

Gaining Competitive Advantage by Using Digital Prototyping to Support Building Information Modeling

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Summary

Building information modeling (BIM), the process of using digital modeling software to more effectively design, construct, and manage building projects, is rapidly becoming the global standard in the architectural, engineering, and construction (AEC) industry. As part of compiling a BIM database, architectural firms often require building product manufacturers to deliver data about their products—including HVAC, lighting, plumbing, doors/windows, and furniture systems—in Autodesk® Revit® file format. Today's manufacturers leverage mechanical CAD tools to assist in the design, simulation, and visualization of product offerings, investing time and effort in creating 3D models to aid in the manufacturing process. The Autodesk solutions for Digital Prototyping and BIM can help provide building product manufacturers a competitive advantage. By using a Digital Prototyping solution, building product companies can bring together design data from all phases of the product development process to create a single digital model, which can be seamlessly integrated into BIM. This integrated workflow enables the manufacturer to communicate and collaborate more effectively with their customers, and improve productivity, predictability, and control throughout the life of the project. By providing the right information to the AEC communities to inform the BIM process, the manufacturer can increase opportunities to secure new business.

Overview

The Need for Better Integration of Building Product Manufacturing in BIM

Current trends in the building product manufacturing segment—including HVAC, lighting, plumbing, doors/windows, and furniture systems—require building product manufacturers to deliver very specific content to the AEC community. The process that drives the need for this type of content is known as building information modeling (BIM) and is rapidly becoming the standard around the globe. This presents a significant challenge (but also new opportunities) for all building product manufacturers, and drives an immediate need for companies to develop strategies and workflows for delivery of BIM-ready content for use by customers and distribution channels.

As the design and construction industry continues to adopt BIM to realize increased productivity and collaboration goals, the building design process is requiring coordinated, reliable, and detailed information, from design through construction and into operations. As a result, building product manufacturers who can support this process are increasingly gaining a competitive advantage and becoming trusted partners by providing manufacturer-specific content to inform the BIM process.

Autodesk's solutions for Digital Prototyping and BIM can help the various disciplines involved communicate and interpret design intent required to design, build, and operate a successful project. Through Digital Prototyping and BIM, project teams can better simulate performance and constructability of a project digitally before it's built to deliver projects faster, with fewer errors and coordination issues, and at less cost.

Market research shows that the future of building design and construction will increasingly rely on BIM. The adoption of BIM has grown by 75% in that last two years, with over 50% of professional service firms using BIM as the foundation for their projects.¹ Both private and government agencies are increasingly adopting and requiring BIM for usage in building projects.²

As a result, manufacturers today are being asked to support their customers' design processes more closely than ever. Coupled with the application of BIM to manage and support increasingly complex building designs and performance goals, the demand for information and content that will support the needs of the architects, engineers, and other construction professionals associated with a given project is growing dramatically. By effectively supporting the needs of the customer, the manufacturer increases its chances of securing new business, developing long-term customer relationships, and differentiating itself from the competition.

A combination of Digital Prototyping and BIM approaches can address the key issues facing manufacturers today:

- Win new business by gaining an advantage in winning project bids
- Improve collaboration with architects, engineers, and construction professionals by providing them with the specialized information to maximize effectiveness and efficiency
- Increase performance and respond to cost pressures by optimizing product performance and improving productivity throughout product development processes
- Meet the sustainability goals required by today's building owners

¹ McGraw-Hill Construction, "SmartMarket Report: The Business Value of BIM," 2009.

² U.S. General Services Administration, 3D-4D Building Information Modeling, http://www.gsa.gov/Portal/gsa/ep/contentView.do?contentType=GSA_OVERVIEW&contentId=20917.

State of Wisconsin - Department of Administration, Division of State Facilities BIM Guidelines & Standards, http://www.doa.state.wi.us/dsf/masterspec_view_new.asp?catid=61&locid=4.

