



Discover the real power of simulation

How discrete event simulation helps manufacturers make better decisions throughout the factory lifecycle to increase efficiency, reduce costs, and drive innovation



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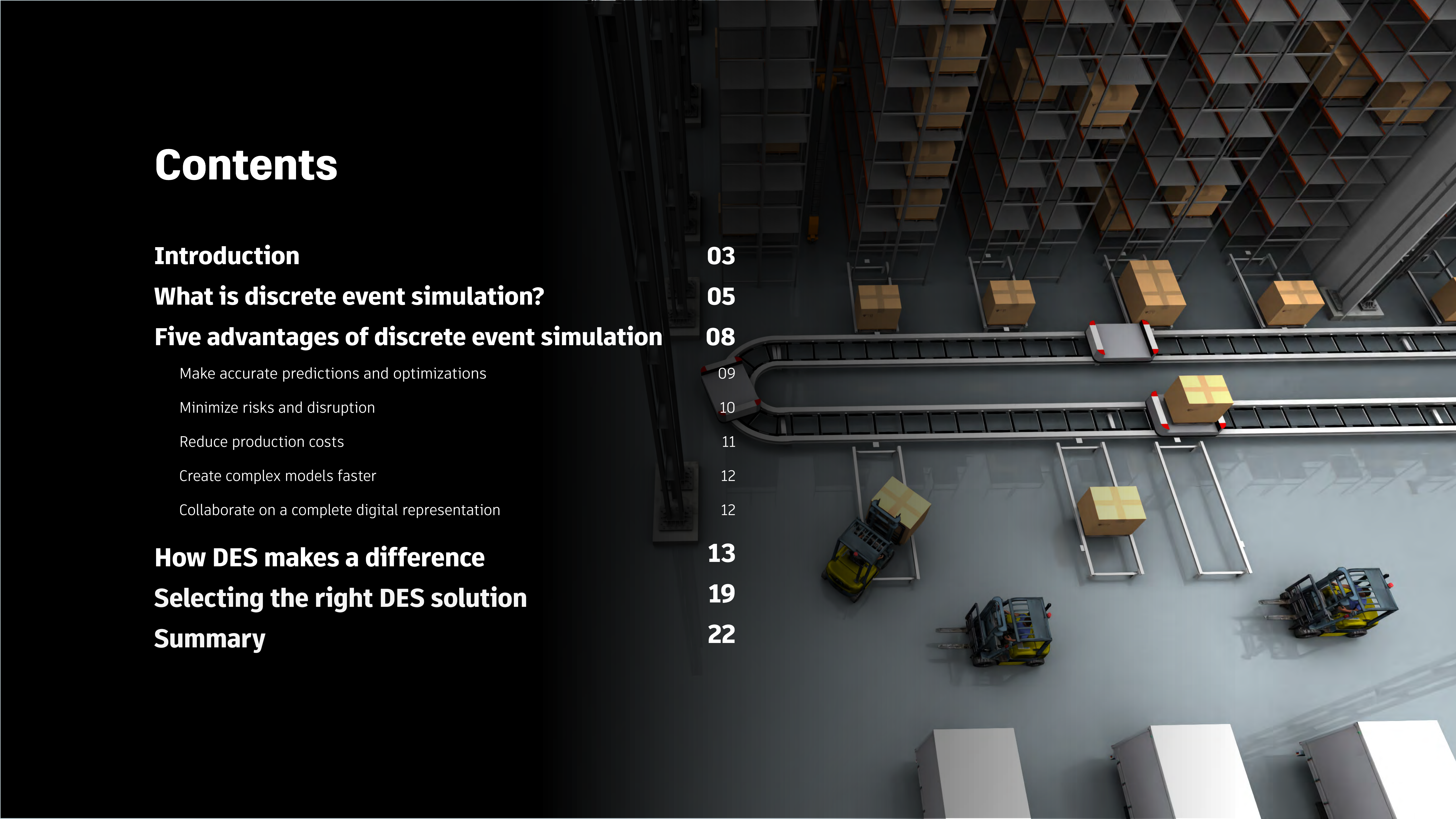
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Introduction

Manufacturers have too many choices when it comes to gaining an edge. Between investing in new equipment, optimizing processes, or taking advantage of AI and other digital transformation tools, the problem is not a lack of ideas. It's choosing the right combination of strategies for the best path forward.

Traditionally, analysts would simply compare options in a spreadsheet. But a spreadsheet can't account for the complexity of modern production systems. At the same time, physical studies are often impossible, because staging a new assembly line (for example) would be incredibly disruptive and prohibitively expensive.

What manufacturers need is a way to experiment with and carefully evaluate a wide range of potential changes in a low-risk environment that doesn't disrupt production. Which brings us to simulation.

Simulation enables manufacturers to study a specific factory system or an entire factory operation. Ultimately, simulation helps you see how planned changes are likely to affect production. For example, you can test changes to production schedules, operating policies, staffing levels, job priorities, new equipment, and much more.

One of the most time-tested types of simulation is discrete event simulation (DES). This data-driven, evidence-based method helps predict how changes in your current system will impact other processes or parts of your factory.

In this e-book, we will explain how DES works, including its unique advantages and most valuable applications.



