AUTODESK

The buyer's guide to 3D CAD for machinery and product design

Choosing software for the design of industrial products, machinery, or equipment

Contents

The hallmarks of successful product development teams

Product design and engineering teams that are efficient and agile can accelerate design cycles and optimize processes. They can automate repetitive, non-value add design tasks. They can seek out information to predict risk ahead of time. They can reduce errors and rework. They can spend their time on the needs of their customers, and they don't need to compromise on the quality of their process.

The promise of efficiency and agility is a high-performing design and development team who can meet your customer needs and your company's objectives without compromising creativity or quality.

So—how can you deliver on this promise?

Leading manufacturer of stair parts and custom staircase systems increased business growth by 50% year over year by implementing automation in their engineering process.

(Viewrail)
Read the Viewrail story

Why CAD software matters

Check all that apply:

- Changing customer requirements and supply chain instability make it difficult for us to predict product development and delivery timelines.
- We are under pressure to develop products that use smart technology to provide additional, post-sale income streams for the company.
- Our backlog on existing product lines is competing for our capacity to develop new products.
- We are under pressure to balance the quality of the design development process with reduced development time.
- It can be challenging and time-consuming to incorporate preferences, information, and best practices from all our stakeholders, inside and outside our company.
- We are struggling to keep up with trends in management and technology that might help us work more productively.
- We're struggling to find skilled workers to provide extra capacity.
- We are finding sustainability requirements challenging.

These are common issues impacting design and development teams globally. There is a problem when current ways of working are too siloed and manual to respond to change effectively. The right technology can underpin a more efficient way of working, helping to connect silos, unlock collaboration, and automate ways of working.

"The pillar of our company is and has always been our engineering division, where we take a customer's problem and we engineer a solution for it. That's really where the Autodesk tools come into play."

Kipp Sakundiak, General Manager, Prairie Machine, Rokion parent company

Read more

Lean and agile product development

The design and manufacturing sector has been subject to rapidly changing customer demands and increasingly complex products, aggravated by headwinds from unstable supply chains and energy supply.

In response companies have adapted the ways they design and engineer their products, thinking of them in lifecycles and adopting agile product development methods, concurrent or systems engineering, and even bringing 'lean manufacturing' methodologies into design development.

What would it mean for your business if you could reduce time-to-market on your next product line?

What would it mean to your team if you could provide them space to make high-quality decisions based on data, and include insights from stakeholders such as procurement and manufacturing? How can you allow your team the time to explore creative concepts and incorporate feedback from your customers?

What would it mean to your stakeholders, if you could deliver the right information at the right time–with greater clarity and fewer errors? These movements together are breaking down silos so you can optimize production quality and efficiency. And the impact doesn't stop there. Every phase of the factory lifecycle–from planning, to design, to validation, to build, to operation–has something to gain.

Together these changes can break down silos, improve collaboration and communication, and reduce non-value add work.

And it isn't just your team that benefits. Providing easy access to trusted data created in design and engineering can improve downstream processes from project management to procurement, from production to delivery, and through commissioning and maintenance to the end of your products lifecycle.

72% percent of digitally mature companies feel confident about their ability to handle rapid change while 52% of less digitally mature companies feel equipped.

Autodesk State of Design & Make report

Learn more

3 things make this possible:

01 Digitalization

02 Data integration

03 Automation

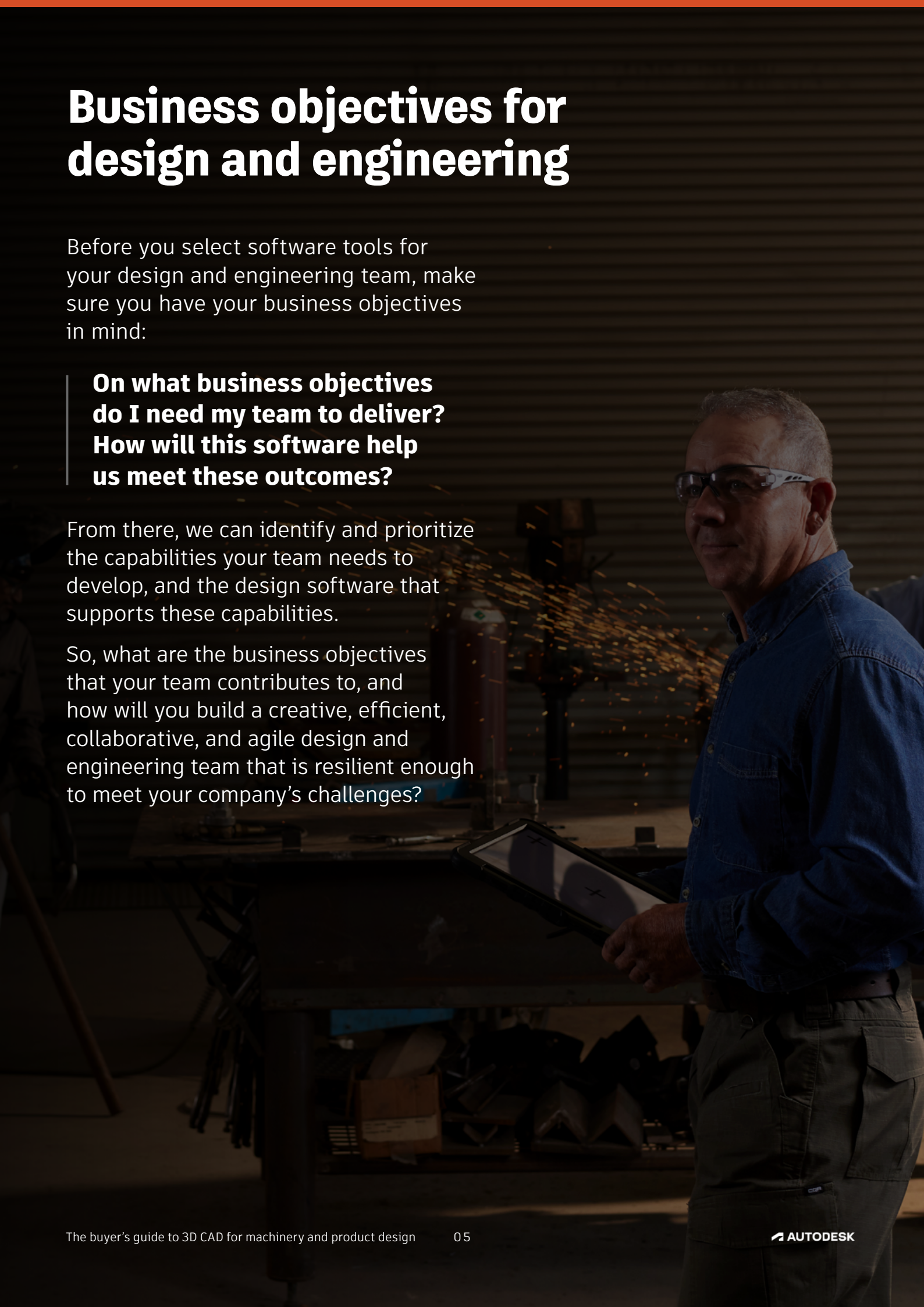
Business objectives for design and engineering

Before you select software tools for your design and engineering team, make sure you have your business objectives in mind:

> **On what business objectives do I need my team to deliver? How will this software help us meet these outcomes?**

From there, we can identify and prioritize the capabilities your team needs to develop, and the design software that supports these capabilities.

So, what are the business objectives that your team contributes to, and how will you build a creative, efficient, collaborative, and agile design and engineering team that is resilient enough to meet your company's challenges?



I need to...
Increase market share

Market share can be increased by:

- Reducing business lost to competitors & third parties.
- Increasing profit margin.

For many in design and engineering, the focus naturally falls on optimizing designs for manufacture. Decisions made during design development can have a great effect on the operational efficiency of the business, which in turn affects profit margin.

However, many business owners are thinking first about sales and market share. There's little value in optimizing a business that isn't selling products.

To increase market share, businesses use standard levers such as cost and price and their knowledge of the competitive landscape. Gains can also be made by expanding into adjacent market segments with existing product lines or by developing entirely new product lines to suit new territories, industries, or demographic market segments.

