

Combining BIM & Production Line Design for Complete Factory Planning



Introduction

Shortened design cycles and more innovative, mass-customized products are putting large manufacturing companies under intense pressure to operate more efficiently while improving product quality and accelerating time to market. As a result, manufacturers must manage an ongoing schedule of projects to build new factories, add new lines to existing facilities, upgrade and retrofit equipment, and improve the building systems in the factory shell.

Manufacturing owners are especially concerned with how quickly these projects can be completed and how closely they adhere to the budget. From the moment the project starts, the clock is ticking. Every project that can be designed and built on time and on budget helps the company achieve its strategic imperatives. Even a small-scale project that fails to stay on track can cause interruptions or delays in production that severely affect the bottom line.

Communication and collaboration among all stakeholders is the cornerstone of efficiency. Projects run best when all teams—from designers to installers to integrators to operations and maintenance (O&M)—share the same source of information and can contribute up-to-date information in a convenient and consistent way. Ensuring this level of coordination with conventional tools and methods is a challenge.

This white paper explores a new approach to production planning: one that leverages industry leading technology and digital collaboration to streamline the flow of information, creates a “single source of truth” for the full project lifecycle, and helps manufacturing owners exert more control over the process—all while driving higher operational efficiency.

Conventional processes outsource control

Manufacturing owners have the biggest stake in the success of any construction project, but often have the least visibility into the process. Current technologies make it difficult to see a “big picture” view of projects in the pipeline from design to operation. Orchestrating collaboration among stakeholders in manufacturing, maintenance, and facilities is time consuming.

As a result, owners often rely on general contractors and engineering, procurement, and construction (EPC) firms to manage all of the information related to design, procurement, construction, commissioning, and handover of any given project. Of course, every project uses different contractors and subcontractors, which makes it hard for owners to transfer knowledge and best practices. In many ways, owners are starting from scratch with every new project.

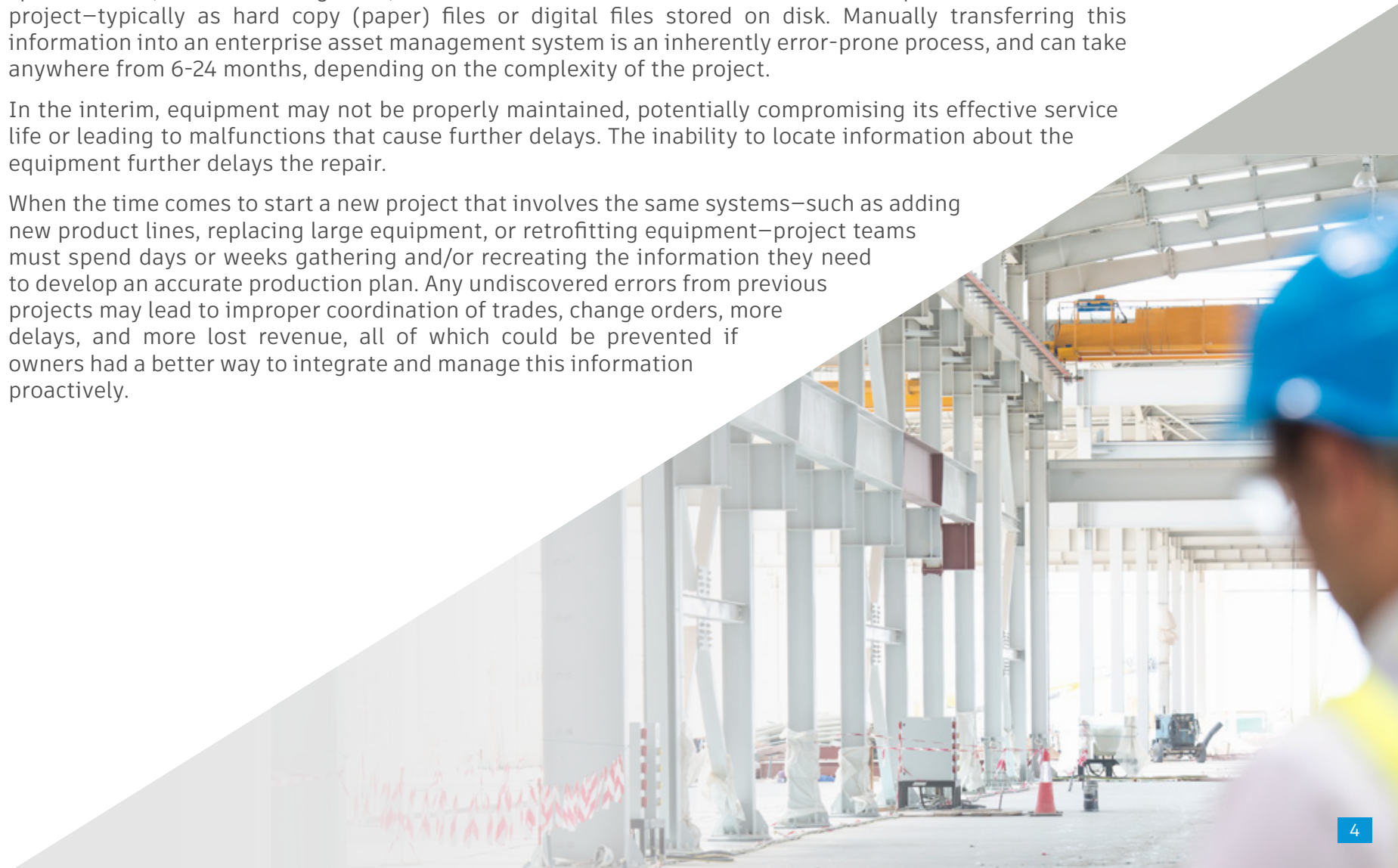
The most common negative consequence is rework. **In fact, an estimated 30% of construction costs are rework.** For example, a concrete pad is poured to support a very large, expensive piece of equipment, but the contractor makes this decision without a complete picture of the factory shell. When installation begins, the crew discovers that the new equipment can’t be moved into position on the pad due to a collision with exposed ductwork. The resulting delay skews the schedule and the budget. Instances like this may be why more than 60% of major capital programs fail to meet cost and schedule targets.