“

Discrete event simulation (with FlexSim) gives you a quick and rough, high-level idea of which brainstormed ideas will give the best output. Then you can narrow it down to two or three options and make detailed models in a more focused way.

”

Michael Belote, Director of Manufacturing 2.0, LM Wind Power

What is discrete event simulation?

Discrete event simulation (DES) helps manufacturers test and validate “what if” scenarios in a virtual environment that combines detailed process steps, current production data, and detailed 3D visuals. This approach allows you to analyze and validate options without guesswork, so you can uncover the best solutions without disrupting real-world production. And unlike a spreadsheet, a DES model can incorporate real-world randomness for more realistic results.

DES and the digital factory

A digital factory is a shared digital model that gives you insights into how to plan, design, build, and operate your facility, reconfigure it for product and process changes, and maximize overall efficiency and productivity. DES belongs to the spectrum of solutions offered by a digital factory, and it excels at focusing on a specific area of production, where it provides the insights manufacturers need to make better decisions quickly. You can also apply DES to multiple areas of a factory or emulate a full production system over time. You can even integrate real-time data to change the model, as seen in digital twin applications.

DES is a key capability for modern digital factories. It plays a role in factory design, helping to assess the potential of production environments and optimize equipment layout. During factory operation, DES enables teams to simulate a variety of production scenarios and use the results to refine and optimize factory design for increased throughput.

More sandbox than solver

One of the best analogies for DES is the sandbox: a safe place to play around with competing ideas and see what happens. DES provides data about what happens to your model under a variety of constraints and conditions. It's a powerful solution when planning, designing, building, and operating a factory:

01 Plan

- Identify each station location, equipment placement, and configuration
- Define space allocation for people, machines, and materials
- Determine how to maximize productivity and reduce bottlenecks

02 Design

- Identify challenges and issues earlier, when they are less expensive to fix
- Get your factory up and running quicker with higher initial throughput
- Build flexibility into your factory design from day one

03 Build

- Test movement and workflows throughout the factory space during construction
- Identify potential choke points or areas of congestion
- Plan for optimal delivery schedules

04 Operate

- Optimize scheduling and other daily operational tasks
- Observe interactions, adjust parameters, analyze results, and gain insights
- Test and optimize your facility to maximize throughput for its entire lifecycle
- Add flexibility to production lines to prepare for unusual market conditions

Use case: DES and construction planning

As a major package delivery company prepared to break ground on an airport-adjacent facility, they removed the truck loading wing and installed construction lifts to get equipment to the upper levels. The operating limits of the lifts (volume and weight) would constrain the project, but by how much? Complicating the situation was the fact that all trucks had to pass through a TSA-controlled gate.

The system integrator needed to figure out whether these variables would create a bottleneck. They turned to FlexSim, a DES solution from Autodesk. The resulting simulation helped tell a clear story of the project's logistics, processing more than a year of deliveries in less than a minute. The simulation speed, combined with the model's adjustable parameters, allowed the integrator to test and evaluate a wide range of what-if scenarios.

Based on the results, the integrator recognized that the peaks and valleys of the existing delivery schedule would create a bottleneck at the TSA-controlled gate. After iterating on the model and smoothing out the schedule, the integrator submitted a revised, evidence-based schedule to all construction vendors, who quickly approved the recommendations.



Five advantages of DES

DES brings a unique combination of speed and flexibility to the challenges manufacturers face. Whether your top priority is increasing efficiency, optimizing throughput, fixing bottlenecks, or simply imagining a new way to improve your factory, DES can help manufacturers:

- 01** Make accurate predictions and optimizations
- 02** Minimize risks and disruption
- 03** Reduce production costs
- 04** Create complex models faster
- 05** Collaborate on a complete digital representation





Make accurate predictions and optimizations

One of the limitations of traditional evaluation methods is accuracy. Even highly customized spreadsheets have a hard time replicating the reality of the factory floor, which means any output is a rough approximation of what may or may not work.

Building DES models helps teams better understand how systems operate in the first place. In this way, DES enables manufacturers to understand processes in much greater detail, account for variability and interdependencies, and predict the performance of very complex systems.

With the ability to test ideas about why a system behaves in a certain way, you are more likely to get the solution right the first time and fine-tune it in the following hours and days—not months and years.

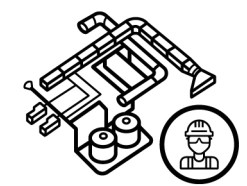
Minimize risks and disruption

DES provides a risk-free environment that allows wide-ranging experimentation without any worry about real-world consequences. By removing risk from the equation, DES enables manufacturers to:



Avoid trial-and-error.

Instead of reconfiguring an actual production line, waiting to see what happens, and then repeating the process over and over, you can test a dozen reconfigurations virtually and see which one delivers the best results.



Explore alternatives without disruption.

DES experiments do not require you to shut down or alter production, change assignments, redo workflows, or otherwise compromise productivity.



Validate strategic decisions.