Texas Facilities Commission, Texas Adopts Building Information Modeling (BIM) capability for State Design and Construction Projects, <http://www.tfc.state.tx.us/newsevents/texas-adopts-building-information-modeling-bim-capability>.

Digital Prototyping in Building Product Manufacturing

What Is Digital Prototyping?

The Autodesk solution for Digital Prototyping brings together design data from all phases of the product development process into a single digital model created in Autodesk® Inventor® software. Inventor software allows engineers to integrate AutoCAD® drawings and 3D data into a single digital model creating a virtual representation of the final product. Using the single digital model, one can design, visualize, and simulate the product digitally, minimizing the need for physical prototypes.

Design - Integrate all your design data into a single digital model, streamlining the design process and increasing communication

Visualize - Create a virtual representation of the final product to review design intent, secure early customer validation, and market your products before they're built

Simulate - Digitally simulate the real-world performance of your product saving you the time and money required to build multiple physical prototypes

A key benefit of Digital Prototyping is the ability to reuse the 3D design data to provide output in many different formats, including specifications, drawings, and visualizations or renderings. Digital Prototyping allows a manufacturer to create an accurate digital representation of the product being designed by the multiple stakeholders that bring a product from conception to reality. This digital model can be used to inform a variety of processes, eliminating wasted effort from the recreation of data to providing cost savings.

What Is BIM?

BIM is an integrated process built on coordinated, reliable information about a project from design through construction and into operations. By adopting BIM, architects, engineers, contractors, and owners can easily create coordinated, digital design information and documentation; use that information to accurately visualize, simulate, and analyze performance, appearance, and cost; and reliably deliver the project faster, more economically, and with reduced environmental impact.

Why DP and BIM?

Today, information exchanged between manufacturing and BIM processes is remodeled or redrawn at an astonishing rate. Beyond the impact of both time and budget is the loss of knowledge captured in the original model leading to an inability to capture and clearly communicate design intent. In addition, the product and building models are rarely combined digitally in order to identify and resolve constructability and performance issues between trades before the building has begun construction. To compound the issue, manufacturers need to provide a variety of content to AEC customers that consist of specifications, drawings, and visualization renderings, depending on the type of customer and the stage of the building project. The need to recreate content to support an increasing number of formats presents a scalability issue for manufacturers.

The rapid adoption of BIM in the AEC space is influencing manufacturers to collaborate in the BIM process by providing "BIM-ready" product information. These requests may come under the terms "BIM objects," "Revit files," or "BIM files." The information consists of product design in accurate 3D geometry, intelligent connectors, and product and performance data. This information is then incorporated into the building design itself to be used by the AEC customers to visualize, simulate, and analyze the building.

Collaborating in the BIM process is becoming a key business issue for many manufacturers, which not only drives the need for closer interactions with their AEC customers but also provides a great opportunity for these manufacturers to win new business.

While both BIM and Digital Prototyping share similarities, the tools used to create these information-rich models enable users to inform models with purpose-built tools designed for the tasks at hand.

Autodesk's purpose-built BIM tool is Autodesk® Revit®. A recent survey of AEC professionals indicates that two of the widely recognized BIM software tools are Autodesk® Revit® and Autodesk® Navisworks®.³ Autodesk Inventor gives manufacturers the ability design, visualize, and simulate products digitally and deliver models of its products to architects who use Autodesk Revit software. Coupled with the fact that Autodesk® Navisworks® can read and aggregate models create with Autodesk Inventor, manufacturers that choose Inventor have the ability to communicate more effectively with their BIM-enabled customers.

³ McGraw Hill Construction, "SmartMarket Report: Building Information Modeling (BIM) - Transforming Design and Construction to Achieve Greater Industry Productivity," 2008.

