

Trends in manufacturing software usage



Trends in manufacturing software usage

In the report of “Six levels of automation in component manufacturing”, developed by our Sandvik Manufacturing Solutions, and EY-Parthenon teams, a framework was introduced to describe present and future automation levels, along with the associated challenges and enablers.

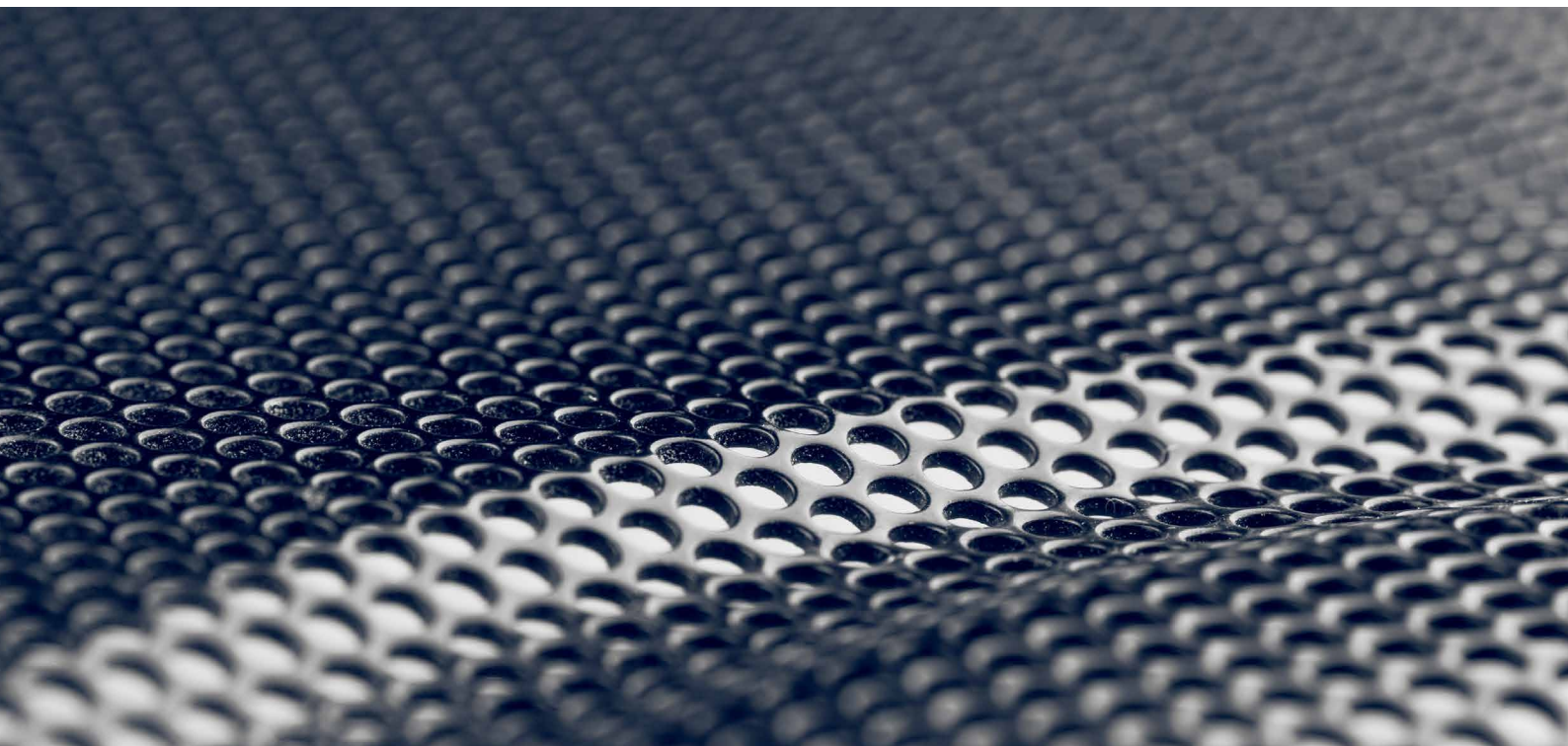
One of the findings from the study was that as component manufacturers increasingly automate their production, the need to integrate the manufacturing process becomes more important. For physical products, this means achieving a highly automated production flow — from raw material inventory through each discrete step of the production line, all the way to finished goods and shipping. An integrated digital thread that follows the product in real time significantly enhances the ability to optimize processes, make timely corrections and incorporate learnings into subsequent production batches.

However, while some companies are making progress toward these goals, the level of integration and automation is not uniform across all operations. Component manufacturers are automating their sites and workflows, but most do not yet have a complete feedback loop in place. Automation tends to be more advanced in certain areas of the shop floor, while other parts remain more manual.

The main drivers behind this push for increased automation are the higher demands on component complexity and a shortage of skilled labor. The rapid advancement of manufacturing technologies and software, which increasingly allows seamless integration between systems, is making it possible to create continuous data flows. These flows support the gradual move toward fully automated production, complete with real-time feedback and data analysis that links back to the original design drawings.