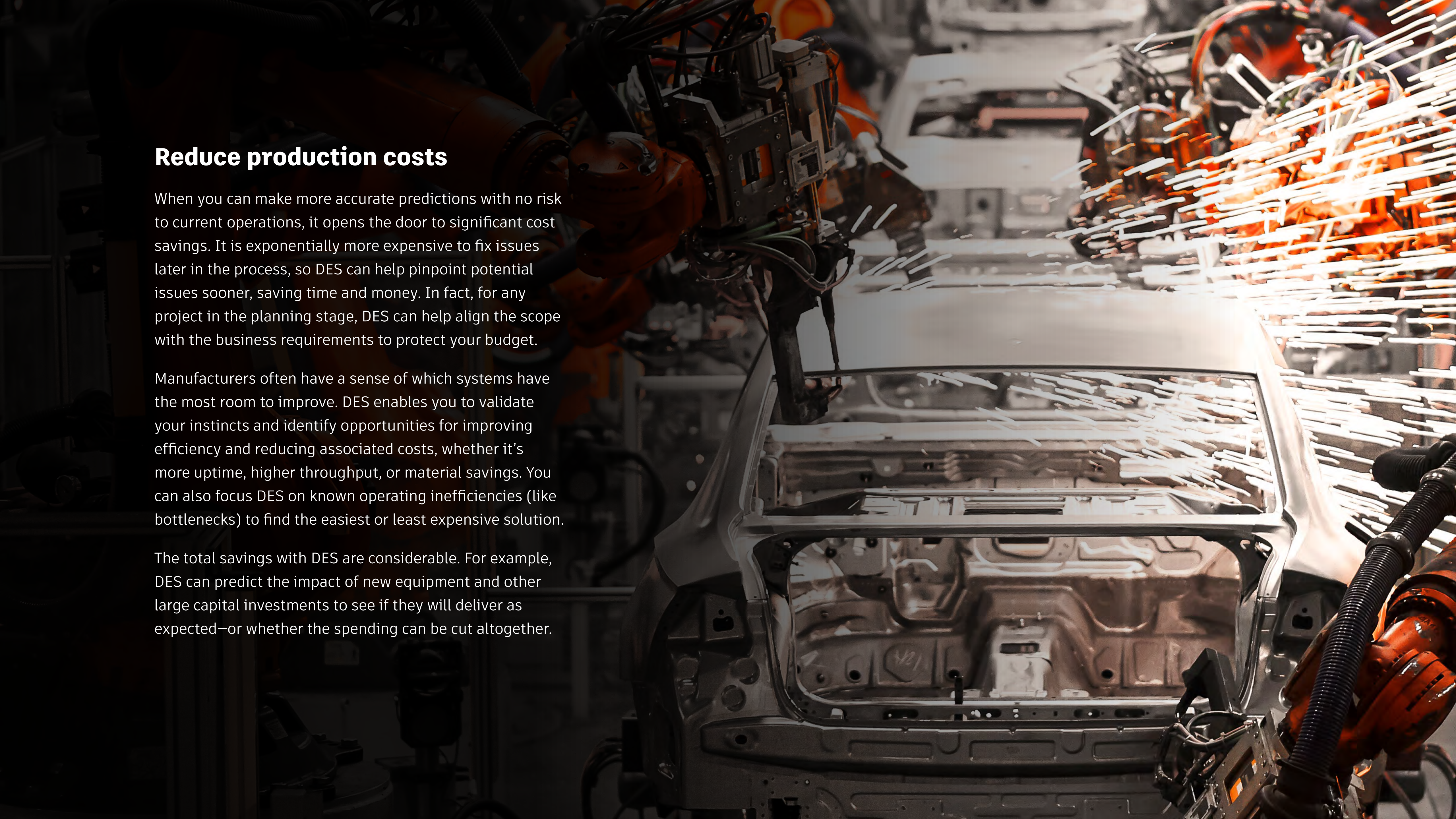
There are many reasons why factories make changes. With DES, you can validate design choices or new production schedules before they take effect.



Prepare for anything.

With DES, you can simulate events that are impossible to test physically—like a large increase in demand, for example—to future-proof your factory.



A close-up, high-angle shot of an industrial robotic arm, painted orange, welding the metal frame of a car. Bright sparks are flying from the welding point, creating a dramatic, high-contrast scene. The car's chassis is visible, showing the interior structure. The background is slightly blurred, showing other parts of the factory floor.

Reduce production costs

When you can make more accurate predictions with no risk to current operations, it opens the door to significant cost savings. It is exponentially more expensive to fix issues later in the process, so DES can help pinpoint potential issues sooner, saving time and money. In fact, for any project in the planning stage, DES can help align the scope with the business requirements to protect your budget.

Manufacturers often have a sense of which systems have the most room to improve. DES enables you to validate your instincts and identify opportunities for improving efficiency and reducing associated costs, whether it's more uptime, higher throughput, or material savings. You can also focus DES on known operating inefficiencies (like bottlenecks) to find the easiest or least expensive solution.

The total savings with DES are considerable. For example, DES can predict the impact of new equipment and other large capital investments to see if they will deliver as expected—or whether the spending can be cut altogether.

Create complex models faster

Not all DES tools are the same. It's important to find a DES solution that enables you to model everything you need with less effort. Look for user-friendly features like drag-and-drop layout, objects with pre-built logic, and a code-free environment.

Investing in the right DES software will pay off quickly when it shaves weeks off a tight construction schedule, delivers analytics that unlock significantly higher efficiency, or prevents the purchase of a multi-million-dollar piece of equipment that would have been redundant.