BIM Workflows

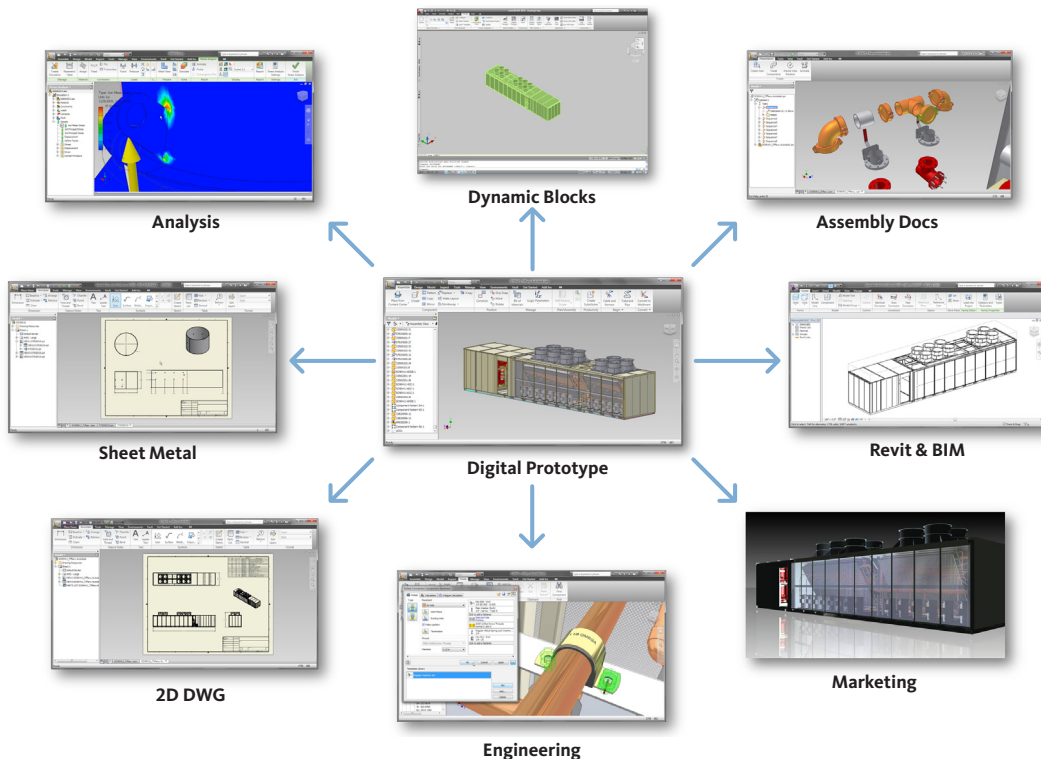
The diagram below provides an overview of the major stages in a commercial building project. Manufacturers can provide valuable information to design and construction teams during both the initial stages of design development and the bid and shop drawing and installation that occur during the construction process. By providing manufacturer-specific information early in the design cycle, architects and engineers benefit from accurate and dependable representations of the products and systems that will be implemented in the building. This enhanced representation enables effective design planning and conflict resolution prior to construction, reducing the risks associated with an uncoordinated design.



Manufacturers benefit as this early involvement often positions them for winning the business of the project. By providing BIM-ready information of their product earlier at the design development stage of the building project, manufacturers gain an advantage in getting specified at an earlier stage of the building project and winning the bid. As project designs are finalized, manufacturers are able to provide detailed models that can be incorporated to validate the design and performance characteristics of the building, which helps reduce costly installation errors.