Given the fast pace of these changes, we sought to gain deeper insights into the priorities of users of manufacturing software solutions.

Sandvik Manufacturing Solutions, in collaboration with EY-Parthenon teams, surveyed approximately 350 component manufacturers about their manufacturing challenges, automation journeys and preferences for manufacturing software. We explored key questions such as: What are the key criteria when selecting manufacturing software? Where are the greatest benefits of integrating different solutions in turnkey or open ecosystems? How do component manufacturers prefer to access and purchase software? How can manufacturing be simplified by using software? These are some of the pivotal questions addressed in this second part of our study, where we delve into how manufacturing companies are using advanced software as an enabler for automation.



About the study

341

Survey respondents

31

In-depth interviews

Company size

28%

<100 FTEs

29%

100-500 FTEs

59%

in Europe

41%

in North America

29%

500-5000 FTEs

14%

>5000 FTEs

End-user industry coverage

Aerospace | Die and mold | Energy | Automotive | Space and defense
General engineering | Medical



Key criteria when selecting manufacturing software

When component manufacturers evaluate manufacturing software, key purchasing criteria include quality, ease of use and innovative technology. The most important criterion is the quality and accuracy of the software results. Ultimately, manufacturing software is used to increase quality and efficiency, as deficiencies in the model can be very costly, e.g., causing rework and scrap. The second most important criterion is the quality of service and support, which emphasizes customers' need for timely, tailored and insightful advice and support for upskilling their employees. The lack of skilled staff is a major challenge for component manufacturers, as highlighted in the first part of our study: *Six levels of automation in component manufacturing*. Similarly, the third most important criterion is ease of use, which underscores the need for user-friendly solutions to shorten the learning curve, as manufacturers struggle to find staff with high proficiency levels in the software.

In essence, component manufacturers are seeking robust, reliable software solutions that are not only accurate and effective but also supported by strong service and designed with the user in mind.

The least important criteria for selecting manufacturing software, according to our study, are brand reputation, competitive pricing and the enablement of sustainable manufacturing. There are several possible explanations for why these factors rank lower.

Regarding brand reputation, customers understand that there are numerous capable software providers for tools like computer-aided design (CAD), computer-aided manufacturing (CAM), and product life cycle management (PLM). As a

result, they prioritize aligning software capabilities with their specific needs and existing skills, rather than relying on brand recognition as a "safe choice."

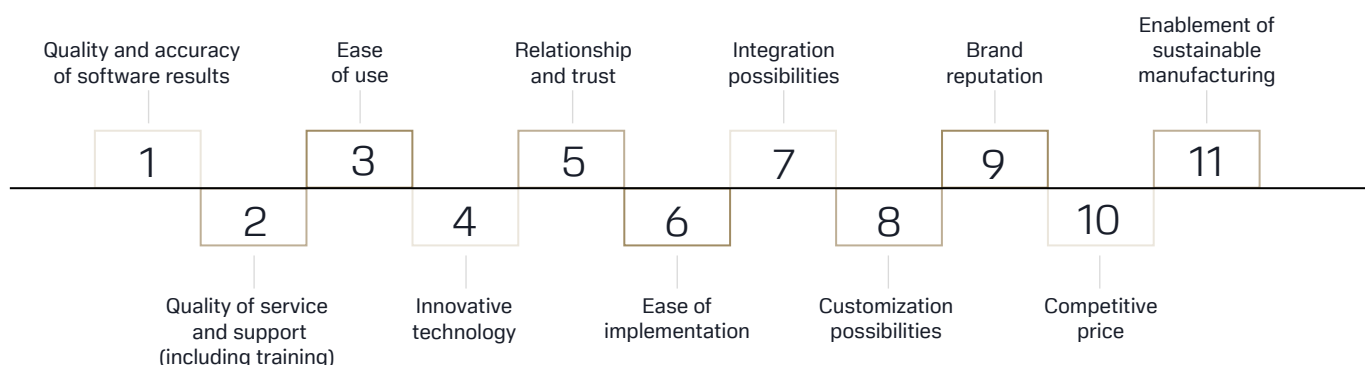
Price is also less significant because other factors, such as quality, service and ease of use, play a larger role in the overall business case. Companies are more likely to invest in software that delivers long-term value rather than simply opting for the lowest-cost solution.

When it comes to the enablement of sustainable manufacturing, our study indicates that sustainability is relatively more important to highly automated manufacturers. In contrast, the broader cohort tends to prioritize more immediate operational needs, shifting the focus to other selection criteria.

Interestingly, the relative importance of these purchasing criteria shows high consistency across company size and geography. However, there are some regional differences. North American companies, for example, place slightly more emphasis on ease of use and ease of implementation compared to their European counterparts. Conversely, European companies prioritize innovative technology, as well as integration and customization possibilities, more highly.

This variation could be due to the generally higher levels of automation in Europe, where companies also face increasing complexity in manufactured parts and rapidly changing customer demands. In North America, the more pronounced shortage of skilled labor may explain the stronger focus on ease of use and implementation, as these features help bridge the skills gap.

When evaluating manufacturing software, what are the key purchasing criteria?