Collaborate on a complete digital representation

One of the ways DES accelerates decision-making in factories is by telling a very clear story about the current situation and how it could be changed.

These stories allow teams to share information across the organization more easily. Realistic 3D visuals and process steps help clarify complex situations, while the data-driven approach helps build a solid case for (or against) specific changes under consideration. In the end, this helps manufacturers make more informed, evidence-based decisions about the factory.



How DES makes a difference

Now that you have a solid impression of how DES works, let's look at how manufacturers are using DES today.

These applications reveal why DES can be so valuable for manufacturing organizations that value continuous improvement.

- **Factory layout and reconfiguration**
- **Investigation of production issues**
- **Evaluation of capital investments**
- **Time-shifting analysis**
- **Validation for new ideas**



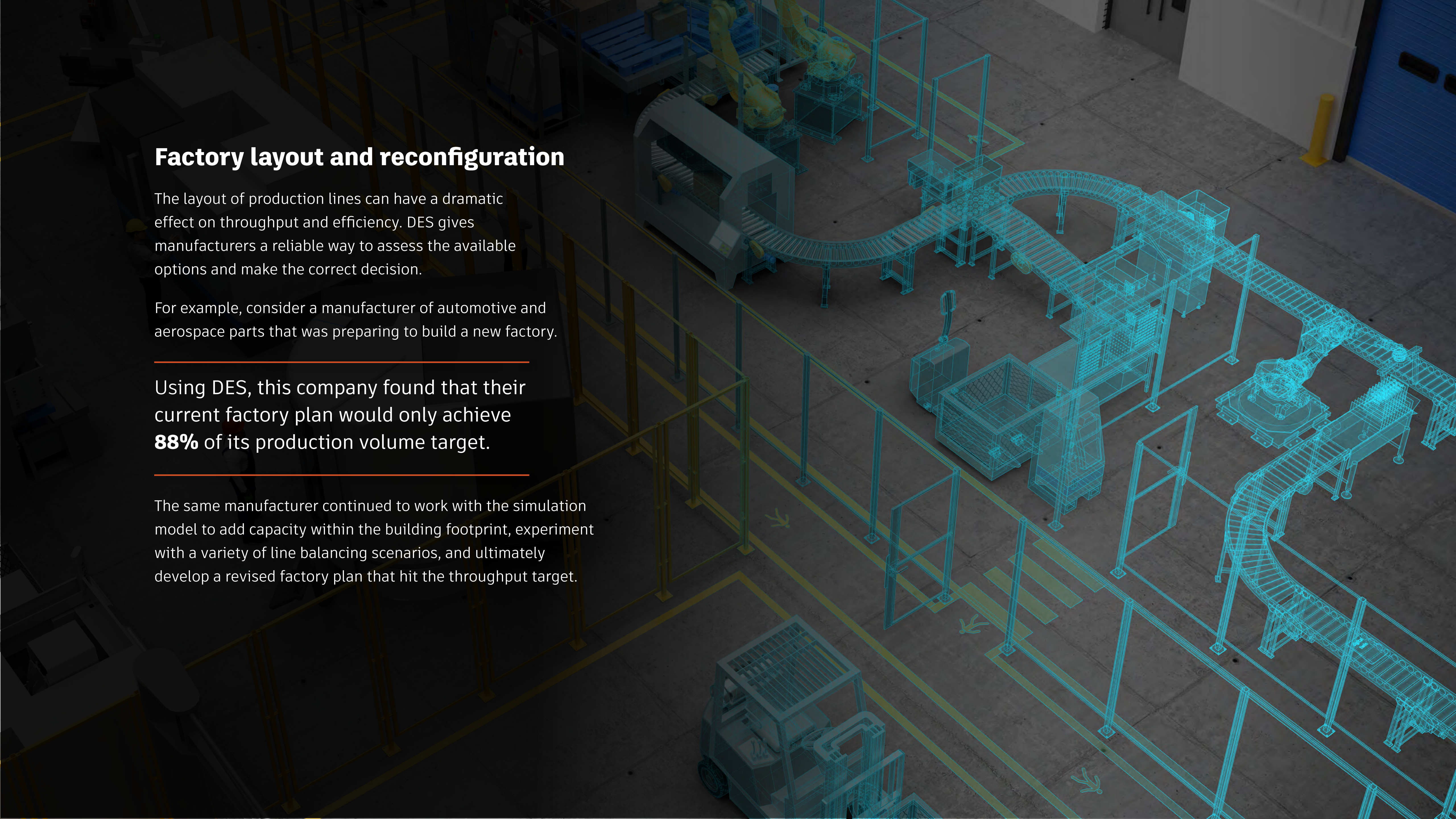
Factory layout and reconfiguration

The layout of production lines can have a dramatic effect on throughput and efficiency. DES gives manufacturers a reliable way to assess the available options and make the correct decision.

For example, consider a manufacturer of automotive and aerospace parts that was preparing to build a new factory.

Using DES, this company found that their current factory plan would only achieve **88%** of its production volume target.

The same manufacturer continued to work with the simulation model to add capacity within the building footprint, experiment with a variety of line balancing scenarios, and ultimately develop a revised factory plan that hit the throughput target.





Investigation of production issues

Bottlenecks, chokepoints, and other points of inefficiency are a persistent risk for manufacturers. DES offers a way to investigate the root cause of these issues and provide the evidence you need to implement a better approach.