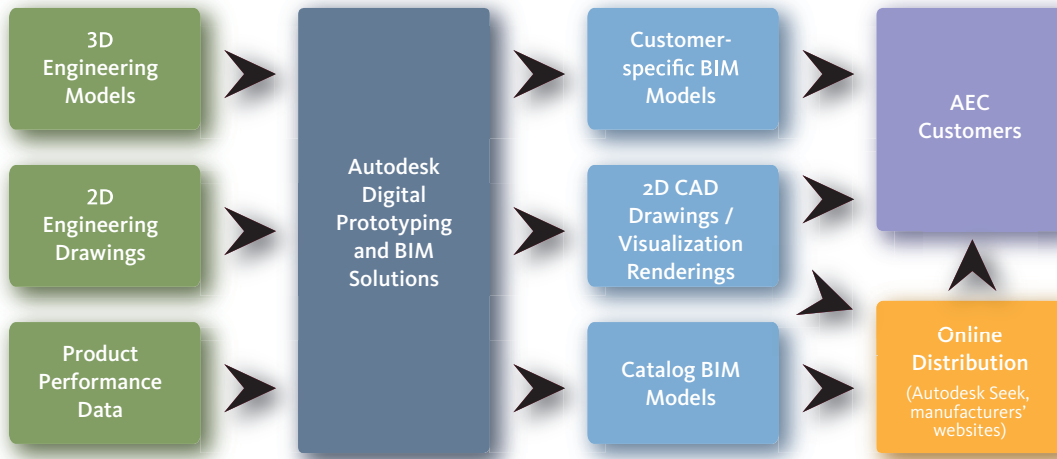
This desire to incorporate manufacturer information into the building information model at various stages of design creates a strong need from the architectural and engineering communities for timely and accurate content. Manufacturers can satisfy these needs by developing a content strategy that will link their product design and manufacturing requirements with the sales and marketing objectives of the organization. By looking for solutions that will tie these needs together, the manufacturer can leverage the time and effort that is used for development of products to satisfy customers' content and information requests. Autodesk is able to assist its manufacturing customers in building a comprehensive pipeline to deliver information derived from manufacturing models through service networks directly to architects, engineers, and builders.

The illustration below is a simple example of how a digital prototype can support a variety of processes and needs. What is relevant and important to the architect is different than the details required by the manufacturer for the same building component. The different details, however, need to be coordinated within a consistent process.



The Autodesk Digital Prototyping-to-BIM Workflow

The diagram below provides an overview of Autodesk's approach to using the Digital Prototyping process to leverage existing CAD designs to create BIM-ready files for AEC customers.



The Autodesk Digital Prototyping-to-BIM workflow is composed of three main phases: 1) input, 2) processing, and 3) output.

Input

Existing product information consisting of 3D CAD models, 2D drawings, and product performance data from multiple sources are collected and stored through the Autodesk Digital Prototyping solution.

Processing

The information is leveraged and reused to create a variety of deliverables that vary in detail and format, depending on the needs of the AEC customers. This is achieved through a combination of tools and services.

Autodesk Inventor enables a manufacturer to simplify a manufacturing model; remove intellectual property and sensitive information; add additional data that is beneficial to the BIM process, such as metadata and connector specifications; and publish this model representation for consumption by the Autodesk Revit family of products, AutoCAD® MEP, and AutoCAD® Architecture products.

The Autodesk solutions also include tools to easily produce a variety of file formats depending on customer needs, for example: 2D DWG™ drawings, DWF™/DXF™ visualizations, and high-quality visualization renderings.

Output

The output consists of drawings, specifications, and visualization renderings, in addition to BIM-ready models. For the latter case, these consist of Revit files that are typically provided to AEC customers through two primary methods:

- Directly to customers as a bid/RFQ response during the bid and shop drawing phases of a building project
- Via an online catalog (for example, Autodesk® Seek) to be used by architects, engineers, and specifiers in the design development phase

The Autodesk workflow encourages the reuse of critical engineering data to enable the provision of content in multiple formats as required by different customers and stakeholders, while eliminating the need to re-create content and the associated incremental cost, time, and inaccuracies from duplicate effort. Furthermore, the workflow contains a standard of best practices that will guarantee only the highest quality of content, and provides a new level of automation that further simplifies the dealer's ability to configure. By offering better, more reliable content faster than its competitors, Autodesk's workflow provides manufacturers with a competitive advantage.

