

Tech-Clarity

Making To-Order Product Configuration Profitable

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Product Customization is Booming, Are Profits?

Increasing Demand for Configured Products

Our 2016 Driving Engineer-to-Order Differentiation and Profitability survey showed that most manufacturers were already increasing product customization and 58% expected it to grow in the following years.¹ Time has passed, the results are in, and the predictions held true. The majority of manufacturers have continued to increase customization in recent years. Looking to the future, 94% of respondents to this year's survey say it will continue to grow over the next five years.

The Pros and Cons of To-Order

Given the growth, it's important to recognize that configuring customized products is both compelling and challenging. Selling to-order products brings significant top-line benefits. However, configuration challenges can lead to business impacts that quickly erode profit margins.

Best Practices to Drive Profitability

How can manufacturers take advantage of the benefits of product customization without suffering from decreased profitability? We gathered responses from 234 companies involved with to-order products and interviewed two leading manufacturers to find out.





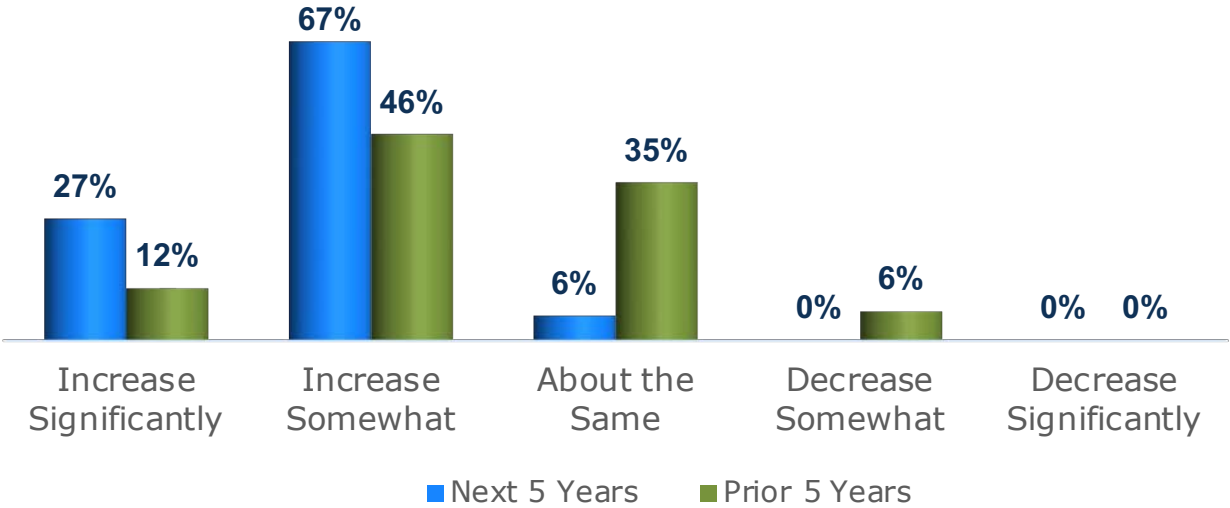
To-Order Continues to Expand

Product Configuration Continues to Grow

Selling to-order products is not new, but it is evolving. One way it's changing is an increase in the amount of configuration and customization in companies' products. Our research over the years has continuously predicted growth in product configurability, and it appears the appetite for customization continues to expand.

Today, over one-half of respondents report that the amount of configuration / customization in their products grew over the last five years. Further, an overwhelming 94% say it will further increase in the next five years! Perhaps just as tellingly, not a single company said they expect it to decrease, even somewhat, in the next five. Selling and producing to-order products is the reality for manufacturers, and there is no end in sight.

CHANGE IN AMOUNT OF PRODUCT CONFIGURATION



What Drives Customization?

Change Revenue Drives Customization

Given the growth of customization, we wanted to understand the primary reasons companies offer to-order products. The short answer is product sales. Three-quarters of companies say they sell to-order products to differentiate from their competition. In addition, two-thirds do it to command higher prices, perhaps because they can better meet customer needs. This driver grew from only 28% in the prior survey. It's important to note that these benefits are not exclusive, and many companies reported both as drivers.

Some Companies Don't See Another Option

Historically, our surveys show that many companies feel they must configure products. It's just the nature of their industry. Typically, between one-third and one-half of companies in our studies report this.² In this study, fewer companies selected that option.