In one use case, a beverage manufacturer working with FlexSim used DES to track a production issue back to a single, poorly performing cartoner machine.

By upgrading this one piece of equipment, the company not only increased availability by 12% but also **improved throughput on the line by 30%**.

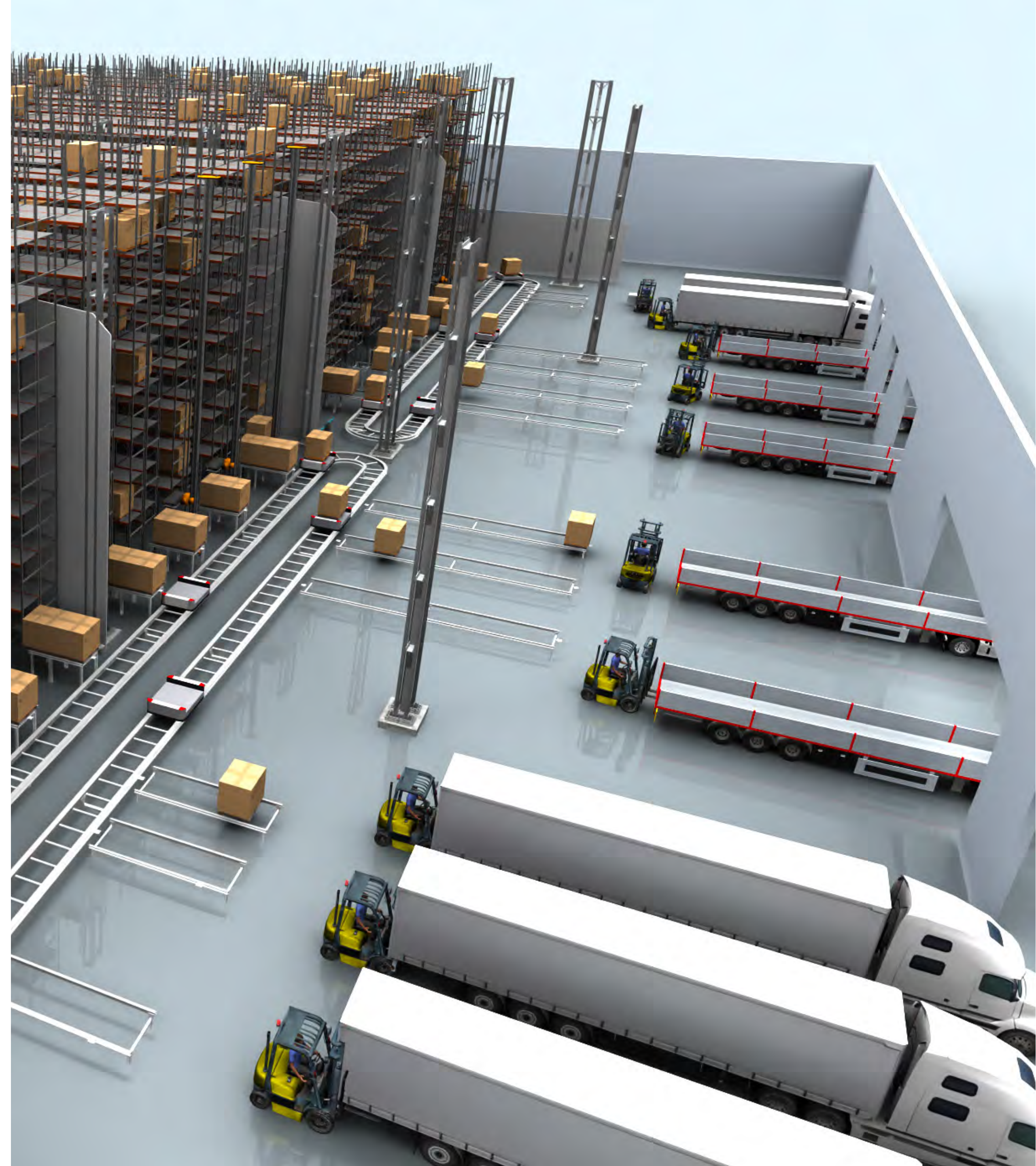
Evaluation of capital investments

One of the most powerful ways DES can deliver value is by validating proposed investments and avoiding poor decisions.

In one case, a large pharmaceutical manufacturer was experiencing increased demand for a specific tablet product and wanted to increase production from 15 to 25 batches per week. The most obvious solution was adding an expensive piece of capital equipment to increase throughput in the blending step, which was widely believed to be the slowest step.

Before taking their recommendations to the board, however, the process improvement team used DES to validate the decision. The simulation, which accurately modeled all of the intricacies in the operation, revealed that the blending step was not the slowest part of the process. It was dispensing that needed the most improvement.