Many companies are increasing market share through product innovation and by offering additional add-ons or customizations. Increasingly, original equipment manufacturers (OEMs) are planning to create additional revenue streams post-product purchase using web-connected technology to provide services such as equipment monitoring or predictive maintenance.

→ **Key capabilities to work on**

→ **Improve design cycle time**

Suggested success metrics:

- Percentage market share
- Revenue generated from new markets
- Product global footprint
- Annual service revenue

Tip: Provide a baseline measure and monitor the health of one or more criteria. Consider which metrics are most important to your company. What measure would indicate success? What measure would indicate failure?

I need to...
Improve profitability

Profitability can be improved by:

- Reducing waste
- Reducing cost per unit
- Increasing production yield
- Increasing profit margin
- Uncompetitive part cost

Increasing sales and market share is one focus for business leaders. With a healthy sales funnel, business leaders can focus on profitability. Profitability within an organization is dependent on the revenue generated minus the cost to the business of the goods sold.

Revenue can be improved through adjustments in product price, product mix, or transaction size, volume, and frequency.

Operating costs can be reduced through increases in productivity, reductions in material costs, design and engineering costs, and fixed overhead costs.

The big target for cost reduction is usually manufacturing–which is where most of the product cost is spent. Techniques such as 'lean' manufacturing are used to reduce scrap and improve yield.

However, the decisions made in design development can have a significant effect on operational efficiency. Designing around standard components and designing for manufacturing can help production reduce product unit cost.

A significant trend is the 'Digital Transformation' of business processes, using software to automate processes to reduce project costs and, in turn, reduce overall payback time.

→ **Key capabilities to work on**

→ **Improve quality and reliability**

Suggested success metrics:

- Total company profit
- Product development costs
- Total part cost = material cost (raw material/logistics) + process costs; yield rate
- Product line profit % (actual vs. target)

I need to...
Expand product offerings

Expanding your range of products or providing products with attached services can help with:

- Low market share
- Uncompetitive vs. competition
- Product usage visibility

And can be helped by:

- Improving the ability to adapt to changes in market requirements rapidly
- Improving design cycle time

More than 25% of total revenue within manufacturing organizations comes from the launch of new products.

Expanding product lines or developing existing products to meet new demographics or territories can help improve market share.

Developing smart products can support post-sales services which in turn can increase revenue and customer satisfaction. Smart products are characterized by the capability to collect and communicate data during their entire lifecycle.

Success in driving revenue from new products requires market insight data to develop product strategy, rigorous product development and launch procedures, resource effectiveness, tight team collaboration, and good employee retention.

→ **Key capabilities to work on**

→ **Improve design development agility**

Suggested success metrics:

- Market share (%)
- Number of products introduced (time)
- Resource required per product
- Revenue
- Customer satisfaction score

I need to...
Improve time to market

Time to market can be shortened by:

- Decreasing design cycle time
- Increasing use of data insights to improve decision making

And can be helped by:

- Improving cross functional collaboration
- Improving design efficiency

The ability to react faster to changing customer requirements and remain one step ahead of your competitors can be improved by reducing the overall time it takes to bring a new product to market.

Bringing a quality product to the market encompasses many functions across the business from strategy and marketing to manufacturing and delivery. The decisions made during design development can have a profound effect on the time it takes to manufacture a product.

The challenge is to maintain the rigor and standards of the product development process while reducing the overall development time.

This can be achieved by making better decisions sooner based on data and insights, improving cross-functional collaboration to capitalise on opportunities and resolve issues sooner, and by automating mundane processes to provide more time for collaboration and problem-solving.

Key capabilities to work on

Improve design cycle time

Suggested success metrics:

- Revenue margin
- Market share
- Time to market
- Part release status
- Number of product issues at launch
- Actual vs. planned target to plan

I need to...
Improve product performance

Increasing product performance helps:

- Improve product success
- Meet customer requirements
- Improve business competitiveness
- Increase market share

In this context, the performance of a product is its ability to meet the customer's requirements.

Improvements in the ability of a company to meet the customer's requirements with their unique product offerings can improve brand reputation and increase market share.

Improvements in product performance may be necessary to remain competitive. Organizations may explore methods to modify their product using the abilities of their existing manufacturing facilities.