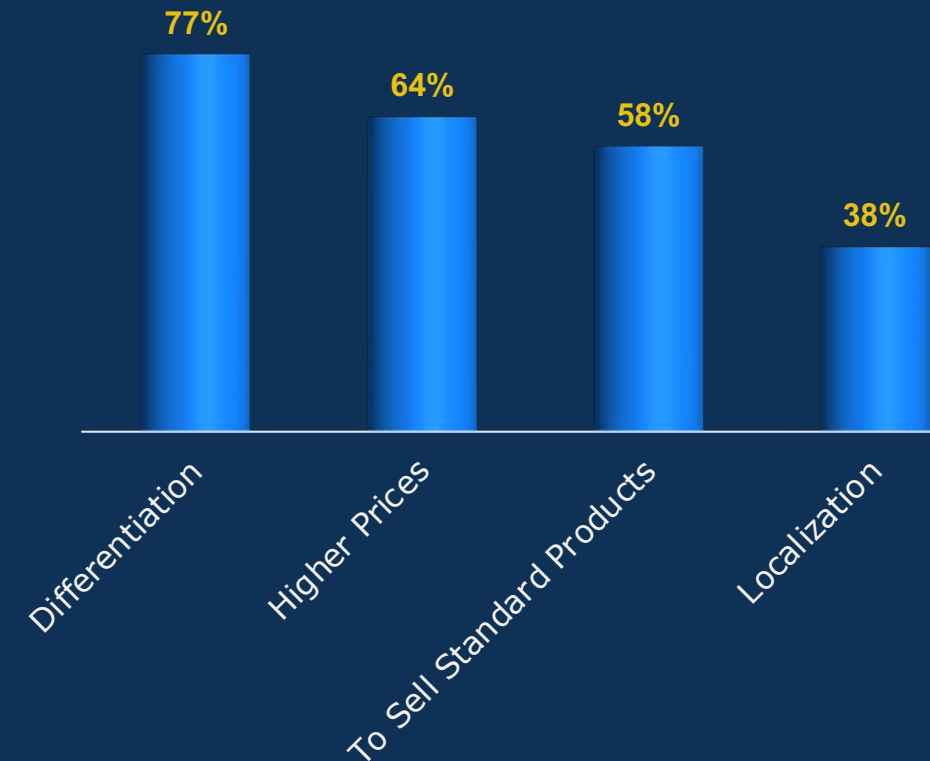
However, more than one-half say that they feel required to sell to-order products in order to sell their standard products. This may account for the discrepancy because selling configured products to maintain the ability to sell standard products wasn't an answer choice in the earlier studies. Protecting sales may be why they said it's just the nature of their industry. While an industry may not require all products to be custom, some customers may require suppliers to customize products to their needs to maintain their status as a preferred supplier.

Localizing Products is also a Common Driver

Configuring products to order can also help companies define a product once and tailor it to specific market needs for an order. Over one-third of respondents report selling to-order products to allow them to localize their offerings for different markets or geographies, similar to the earlier survey.



TO-ORDER BUSINESS DRIVERS



TO-ORDER DIFFERENTIATORS



Differentiating To-Order Products

Better Meeting Customer Needs

Given the prevalence of customization, how can manufacturers differentiate their to-order products from those of their competitors?

The overwhelming answer is to better meet customer needs, as reported by about three-quarters of companies. In addition, about two-thirds differentiate through their level of product customization. Manufacturers that are flexible enough to satisfy customers' needs are more likely to win the business, assuming all else is equal. ***"One of our key advantages is that our products are not cookie cutter. Our custom engineering and manufacturing capabilities enable us to deliver tailored solutions,"*** explains Stone Kane, a business analyst at Schumacher Elevator Company. ***"Customization allows us to be competitive."***

Differentiate Through Customer Experience

As mentioned above, meeting customer needs will likely lead to the order if all other things are equal. However, this is rarely the case. Another essential factor is offering a compelling configuration experience. For example, about one-half of responding

companies report developing quotes rapidly is important to differentiate. This has more than doubled since the previous survey. Customer expectations have gotten higher as manufacturers have improved their product configuration capabilities.

Differentiate Through Efficient Operations

Efficient configuration execution is also essential. One of the primary ways that companies compete by operating efficiently is by offering a competitive price. One-half of companies report price as a way they differentiate and the importance of cost as a differentiator has significantly increased. ***"Speed to market is huge, and newer customers just want the highest value product,"*** says Ingersoll Rand's Geoff Leach.