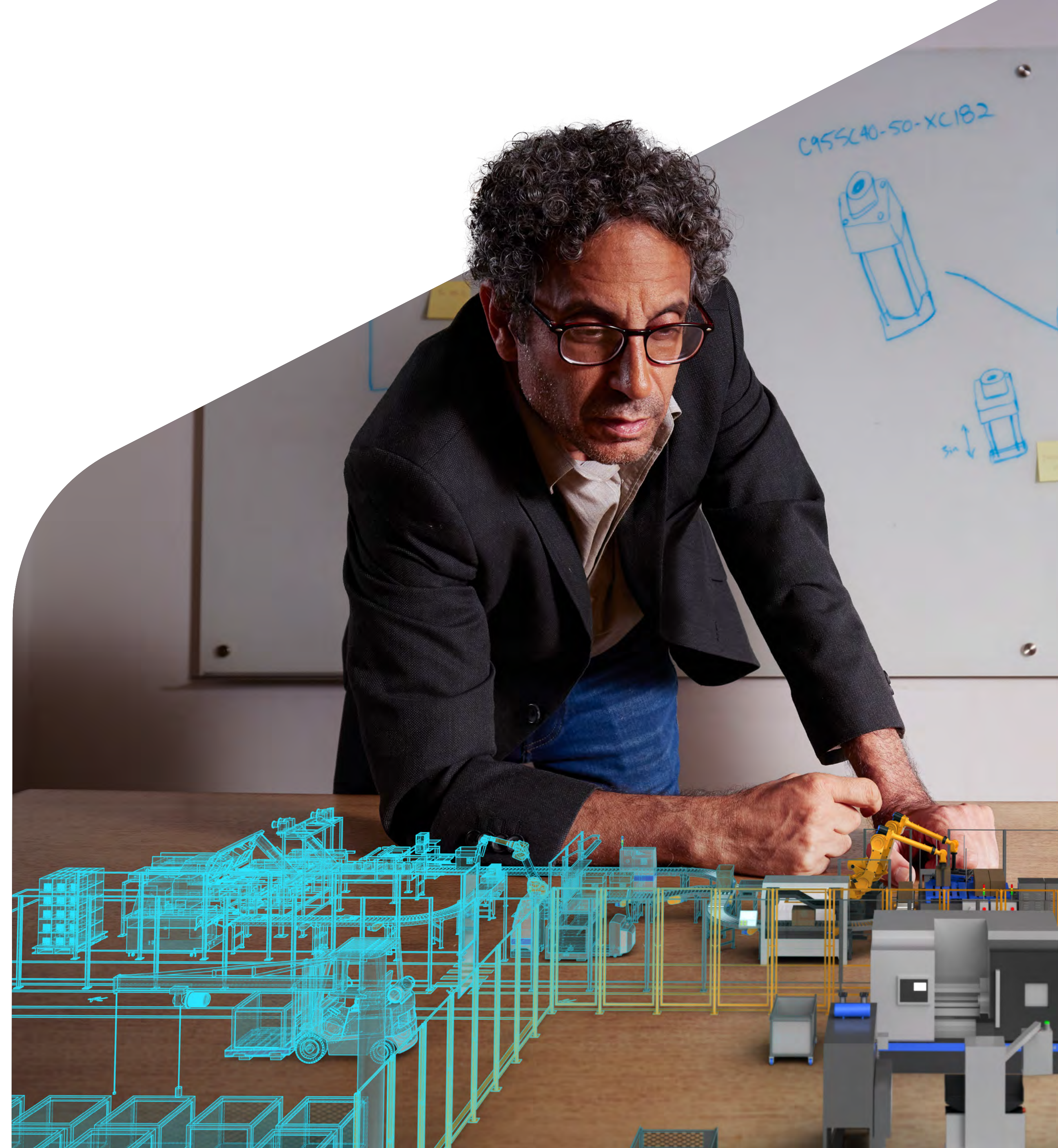
The simulation helped the team test a variety of changes to the dispensing area that increased throughput to 20 batches per week, well within striking distance of the target. Most important, DES showed that **the proposed \$50 million piece of technology was not necessary.**



Time-shifting analysis

DES excels at playing with time, whether you want to speed up a process to estimate its results over many weeks and months or slow down a specific event to scrutinize it in detail.

The TSA-controlled gate use case mentioned earlier spotlights the importance of this capability. The delivery company created a simulation of the logistics involved in constructing a new facility located near an airport. The simulation was able to process more than a year of truck deliveries in less than one minute. Based on this work, the company developed an entirely new delivery schedule for its construction materials to **minimize a schedule-breaking bottleneck** at a TSA-controlled gate.