”Ease of use is most important, as even the best piece of technology is worthless if I am not able to use it.”

Supervisor CNC manufacturing, aerospace part manufacturer, US

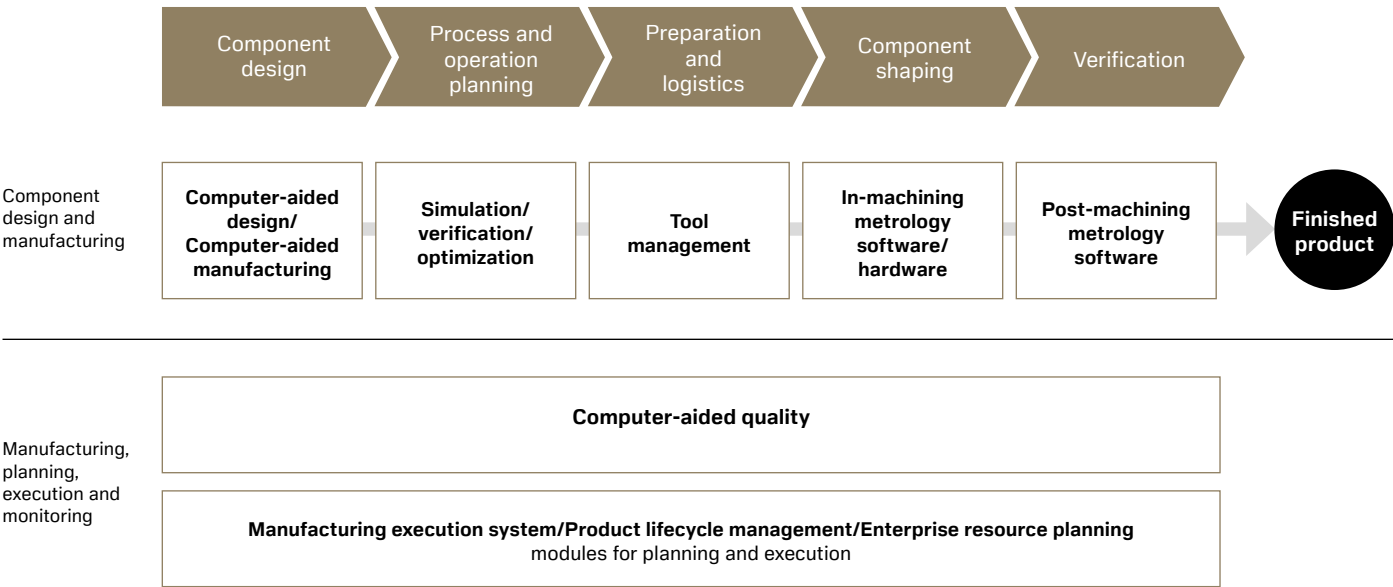
As mentioned above, when companies’ desire and ability to automate increase, the importance of software support and seamlessly integrated data flows also rises. Fully integrating the entire component manufacturing process into one digital twin thread, with feedback loops for self-correcting adjustments, may be the ultimate goal for many. However, the path to achieving this varies for each company, and every step must be justified by a business case. Depending on the type and size

of manufacturing, this may not be a realistic or even necessary goal for some. As a result, the priorities and pace toward more integrated manufacturing data will vary by company. To better understand these priorities, we assessed which software solutions are most commonly used, and which integrations are deemed most important. We also asked component manufacturers to what extent they prefer to acquire solutions from multiple vendors or to seek bundled or turnkey solutions.



Commonly used manufacturing software

Even though there are many different software solutions supporting the component manufacturing process, this study focuses on the following solutions:



The use of these various tools varies by company size; in general, adoption increases with the size of the manufacturer. Usage also varies depending on the type of manufacturing. For example, advanced manufacturing companies, particularly those selling into sectors such as aerospace, have the highest usage of CAM and simulation, verification and optimization (SVO) software.

While the general usage of these software solutions is high, the sheer number of different solutions makes it difficult to pass critical manufacturing information from one stage to the next, thereby complicating full data utilization. When embarking on the automation journey, what are the most valuable integrations manufacturers should prioritize?



Importance of software integrations

Component manufacturers rate integrations between CAM software and simulation, verification and optimization software as the most critical, followed closely by PLM/CAD-to-CAM integration. These two are vital for creating a streamlined workflow that closely aligns design, simulation and production processes. While these integrations are already valued for their effectiveness, there is still significant potential for them to become even more seamless, further enhancing efficiency and reducing errors.

Integration between CAM and tool management ranks third, highlighting the importance of optimizing tool paths using robust tool libraries for efficient machining processes. Specifically, physics-based cutter path strategies, for example, depend on

accurate tool data to maximize material removal rates. CAM systems that effectively utilize tool data to interact with CNC machines can better support digital twin and digital thread strategies. Furthermore, as more complex machine tools are adopted, the need for precise tool data becomes even more critical to ensure that CAM systems can accurately simulate and verify the machining processes.