This is another sign that customer expectations have increased, even for highly configured items. This may be due to increased configuration maturity and fiercer global competition in the manufacturing industry. Beyond cost, effective operations can also help deliver service excellence and product reliability, which are also differentiators.

Profiting from To-Order Products

Deliver Rapidly on Customer Expectations

Capturing orders through differentiation is only valuable if that business is profitable. Companies must do many things right to make money from configured products. These include setting and meeting expectations created by quotes and effectively executing configured orders.

Accurately Predict Cost, Leadtime, and Performance

Two-thirds of responding companies say that offering accurate quotes is one of the most impactful factors driving the profitability of their to-order products. Over one-half also report both engineering and delivery leadtimes as drivers. In addition, about one-half report meeting planned performance drives profits.

Increased emphasis on price differentiation puts stress on the ability to predict product costs. Without accurate predictions, manufacturers must cushion their price and risk losing the sale or keep prices tight and risk selling unprofitable deals. The same is true for promised leadtimes.

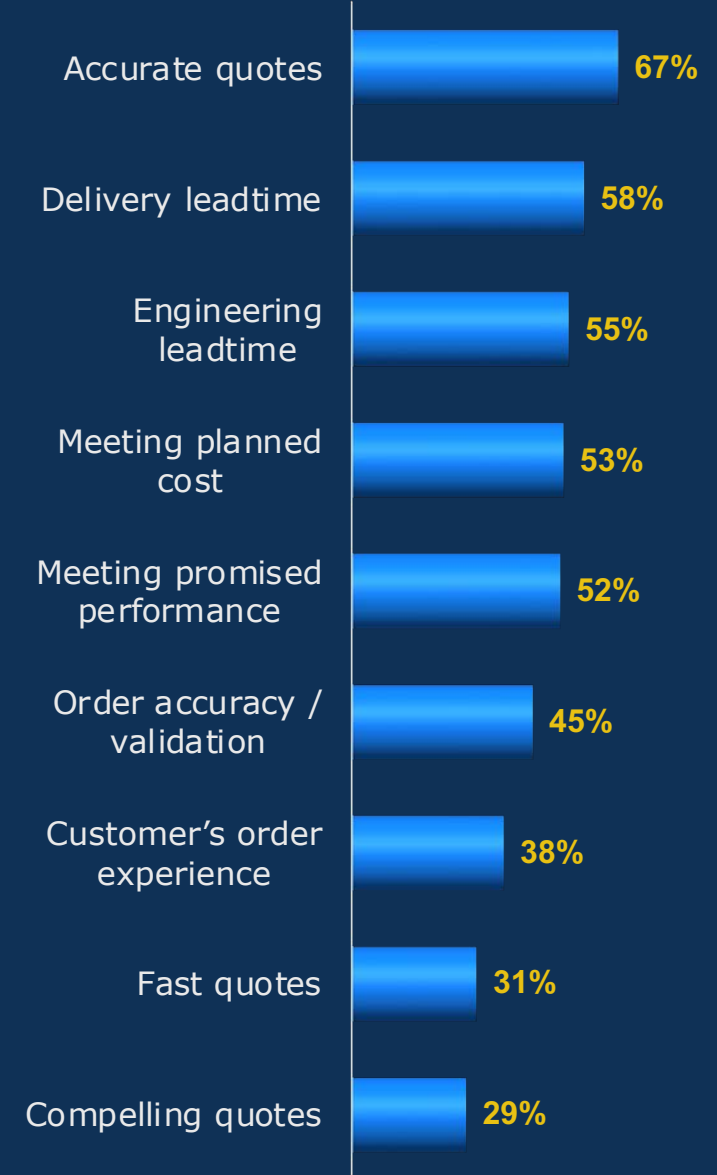
To compete, manufacturers must be able to set – and meet – customer expectations. This goes well beyond capturing order parameters.

Offer a Compelling Order Experience

Beyond that, companies must ensure an effective order process. Almost one-half of respondents say that order accuracy impacts profitability, and well over one-third report that the ease and speed of their customer's order experience drives profits. ***“Speed and accuracy are critical factors that help us win more work,”*** says Schumacher Elevator’s Kane.

Getting the order experience right drives profitability, not just competitive differentiation. Of note, companies are less than one-half as likely to report that fast quotes drive profits as accurate quotes do, although rapid quotation is essential to differentiation. It appears that it's more important to get quotes right than deliver them fast to make money, although both are important to differentiate.