Key capabilities to work on

Improve design development agility

Suggested success metrics:

- % Market share
- Profit
- Customer satisfaction score
- Brand rating index

I need to...
Increase product development agility

Increasing product development agility helps:

- Reduce design cycle time
- Rapid adaption to market changes
- Rapid exploration of design options
- First to market

Product development is a significant investment period for a product-based business. Design and engineering teams that are agile can more easily incorporate customer feedback while minimizing the number of design iterations to arrive at a viable proposition.

Through internal and external collaboration, the adoption of concurrent engineering, process automation, data management, and the application of valuable and meaningful customer insights, the product development team can better utilize their available resources to produce viable, coordinated, and clearly communicated product designs–without compromising the quality of the process, in a reduced timescale.

Key capabilities to work on

Improve collaboration

Suggested success metrics:

- Product development cycle (time)
- Number of products to market
- Customer satisfaction score

Key capabilities to work on in design and engineering

Now that you are clear on the business objectives you want to target, you can determine the key capabilities you need to develop so you can choose software that supports you.

They are:

Collaboration: To help multiple departments, external stakeholders and clients collaborate on a design effectively.

Quality and reliability: To help meet your customers' expectations of reliability, durability, and conformance – while balancing costs.

Design development agility: Using data management, standards, and automation to reduce non-value add work, increasing the ability to take advantage of opportunities as they develop.

Design cycle time: Using data and insight to make better decisions sooner, and to reduce the overall development and production time from design concept to delivery.

Let's take a closer look at each one.

Collaboration

Your choice of software for design and engineering can have a multiplier effect on collaboration within your business. Passing data back and forth across multiple locations and between design tools causes friction, slowing down the design process, and making it difficult to collate feedback and understand the status of the project.

This process can cause confusion over which data is current. It's difficult to know who has seen the design, who has contributed feedback, or who has signed off on their stage. In particular, it can be difficult to share data with collaborators outside your company firewall.

Look out for functionality that allows your team to collaborate around a single design model, which is permission controlled, and securely accessible to your extended team, with all feedback and decision-making recorded–automatically providing a clear audit trail of decisions made.

Capabilities to work on:

- Data management: Trusted, secure, file and document management.
- Design collaboration: Across multiple departments, internal and external stakeholders, and with customers, based around a single source of data.
- Change management: Define, review, approve, and automatically track changes required to the product design through your development process.

"We make leading-edge technology, so we are developing and revising our products at a fairly high rate. It is critical to know which vehicles have what revision, as well as which revision of each part is on our shelf, and which revision we want to manufacture. We have to manage this on a daily basis, and Vault helps us do that accurately."

Ryan Kolenosky, Production Engineering Supervisor, Rokion

Read more

Path to maturity

L1	Data management for all authoring departments. Managed file sharing and revision control within the department.
L2	Information access for non-authoring departments. Files are accessible to colleagues who have the correct permissions.
L3	Organization-wide collaboration on models for activity tracking, design review, and approval.
L4	Collaboration and review enabled for external stakeholders. Single source of truth for all data and processes with appropriate access controls.
L5	Data is connected and processes controlled to automatically sync with internal and external business systems (PLM, MRP, MES, ERP, etc.).

Solution:

Vault Professional

Find out more

Quality and reliability

The quality of your product can be thought of as its ability to meet a customer's expectations of reliability, conformance, and durability.

A product that does not meet expectations can lead to customer dissatisfaction and/or increased warranty claims which erode company margins.

Look for design and engineering software that offers functionality in product design, communication, simulation, testing, and prototyping.

Capabilities to work on:

- Improving conceptual modeling to rapidly iterate and scrutinize design concepts to ensure they meet requirements and user expectations.
- Automating technical documentation to communicate your design, including information for manufacturing and additional downstream uses such as operations or maintenance.
- Implementing model-based definition, to make the 3D CAD model the source authority for design engineering, coordination, and downstream stakeholders.
- Using product simulation to reduce physical prototypes by virtually testing how a component will behave during manufacture or when subjected to operating conditions.
- Investing in rapid prototyping (additive such as 3D Printing and subtractive such as CNC milling) to create physical models from digital data for review or testing.

"Delfast decided to give up on physical iterations because the accuracy of virtual simulations was over 80%."