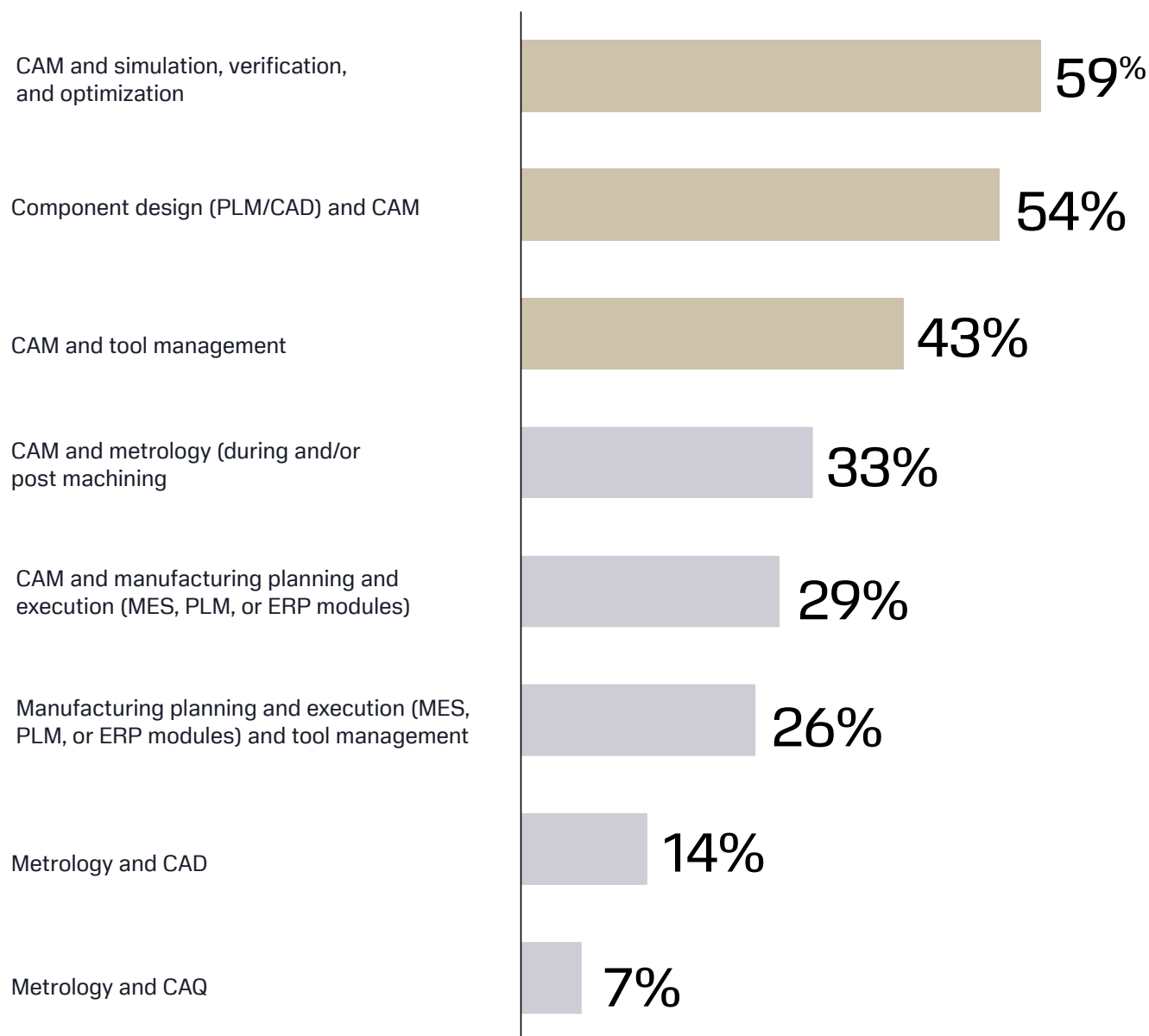
Manufacturers emphasize that well-functioning, robust integrations are essential. The opportunity to further enhance these connections is key, as poor or incomplete integrations can lead to inefficiencies and user frustration, underscoring the need for continued improvement in this area.



"We do not have any integrations in place. The different providers of solutions are keeping things separate. CAD and CAM integration is definitely the most important one."

Mill programmer lead, general manufacturer, US

Which of the following integrations do you consider the most important?*



"We are considering a PLM system to manage our data and previous designs to enable improved connectivity between software, which is currently done manually."

Manufacturing engineer, tool manufacturer, Canada

*Maximum three answers selected by each respondent

When it comes to the benefits of already integrated solutions, 65% of component manufacturers prefer to buy bundled solutions, while the remaining 35% prefer to separately buy the best software for specific applications from different providers. Smaller component manufacturers tend to favor bundled solutions more than larger ones. Larger companies typically have more in-house expertise and unique use cases,

which is one reason why they prefer customized integrations. Additionally, implementing a bundled solution may be relatively more costly for these larger companies. The main reasons for choosing bundled solutions are if the provider can showcase a superior ease of use, seamless integrations and a clear business case.

To integrate software, do you prefer to buy a turnkey/bundled solution or connect separate software from different providers?



