipment through all phases of a construction project
- create more useful and accurate information for development of performance measures that can facilitate innovation in technologies and materials and improvement in products and processes.

The first activity the NRC recommends is “widespread deployment and use of interoperable technology applications.” Among numerous other identified benefits, interoperable technologies can help “through more collaborative processes and an emphasis on planning up front ... improve the quality and speed of project-related decision making; integrate processes, supply chains, and work flow sequencing; improve data accuracy and reduce the time spent on data entry; and reduce design and engineering conflicts and the subsequent need for rework.”

A small but growing community of owners, contractors, and engineering/design firms have already adopted this principle and together have begun integrating project stakeholders, project processes, and project technology to improve project productivity and long-term capital asset value. These organizations are leading the charge in highly collaborative delivery methodologies such as Integrated Project Delivery and efficiency-maximizing Lean construction. And they are leading the way in adopting AEC-specific and highly collaborative technology solutions for Virtual Design and Construction and Integrated Program Management.

To eliminate silos of people, process, and information, these organizations focus on collaboration, standardization, and integration, and trade an antagonistic project delivery model of risk shedding for a collaborative project delivery model driven by project success metrics. A holistic application technology strategy plays a critical role in this, as technology should break down the silos of information and data, enable effective collaboration, provide specific AEC functionality across the full project lifecycle, and provide scalability from the project level to the enterprise level. Leading

technology vendors embrace this approach and base their solution strategies on completeness of AEC functionality, scalability, and interoperability.

Complete AEC solution

A key to successful project delivery is the earliest possible collaboration across stakeholders during project delivery. This requires that project stakeholders share information from their respective areas of expertise as completely and as early as possible. An AEC firm's technology strategy must therefore take into account not only that firm's specific functional requirements, but also the requirements of the entire project delivery lifecycle. The complete AEC solution environment extends across all aspects of the capital delivery lifecycle, including funding and budgeting, design, estimating and scheduling, resource management, construction management, procurement, and accounting. An AEC firm's technology strategy must take into account this complete solution environment, even in those instances where that firm's use of a particular technology is minimal.

Also, to maximize project productivity and capital asset value, it is important to clearly understand the potential impacts of project decisions before taking them. The key to achieving this is through early and continuous information sharing during pre-construction and construction, application-driven analysis of project forecasts, and continuous monitoring of project- and facility-performance metrics. It is therefore important to understand clearly which data from differing functional areas reside in which systems. Based on this understanding, firms should then identify which systems contribute to the collaboration requirements within and across organizations, and which integration approaches can best serve the needs of the project team as a whole.

Scalability

Full project collaboration requires getting the right information to the right people at the right time. In addition to considering the complete AEC solution environment, the scalability of AEC technology becomes critical. Deploying new technology and collaboration systems for each project simply does not scale, and it quickly becomes a costly and administrative headache.

Therefore, an organization's technology strategy should aim to pursue scalable systems that can:

- grow from a project level to an enterprise level within the organization;
- readily integrate with the systems of a diverse array of outside stakeholders; and
- maintain cross-project and stakeholder data integrity and security.

Technologies that can scale across projects and organizations provide a means to greater transparency and efficiency. They also form the foundation for effective collaboration across stakeholders through data and access security and easier system administration.

Interoperability

Interoperability of application technology is key to supporting enhanced collaboration and productivity and eliminating the costs of double data entry and data errors. Ready interoperability between key AEC technologies provides for greater accuracy of information, streamlined internal processes, elimination of rework, and also a lower total cost of technology ownership for each firm.

To achieve interoperability, AEC technology strategies must look beyond file compatibility and import/export mechanisms. This approach is functionally limited, saps valuable time and resources, and does not meet the needs of highly collaborative projects. While document and file management and control will remain a key component of project delivery technology, interoperability shifts the focus toward data integration strategies to cut out import/export and file management steps.

Many AEC technology solutions today offer Application Programming Interfaces (API) that enable custom data integrations to and from other systems. While API-built integrations are dynamic in data exchange, they are very specific to the systems involved, and do not readily extend to systems beyond any one organization's setup. As such, the cross organizational requirements of collaborative projects cannot readily be met by APIs alone.

Web services, or Web APIs, do provide a measure of flexibility by enabling integrations and access to remote systems — for instance, two Web-based applications hosted on disparate networks. However, as with API-driven integrations, Web-services-based integrations are also highly specific, and each project, or each new project team, faces the integration setup challenge anew.

Leading AEC technology vendors now offer out-of-the-box integrations between AEC solutions, including integrations to and from other vendors' solutions. The benefits of out-of-the-box integrations are ease-of-use and implementation, greater applicability across project stakeholders, speed of implementation for new projects/systems, and a lower total cost of ownership, since the vendor maintains the integration rather than the user. The limitation of out-of-the-box integration is the scope of solutions a given vendor considers and for which it develops out-of-the-box integrations.

A current industry movement with great promise is standards-based interoperability. Several organizations — such as FIATECH (www.fiatech.org) and the National Institute of Building Sciences' buildingSMART alliance (www.buildingsmartalliance.org) — are working in close collaboration with AEC firms, owners, and technology vendors to develop and publish standards for interoperability specific to the capital asset lifecycle, including all facets of capital asset project delivery. Interoperability standards will provide a single means for any application to share and integrate relevant data across project phases and disciplines. As these standards are published and updated, continued standards support from leading technology vendors will drastically increase interoperability options.

Conclusion

AEC firms need to evaluate their technology strategies hand-in-hand with their processes and personnel across their enterprise. Technology strategies must include dimensions for scalability and interoperability; they can no longer be limited to specific project domain functionality — consider prior and subsequent project phases as well. A technology solution's ability to provide project-phase specific functionality, enterprise scalability, as well as complete project lifecycle interoperability and collaboration, should increasingly drive implementation decisions.



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Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
U.S.A.

Worldwide Inquiries:
Phone: : +1.800.423.0245
oracle.com/primavera



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