Read more

Path to maturity

L1	Limited 3D design, 2D drawings drive manufacturing.
L2	3D design with associated 2D drawings for manufacturing. Consistent drafting standards in place. Some use of computer-aided engineering (CAE) tools for simulations such as stress, thermal, fluids, or vibration.
L3	3D design with design intent. Consistent design standards in place. Simulation is used to inform product design.
L4	Fully intelligent 3D models integrated into critical systems of the company. Simulation is integral to the approval process. Updates to design permeate into engineering and production.
L5	Agile improvement of design is enabled via real-time feedback from live product usage.

Solution:

Inventor — Find out more

Fusion 360 — Find out more

Design development agility

Product development is a significant investment period for a product or project business. Organizations that are agile in design development can benefit from improvements in the incorporation of customer insights, feedback from stakeholders, and data from testing to get higher quality products into the market while better utilizing design engineering capacity.

Look for functionality that can reduce friction for internal and external collaboration, automate your design and engineering processes and help to incorporate feedback, and customer insights.

Capabilities to work on:

- Incorporating electrical design with mechanical design to coordinate printed circuit boards (PCBs), and routing of cable harnesses in the 3D CAD model.
- Implementing design for manufacturing and assembly (DFMA) with data from machine and factory simulation, to understand better how decisions made in design development can improve operational efficiency in production.
- Exploring generative design to rapidly generate multiple pre-validated design options around your dimensional and load constraints.
- Using product simulation to reduce physical prototypes, by virtually testing how a component will behave during manufacture or when subjected to operating conditions.
- Investing in rapid prototyping (additive prototyping such as 3D printing and subtractive prototyping such as CNC milling) to create physical models from digital data for review or testing.

Continues to the next page

"We've shown our internal departments that they can create a new model in two hours instead of three weeks, depending on the complexity of the system, they can cut engineering time anywhere from 30% to 80%. That makes it much easier to meet customers' needs."

Lune Riezebos, Application Specialist in Service Delivery, GEA

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Design development agility

Path to maturity

L1 The design process is linear, sequential, disciplined, and rigid. Each member of the team has a specific remit, and only accepts work from predecessor as part of a formal hand over of responsibility. It's hard to accelerate the design process, and costly to adapt to new information when a project is underway. (Also described as 'Waterfall' project management).

L2 Team members receive access to multiple design tools and training so that they might take up the next task required, rather than waiting for a task that falls into their remit.

L3 Teams have access to a shared design model for collaboration. Team members can work concurrently on the same design and are empowered to organize and prioritize their workload based on the resources and constraints of the team.

L4 'Sprints' are implemented, short design cycles with the opportunity to revise the requirements with feedback from customers and stakeholders at the end of each sprint. The audit trail is recorded automatically, reducing time spent on meetings for coordination, reporting, and handover.

L5 Agile project management is fully implemented and supported by management with appropriate investment in technology and training.

Solution:

Inventor	Find out more
Inventor Nastran	Find out more
Factory Design Utilities	Find out more
AutoCAD Electrical 2024	Find out more
Fusion 360	Find out more

Design cycle time

Accelerating time to market gives a competitive advantage with the ability to react faster to market changes and stay one step ahead of competitors. Many organizations have a product development process encompassing functions from around the business to bring a quality product to market. Organizations want to maintain rigor and standards when bringing a product to market but within a reduced time frame.

Look for functionality in your design engineering software that automates design processes, improves cross-functional collaboration, and utilizes emerging technologies such as AI or immersed reality to improve collaboration.

Capabilities to work on:

- Using modular design to subdivide systems into modules, supporting rapid proposal creation and better communication of data for servicing.
- Using design automation to complete design tasks, within specified design rules and parameters.
- Design automation and modular design lead to product configuration allowing sales teams or even customers to customize or configure your products to suit their needs.

"Using integrated solutions like the Product Design & Manufacturing Collection allows us to reduce our design time by half. We're not repeating work, which is a big time savings. If we have standard projects that use components from the library, we can minimize engineering time as well. On top of that, we're eliminating the risk of losing time correcting errors because we're all using accurate data."