65%

Turnkey/bundled solution (combination of two or more types of software sold together as a package from one provider)

"I prefer purchasing bundled software as I can have a single point of contact, making it easier for a smaller organization like ours to manage and maintain license agreements and seats for our software."

Manufacturing engineer, tool manufacturer, Canada



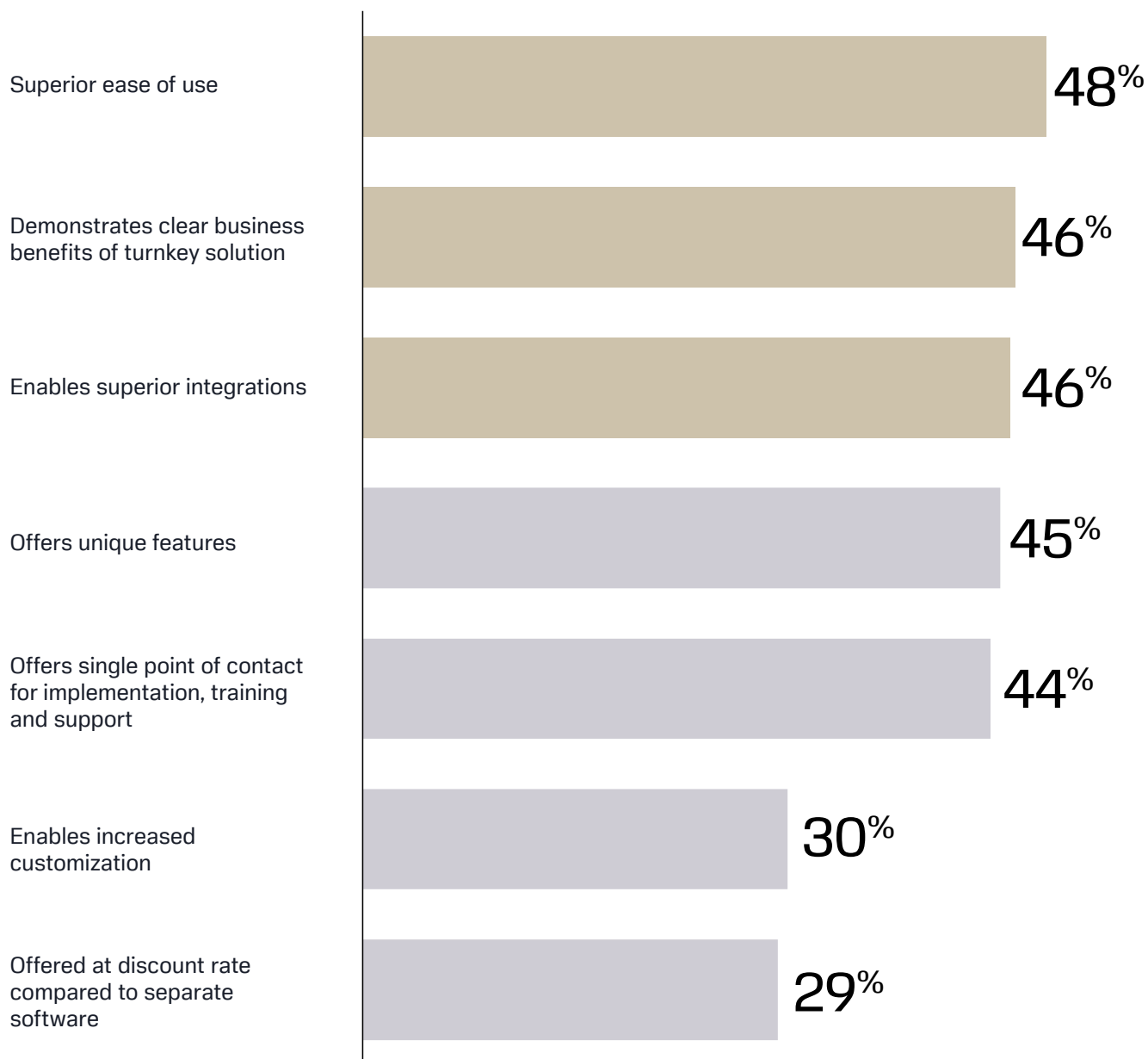
35%

Connecting separate software from different providers

"Historically, we have switched software providers to increase integrations between our solutions and become more autonomous."

CEO, component manufacturer, Switzerland

What makes you buy a turnkey/bundled manufacturing solution instead of separate software?*



*Maximum three answers selected by each respondent

Delivery and hosting preferences

Cloud hosting of software delivered as SaaS is steadily increasing. Compared to on-premise perpetual license software, cloud-based hosting makes it easier for providers to deliver, maintain and scale solutions. However, when asking component manufacturers, 55% still prefer a perpetual license model, while 45% favor SaaS. Similarly, the majority of respondents (41%) prefer on-premise hosting due to security concerns with publicly hosted cloud solutions. Another 29% prefer hybrid hosting, and 19% opt for private cloud. Only 11% of component manufacturers prefer public cloud solutions. When comparing different sizes of component manufacturers, larger companies show a greater preference for cloud hosting, while smaller players favor on-premise hosting.