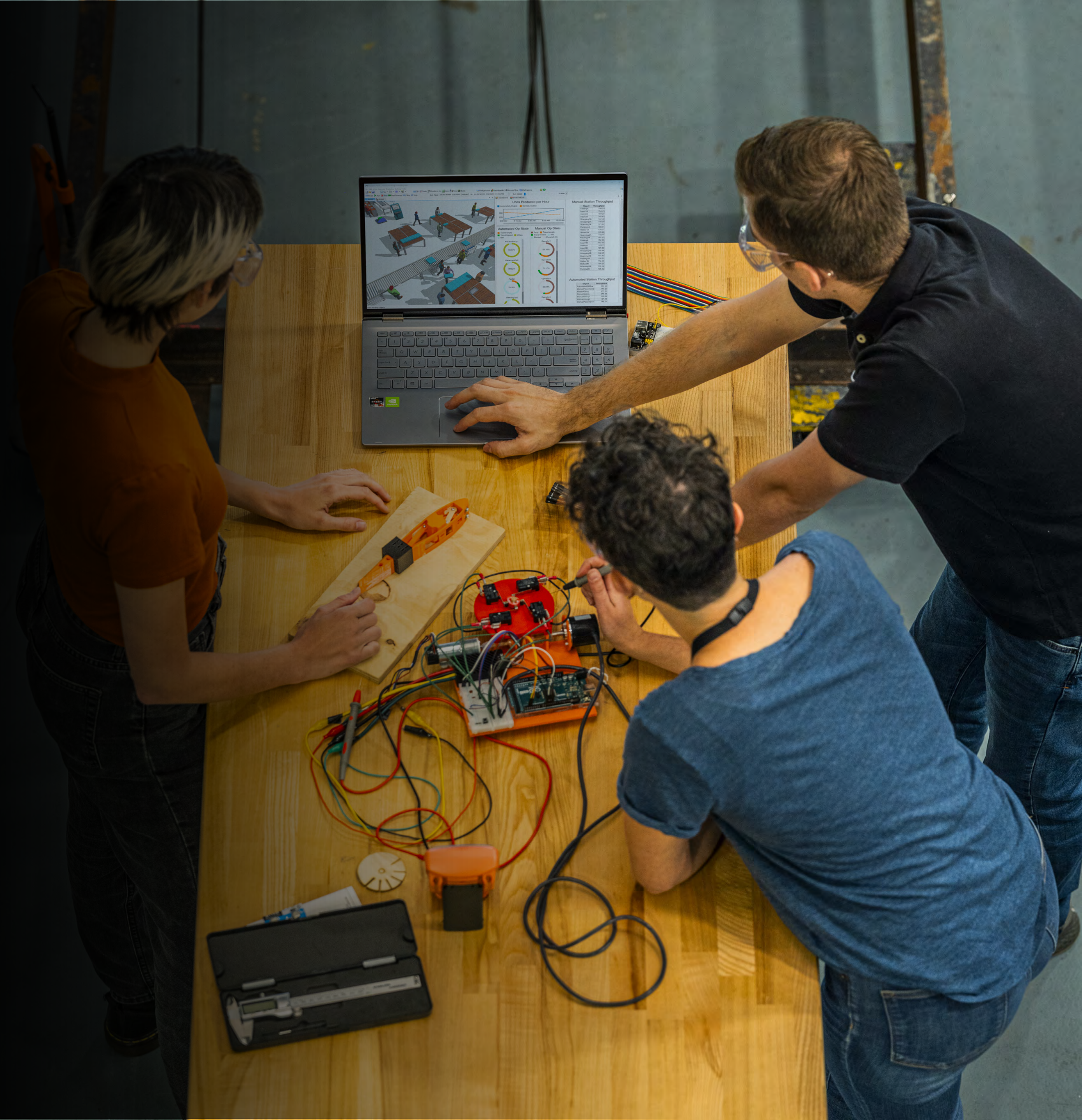


Validation for new ideas

Manufacturers rely on the innovation of their best people to solve all kinds of problems throughout the factory environment.

DES plays an important role in these efforts, giving teams a way to validate new ideas that may seem out-of-the-box, unconventional, or otherwise unproven—all of which are the hallmarks of innovation.

Building a DES model of a specific production area, for example, could help a team evaluate dozens of ideas for improving efficiency, throughput, cost, or any other important performance metric. The advantage to simulation is that you don't have to use gut instinct or guesswork to evaluate ideas that might seem unusual or potentially groundbreaking. You can simply test them within the model and gauge their potential with results you can trust.



Selecting the right DES solution

Not all DES solutions are the same. When reviewing your options, it is important to look for capabilities that will allow you to take full advantage of simulation with less overall effort. In short, look for a DES solution that is:



Comprehensive capabilities

It is vital for your DES solution to provide comprehensive tools and objects, so that you are equipped to model a wide range of manufacturing environments. FlexSim from Autodesk comes with all of the features necessary to simulate manufacturing, packaging, logistics, and supply chain scenarios. It also has industry-specific modules for conveyor systems, AGVs, warehousing, supply chain, and healthcare simulations.