Assaad Hani, Business Analyst, Technica International

Read more

Path to maturity

L1	Reusable templates.
L2	Ad-hoc use of manually triggered automation scripts (custom menus).
L3	Introduction of engineering rules to drive design. Interconnecting data from multiple applications (including third party).
L4	Full design automation triggering actions across multiple applications. Full enterprise integration for automation (ERP/MRP/PLM etc.).

Solution:

Inventor	**Find out more**
Vault PLM	**Find out more**
AUTODESK Platform Services	**Find out more**

3 key qualities of design engineering software

That's a lot to consider. All the key points mentioned share three common denominators that will help you choose your software for design and engineering.

They digitalize processes.

Design engineering doesn't happen in isolation. The most successful designs exceed customer expectations and are enhanced by the culmination of knowledge and experience from your business and supply chain. Friction in the collaboration process can waste time, and opportunities to create better products can be missed.

By digitally integrating and synchronizing processes across disciplines, businesses can remove friction around collaboration, and implement agile workflows to improve innovation and increase customer satisfaction.

They put data at the center

At the heart of a mature design engineering process is a single, centrally managed, permission-controlled data source, which informs and coordinates between disciplines and provides the starting point for downstream workflows.

By providing access to correct and current data to all stakeholders, at all stages of the product lifecycle, businesses can benefit from data insights to make better decisions sooner, improving operational efficiency and reducing time to market.

They provide people with new ways of working.

Even the best design teams have limited capacity. Hiring and retaining talent is a problem for businesses all over. Simply expecting your design team to work faster can result in reduced quality–meaning less successful products.

Utilizing automation, and artificial intelligence (AI) tools such as generative design, design engineers can reduce non-value add tasks, increasing their capacity to focus on developing creative solutions to your customers' most pressing problems, while maintaining the quality of their processes.

Why Autodesk?

For designers and engineers who develop commercial products, industrial machinery, and equipment, Autodesk provide comprehensive, purpose-built software to support your design and engineering workflows, automate your busy work, and connect your data and processes.

Autodesk design and manufacturing solutions flex to your preferences, integrate with your business solutions, and connect stakeholders into an integrated product development digital ecosystem.

Product & Machine design software

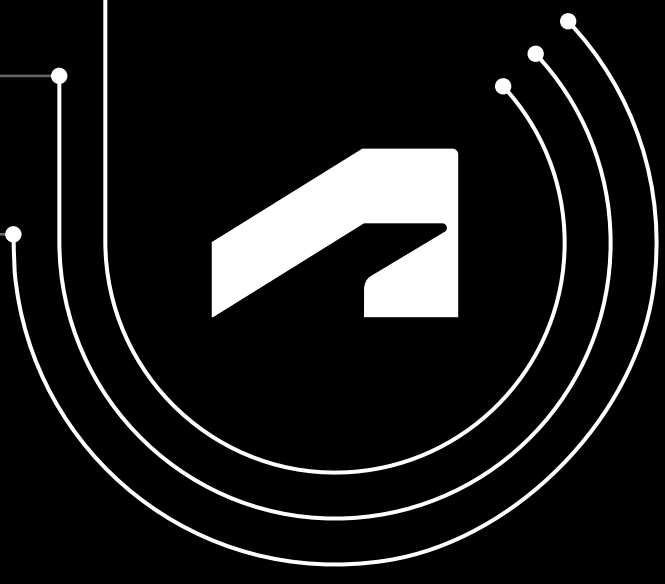
- Product design and manufacturing collection
- Inventor
- AutoCAD
- Vault
- Fusion 360

Autodesk design technology is:

Efficient. Design workflows minimize repetitive tasks and disconnected processes that slow you down so you can get to work on the things that matter most.

Integrated. Collaboration is seamless for the entire project team, no matter what tools and file types they're using.

Mature. Industry-leading design engineering software is trusted by our customers, and enhanced based on user feedback.



Why leading companies partner with Autodesk

"With Autodesk's virtual manufacturing tools, the company has achieved a significant reduction of around 70% of the costs caused by process incidents, and start-up times have been drastically shortened."

Javier Molina, Engineering Director, Frumecar

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"Thanks to the digital way of working, the exchange with development and suppliers is much faster and more flexible. We get to the finished product very quickly."