Other risks of disconnected data are more serious. Lack of visibility into safety and quality programs (both on site and at the executive level) can negatively affect the company’s Experience Modification Rate (EMR) and lead to higher overall safety spending.

A complete picture of the factory usually is not available because of the way in which drawings, specifications, commissioning data, and O&M documentation are handed over upon conclusion of a project—typically as hard copy (paper) files or digital files stored on disk. Manually transferring this information into an enterprise asset management system is an inherently error-prone process, and can take anywhere from 6-24 months, depending on the complexity of the project.

In the interim, equipment may not be properly maintained, potentially compromising its effective service life or leading to malfunctions that cause further delays. The inability to locate information about the equipment further delays the repair.

When the time comes to start a new project that involves the same systems—such as adding new product lines, replacing large equipment, or retrofitting equipment—project teams must spend days or weeks gathering and/or recreating the information they need to develop an accurate production plan. Any undiscovered errors from previous projects may lead to improper coordination of trades, change orders, more delays, and more lost revenue, all of which could be prevented if owners had a better way to integrate and manage this information proactively.



Moving from reactive to proactive

What many conventional production planning processes have in common is not the technologies involved or the mix of stakeholders, but the reactive approach to information management. Details are gathered after the project starts, data formats are determined after data is collected, integration occurs after many projects are completed, and errors are fixed after a bad outcome brings them to light. Fortunately, a methodology exists that allows manufacturing owners to switch from a reactive approach to a proactive one.

With this methodology, which has become an industry-standard approach in the architectural, engineering, and construction (AEC) space over the past 15 years, it is possible to build a “single source of truth” for all relevant information about the factory shell and all of the production lines and equipment the shell contains. This single source can be available online and through mobile devices, and updated in real time by a variety of authorized stakeholders according to consistent best practices.

The core of this proactive methodology is Building Information Modeling (BIM). The U.S. National Building Information Model Standard Project Committee defines BIM in this way:

“Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility. A Building Information Model is a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition.”

Essentially, BIM uses intelligent 3D models to capture, explore, and maintain consistent and coordinated planning, design, construction, and operational data, giving all stakeholders—but especially owners—better insight into actual project cost, schedule, and constructability.