By helping manufacturers to author, validate, and market BIM-ready content throughout workflows with an optimal mix of software, user processes, and services, the Autodesk tools facilitate improved collaboration and communication between manufacturers and their customers. Some of the tools and services available to manufacturers include:

- Autodesk Inventor: Autodesk's Digital Prototyping software for product and equipment design. Tools within Inventor provide manufacturers with the ability to leverage digital prototypes of real product designs to create simplified models, intelligent connectors, and product metadata that can be directly read by Autodesk Revit-based products, AutoCAD Architecture, and AutoCAD MEP products. Digital prototypes can also be leveraged for marketing collateral creation, documentation, assembly and installation instructions, and simulation and analysis, all while providing the basis to support manufacturing processes.
- Autodesk Seek: Autodesk's online marketing source that allows building product manufacturers to reach their target audience—architects, engineers, and builders—while they work inside their Revit and AutoCAD applications. Autodesk Seek gives manufacturers the opportunity to showcase and differentiate their products beyond the simple listing pages found in directory or catalog services.
- Content Services: Autodesk Seek Content Services, along with a network of third-party service providers, can help manufacturers author BIM-ready product content that adheres to industry-standard and Autodesk-authored guidelines. Manufacturers can be confident that they are producing product content that is consistent and able to be leveraged by the range of Autodesk applications for visualization and specification.
- Autodesk Revit-based products: Leverage Autodesk's core BIM products that can be used to create BIM-ready models based on Inventor designs and to validate the manufacturer designs in the building context.

Autodesk's technology goal is to ensure that each of our various products are best in class for the task at hand, whether that be modeling, drafting, collaborating, or managing every aspect of a building or product throughout its lifecycle.

Future Trends

Market research shows that the future of building design and construction will increasingly rely on BIM. Coupled with the view from construction professionals that BIM will provide enhanced opportunities to build more effectively, manufacturers need to develop a BIM strategy that will allow them to meet the needs of their customers' processes.

Usage of BIM will further extend into building and facility lifecycle management, providing manufacturers with yet another opportunity to service their customers and differentiate themselves from the competition.

Additional types of information will be required to support BIM processes as enhanced analysis, simulation, and construction methods are enabled by the adoption of BIM and advancements in building analysis tools. Examples include more detailed information embedded in the manufacturer's BIM models that can assist the architect and engineer in making more sustainable design decisions based on the components within the building.

Manufacturers will continue to see a need for collaboration with the BIM process. It is vital that they look for attainable, scalable, and cost-effective solutions that address their needs, as well as the needs of their customers.

As a world leader in digital prototyping and BIM, Autodesk, Inc. is uniquely positioned to provide building product manufacturers with the software tools to leverage digital prototypes for integration into the BIM process. By providing technology to both manufacturing and AEC customers, Autodesk is able to build the bridges that are needed to allow these customers to communicate more effectively. Architects and engineers that make use of manufacturers' content derived from Digital Prototyping for the BIM process will be able to deliver projects more effectively and more economically, with reduced environmental impact and greater confidence, and will continue to transform the building industry. By choosing Autodesk as a partner to fulfill technology needs, both manufacturers and building design and construction professionals are able to leverage both Digital Prototyping and BIM to win new business, collaborate more effectively, and reduce the costs incurred for both product and building design.

For More Information

To learn more about what makes Autodesk a leader in the building products industry, visit www.autodesk.com.

About Autodesk, Inc.

Autodesk is a world leader in 2D and 3D design, engineering, and entertainment software for the manufacturing, building and construction, and media and entertainment markets. Since its introduction of AutoCAD software in 1982, Autodesk continues to develop the broadest portfolio of state-of-the-art software to help customers experience their ideas digitally before they are built. Over 9 million users take advantage of Autodesk software tools to design, visualize, and simulate their ideas to save time and money, enhance quality, and foster innovation for competitive advantage.

With Autodesk's established presence within the manufacturing and AEC industries through purpose-built Digital Prototyping and BIM tools, Autodesk is uniquely positioned to help connect manufacturers to their AEC customers.