There is a significant opportunity to offer flexibility in deployment options.

Vendors should provide the ability to deploy software as a service while also allowing customers to choose their preferred environments, whether that be in a customer cloud or on a traditional server. Modern cloud technologies make this possible. As a result, customers can benefit from faster deployments, simplified upgrades and the ability to focus on creativity and business improvements rather than managing IT resources, often with fewer cybersecurity capabilities.

These numbers indicate that component manufacturers are more conservative in their view of cloud hosting and SaaS payment models (which can still be deployed and managed in a customer environment but charged via subscription), compared to other industries and types of software, such as CRM and HR systems.

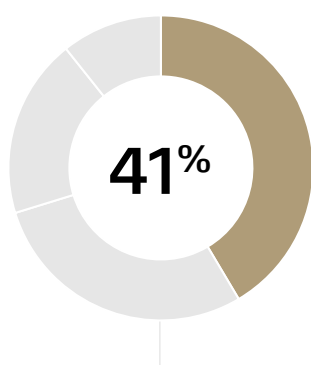
There are several reasons for this, including:

- Manufacturing software manages core processes where any downtime could be very costly. As a result, there is reluctance to change either the software or the delivery model.
- Many component manufacturers serve regulated industries, such as defense, where there are restrictions on using cloud-based solutions for core manufacturing process.
- The preference for an on-premise license model is partly connected to hosting preferences, as there is a large overlap between the two.

”We store everything on a local server. It is not the preferred way to do it, but I believe anyone working within the defense industry operates that way. We cannot really use cloud-based servers due to privacy concerns.”

Engineering manager, machined parts manufacturer, US

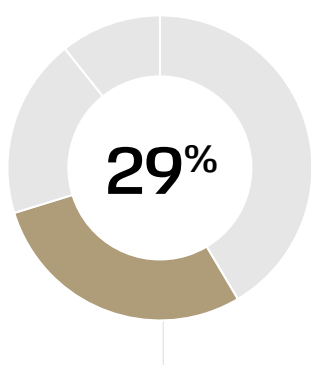
How do you prefer to host manufacturing software?



On premise

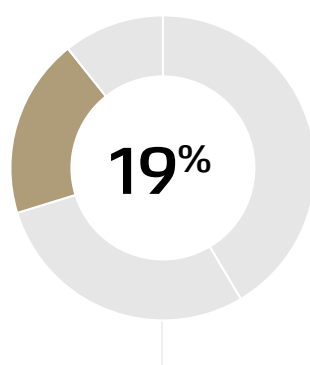
Infrastructure hosted and managed with organizations premises

62% of respondents selecting on-premise also prefer the perpetual model



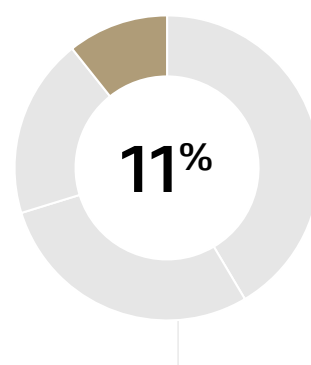
Hybrid hosting

A combination of on premise, private and public cloud



Private cloud

Computing resources and services managed internally or through third party



Public cloud

Computing resources and services through third party, accessible by multiple organizations

How do you prefer to deploy and pay for manufacturing software?