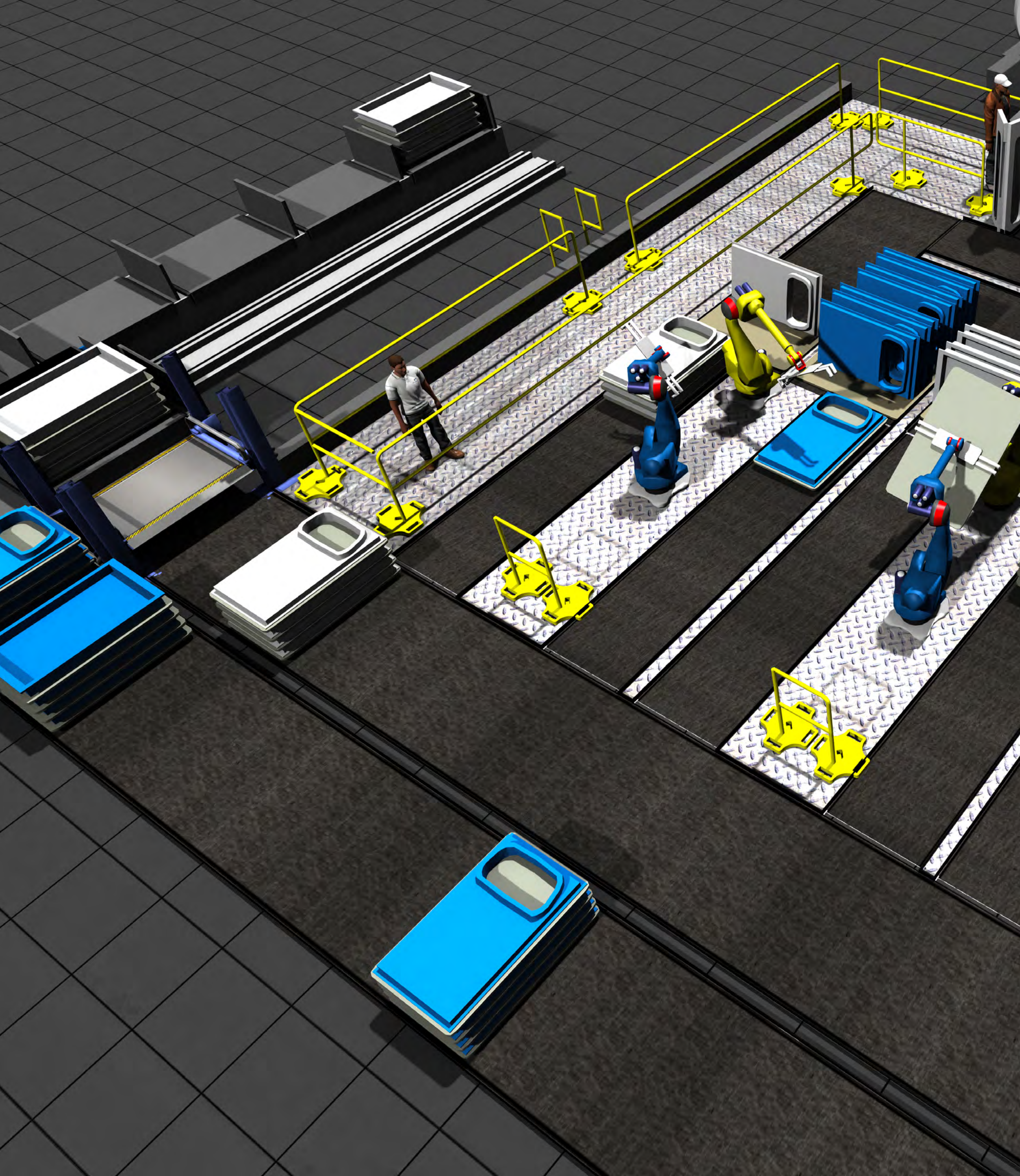
Flexibility and scalability

When your DES solution has appropriate flexibility and scalability, it gives you the ability to create a baseline model that is primed for further experimentation. The solution you choose should have the capability to build models of any size and scale, for example. FlexSim does this through a scenario manager that streamlines experimentation and optimization to help discover the most insightful results. It also offers customizable statistics and dashboards for more thorough analysis.

User-friendly experience

Creating accurate simulations can be a complex effort, but there are specific features that make the process faster and easier. To reduce the time it takes to build accurate simulation models, FlexSim features convenient drag-and-drop layouts, a full library of objects with pre-built logic, and a code-free logic-building environment.





Future-proof performance

DES solutions are intended to help manufacturers make more informed decisions at every stage of their lifecycle. In other words, the utility of DES does not stop when the factory is up and running, or even when it has been running for several years. That is why these solutions need to be designed for longevity. To ensure that it can support Industry 4.0 efforts, including digital twins, FlexSim features an open architecture, robust database connectivity, and advanced communication features. It can support VR and AI, and streamlines data import and export with easy connectivity to traditional spreadsheets and databases.

“The FlexSim model allowed us to do optimization runs where we could zero in on how many people we needed on each level and how big a pick wave we can run.”

John Friedl, Senior VP of Automation and Industrial Engineering, ThredUp

Optimize your future with simulation

DES enables manufacturers to study factory systems in depth with a detailed digital model. Ultimately, this type of simulation helps reveal how proposed changes may affect production, efficiency, costs, and many other critical metrics.

Using DES gives manufacturers a critical advantage at a time when the number and complexity of challenges is growing rapidly alongside the potential number of solutions. With DES, you can focus on a specific area of the factory, production line, system, or observed operational issue. By modeling the system and experimenting with it freely, manufacturers can make more accurate predictions and optimizations, minimize the risk of disruption, and reduce production costs. With the right DES solution, you can also create complex models faster and collaborate through a realistic digital representation.

The practical applications of DES are extensive. Manufacturers are already using DES to optimize factory layout and reconfigure production lines, investigate production issues to find the root cause, evaluate whether capital equipment purchases will deliver results as intended, simulate multiple years of activity in minutes, and provide a validation for innovative improvement ideas that fall outside the mainstream.

Of course, not every DES solution provides the same capabilities. As you consider your options, it is important to find a platform that delivers maximum value through a comprehensive approach, flexible and scalable design, a user-friendly experience, and future-proof performance. With a solution that meets these criteria, manufacturers will be poised to drive innovation and make better decisions when designing, building, and operating a factory.



**Explore DES solutions
from Autodesk**