Marlon Wagner, Head of Engineering,
Premium Mounting Technologies

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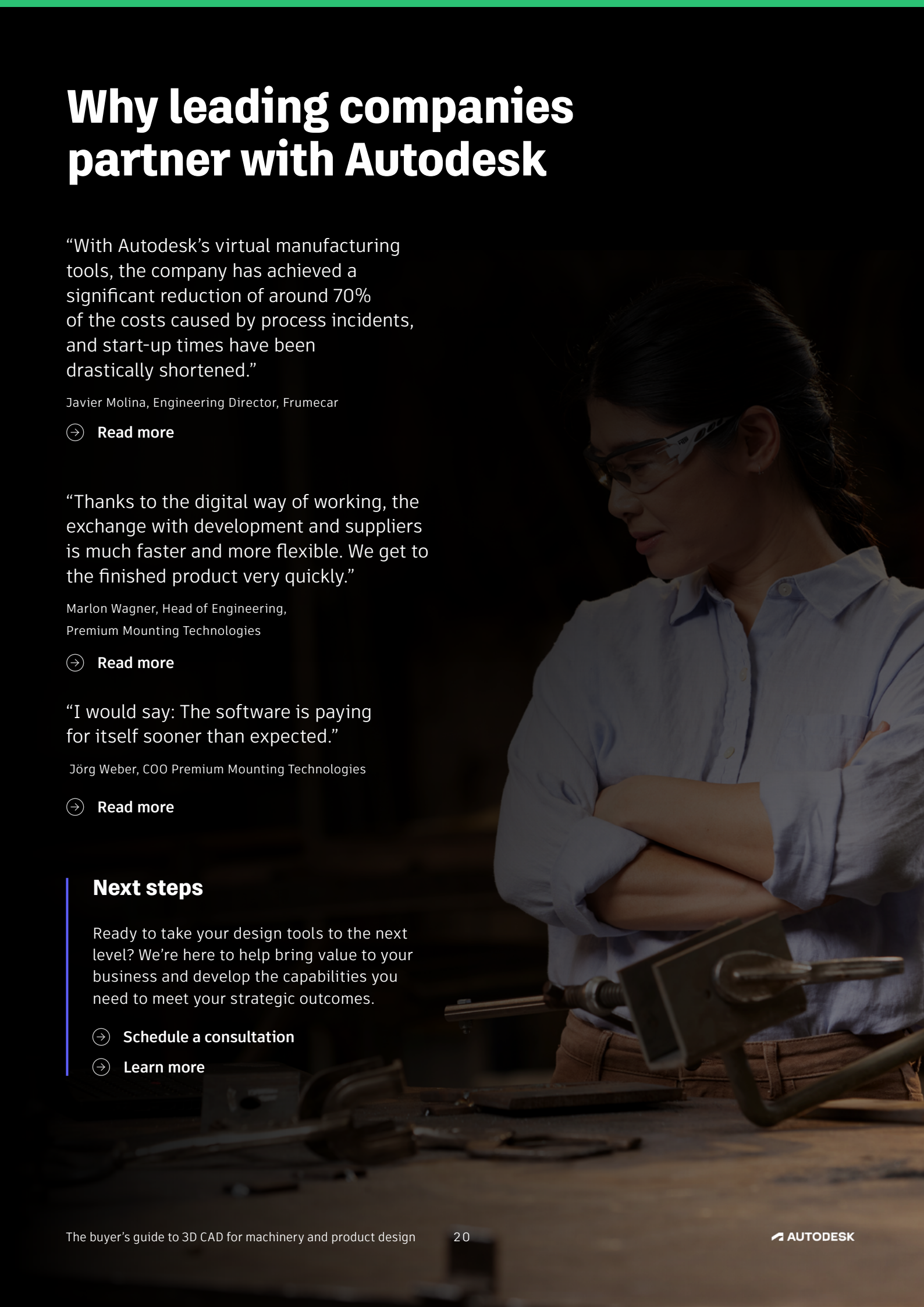
"I would say: The software is paying for itself sooner than expected."

Jörg Weber, COO Premium Mounting Technologies

Read more



Next steps

Ready to take your design tools to the next level? We're here to help bring value to your business and develop the capabilities you need to meet your strategic outcomes.

Schedule a consultation

Learn more