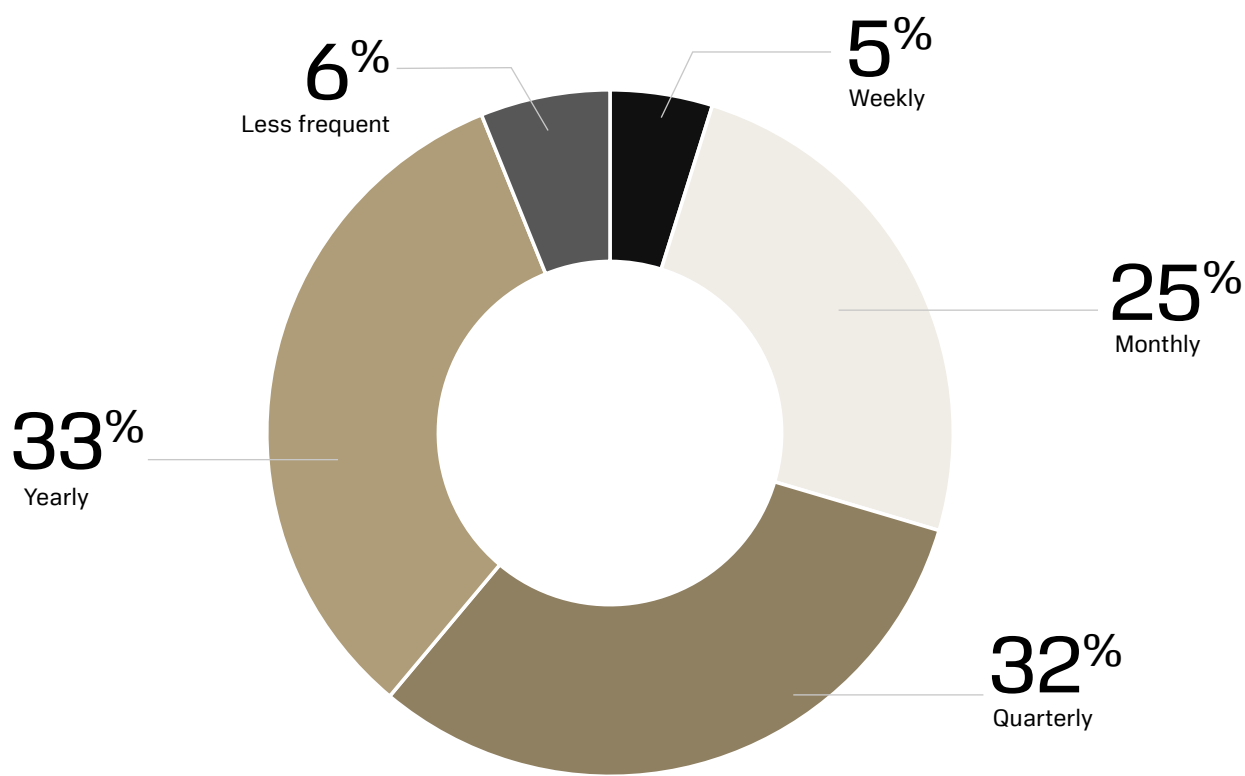
55%

Perpetual model (one-time license payment and annual service/maintenance fees)

45%

SaaS³ model (subscription payment for continuous upgrades and support access)

How often do you prefer to install manufacturing software updates?



When it comes to the frequency of software updates, preferences are relatively evenly distributed among yearly, quarterly and monthly intervals. The preferences are similar across different company sizes, with the main difference being that 34% of large companies prefer monthly updates. Large companies are also the most open to cloud-based solutions

and a SaaS payment model. They also rate themselves the highest regarding the usage of various manufacturing software. One explanation for this could be that they benefit from the scale of manufacturing software without facing the complexity encountered by some enterprise-sized companies.

AI use cases

The use of artificial intelligence (AI) is rapidly increasing in all areas of society. From professional to everyday life, AI functionality is quickly being built into the products and services we use.

For component manufacturers in our study, AI functionality in feature recognition of CAD files and guidance in CAD designing and CAM programming are considered the top two use cases. Ultimately, these complex key processes within component design are precisely where AI-enabled software can deliver tremendous value, provided that the algorithms have access to a robust dataset composed of both actual and synthetic data to enhance their capabilities. The business rationale for these two use cases is very strong: Feature recognition will

allow manufacturers to respond quicker to quotation requests, potentially winning more business, while AI in CAD/CAM could lower costs and enable quicker time-to-market.

Further, AI-enabled detection of quality deviation is considered the third most important use case, as achieving first-time right production and reducing scrap have a significant cost impact for component manufacturers. Lastly, many manufacturers consider AI as a support tool for day-to-day tasks, such as advanced assistants, which aligns with the development of generative AI tools. Sandvik recently released a copilot for manufacturing with the ambition of simplifying production processes, improving customer assistance, and decreasing the learning curve for end users.

What do you consider to be the primary use cases for AI enabled functionalities?