All stakeholders can contribute BIM content to the model. This BIM model can represent everything in the manufacturing facility, including the individual components of production lines and critical facility systems, such as HVAC and plumbing. Each object includes a visual component as well as metadata about the part or system, including serial numbers, operating specifications, warranty details, and more, depending on your needs. In most BIM environments, this data is available to stakeholders who are in the office or out in the field.



Over time, as Building Information Models accumulate and interconnect, manufacturing owners can acquire complete digital 3D models of multiple facilities. This model has useful applications in all phases of facility, factory, and building projects:



Design

Iterate more quickly on a wide range of design elements, including factory shell form, production line configurations, sustainability, government regulations, and budget.



Construction

Link project planning to construction planning and simulation, as well as visualization during construction, to enhance collaboration among general contractors and subcontractors during installation and commissioning.



Management

Reuse building models and data to better manage facility operations, find and resolve problems before they escalate, reduce waste, and minimize lifetime maintenance and operation costs of equipment.

Advantages for manufacturing owners

Most important of all, BIM gives owners greater visibility and control over the coordination of all projects in the pipeline:

One data source

A single, continuously updated source of production planning data for both manufacturing equipment and the factory shell eliminates the need to recreate these details for every project, helping to ensure data is accurate and complete throughout the project life cycle. This eliminates the need to cobble together data from multiple unlinked sources.

Convenient access

“Anytime, anywhere” access to the model makes all processes more efficient, from routine maintenance to emergency repairs. Information from the BIM environment can also be easily shared with energy and O&M systems.

Higher efficiency

Streamline production planning with a unified 3D model including manufacturing equipment and building systems. Identify potential problems (such as the collision between the concrete pad and the expensive capital equipment) earlier, keep projects on schedule, and start new production lines sooner.

Keep in mind, manufacturing owners do not need to build or maintain the BIM model in-house. By requiring general contractors and other third-party stakeholders to follow a BIM methodology and deliver BIM models as part of the RFP, bidding, and planning process, manufacturers gain better control over their manufacturing facilities, factories, and building assets. In addition, service providers can host the model (typically in a cloud-based environment) and manage secure access to it by authorized stakeholders.



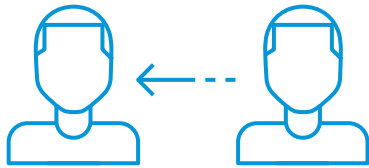
The business value of BIM

Requiring a BIM workflow for production planning helps manufacturing owners:

-  Reduce costly change orders and rework
-  Minimize the risk of project delays and unexpected downtime
-  Lower contingency budgets
-  Achieve full production faster
-  Collaborate more effectively with contractors and EPC firms
-  Gain insight into operations
-  Optimize maintenance schedules for equipment

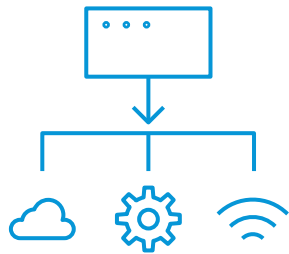
Take the next step

Imagine two scenarios for your next project, whether you are investing in a new factory or adding production capacity to an existing facility:



1. Give control

of the project to the general contractor and hope for the best, despite having very little visibility into the process and no reliable way to keep the schedule on track.



2. Delegate control

of the project to the general contractor, with the ability to check on the production plan at any time, be notified of issues sooner, and coordinate with all stakeholders more easily anytime, anywhere.

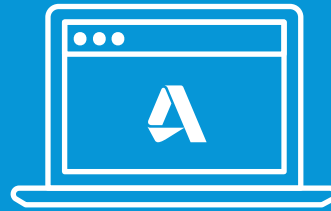
If the second scenario sounds more attractive, Autodesk can help you get started. We are already working with customers who have used BIM methodology to build plants 25% faster, save up to 15% on construction costs, avoid paying for field orders associated with trade collisions, and achieve industry-best safety records.

To learn more:



Contact an Autodesk
representative today at
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With decades of experience in the manufacturing and construction industries, Autodesk is uniquely positioned to share insights that help companies in both spaces work together more effectively and extract the most business value from new technology.