1

Feature
recognition of
CAD files

2

Guidance/
recommendation in
CAD designing/CAM
programming

3

Automated detection
of quality deviations in
inspection

4

General use of AI
to solve day-to-day
tasks, e.g., advanced
assistants

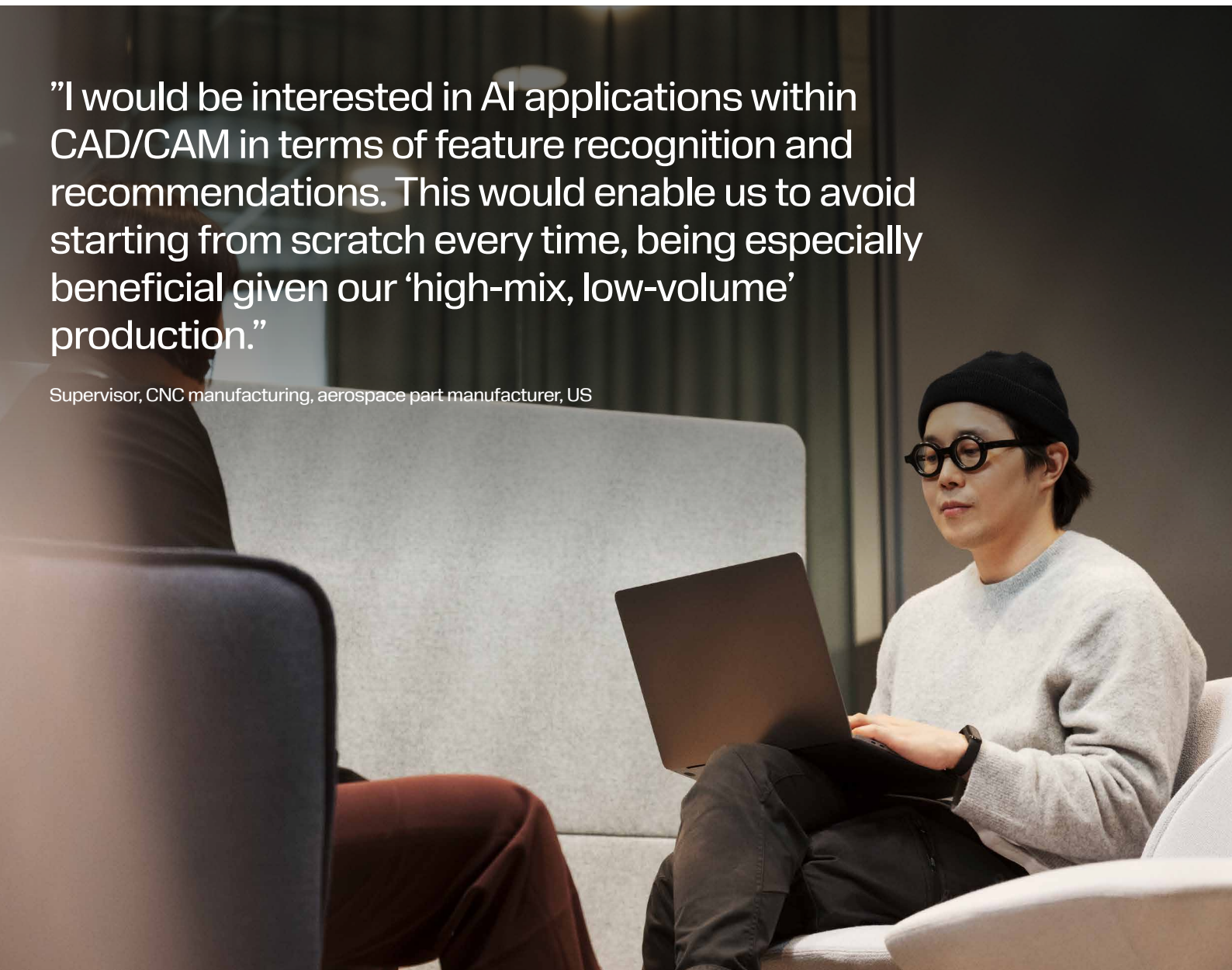
Companies that successfully integrate AI into their manufacturing software solutions, such as CAM, are likely to gain a competitive advantage. The ability to offer AI-enhanced CAM software that improves efficiency, reduces costs, and increases flexibility will be a key differentiator in the market. Our study predicts that AI will become increasingly integrated into manufacturing software over the next few years. As manufacturers continue to seek more efficient and automated processes, AI will play a critical role in enhancing CAM capabilities, particularly in areas like toolpath optimization, machine learning for predictive maintenance and real-time decision-making on the shop floor. As seen in other industries, such as GitHub Copilot, we expect a productivity increase,

a reduction in the time spent searching for and gathering information, and avoidance of obsolescence due to productivity shifts. There is also a shift in employee expectations, with decreased learning curves, fewer repetitive tasks and reduced time spent on programming jobs.

While Industry 5.0, is still being defined, humans will continue to be in the loop. However, generative AI will infuse a generational shift in how component manufacturers can compete, increase productivity, and change their ways of working, while also infusing intelligence into the complex system landscape in manufacturing.

"I would be interested in AI applications within CAD/CAM in terms of feature recognition and recommendations. This would enable us to avoid starting from scratch every time, being especially beneficial given our 'high-mix, low-volume' production."

Supervisor, CNC manufacturing, aerospace part manufacturer, US



Summary

Based on our study of component manufacturers' software use, we can summarize the following:

1. Integrations are important where maturity is high (between CAD and CAM, between CAM and simulation, verification and optimization). Responses regarding how software and integration should function are tightly linked to the two overarching production challenges: customer requirements and the lack of skilled labor.
2. Bundled software is preferred where the benefits can be clearly visualized, including business cases and superior integrations.
3. AI will have a big impact in the coming years, with key use cases for component manufacturers, including feature recognition of CAD designs and guidance in CAD design and CAM programming, thereby decreasing the learning curve and improving customer support.
4. The preference for on-premises hosting is heightened in regulated industries, such as defense, where strict privacy and security requirements limit the use of cloud-based solutions. This currently presents a barrier to broader cloud adoption.
5. The journey to a true SaaS environment is fairly long, with approximately one-fourth of respondents still preferring an on-premises solution with a perpetual licensing model. Even though the openness to subscription-based pricing is relatively high (at 45%), only one in 10 prefers a public cloud software delivery model. Component manufacturers' views on how to run their manufacturing software are thus more conservative than those in many other industries, as well as for other types of software, such as CRM and HR.
6. There is a significant opportunity for software vendors to offer flexible deployment options — such as customer-controlled cloud environments, hybrid models and traditional on-premises setups. However, this should be coupled with training and education to help customers better understand modern cloud options, including how deploying in a customer-managed cloud can still align with SaaS benefits.





SANDVIK