TO-ORDER PROFITABILITY DRIVERS



Evolving Customization Strategies

The Bar on Configuration is Higher

The challenges companies face designing, selling, and producing to-order products are significant, and the bar for selling and delivering them is higher than ever. How are companies responding?

Make Customization More Standard

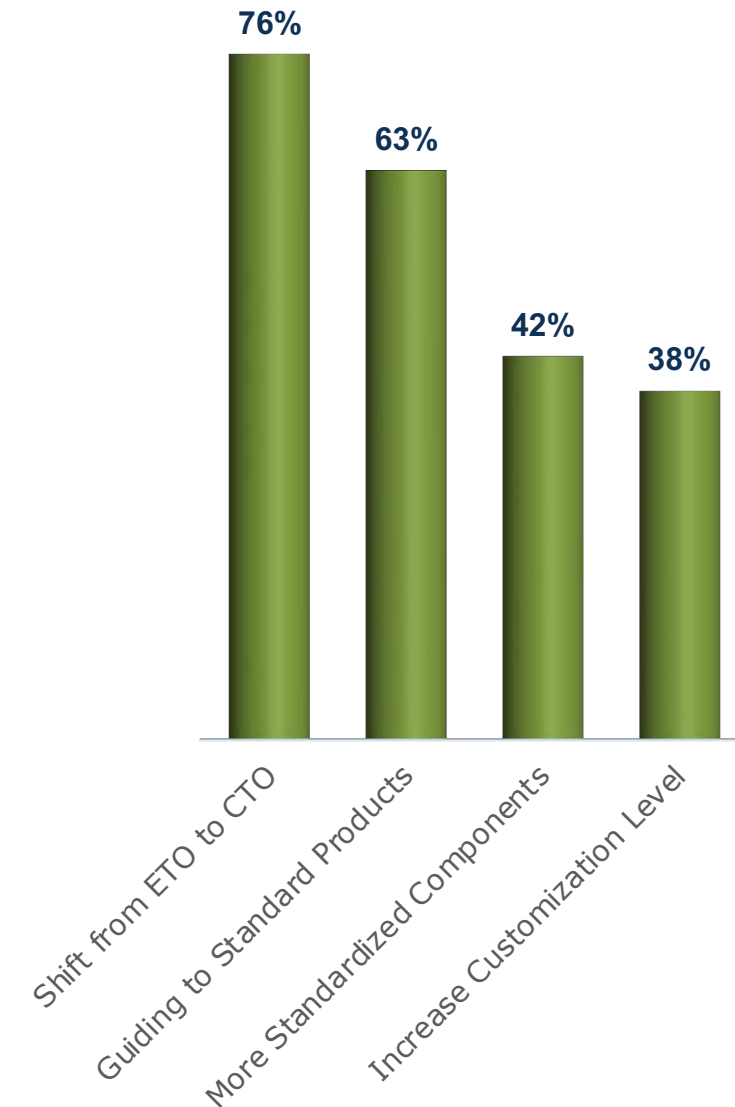
To-order product strategies are shifting to help companies simultaneously increase customization and lower configured order complexity. They want to offer customization, but they want it to be less burdensome. Several of the most common strategies aim to meet customer needs in a more standard or configure-to-order (CTO) approach instead of an engineer-to-order (ETO) way to reduce cost, time, and the chance to introduce errors. Around three-quarters of companies are shifting products from ETO to more pre-engineered, modular CTO products. **"Customers want it faster. CTO, taking out the ETO element, is helping us get there,"** shares Geoff Leach of Ingersoll Rand. **"Engineering is expensive, and CTO reduces our engineering hours,"** he adds.

A related approach, reported by almost two-thirds of respondents, is to steer customers toward more standard products through guided selling. This allows companies to meet customized needs but do so with more standard configurations. Another approach that decreases complexity, reported by 42% of companies, is selling products that are ETO at the systems level but basing them on more standard / CTO components.

Maintain the Ability to Meet Customer Needs

Clearly, manufacturers are pursuing more than one of these approaches. They are complementary and signify a desire to minimize custom engineering if possible while recognizing the reality that meeting customer needs drives differentiation. It's important to note that this isn't counter to the goal of meeting customer needs, as over one-third are trying to increase customization. The idea is to pursue custom products with the ease of standard products.

TO-ORDER CONFIGURATION STRATEGIES

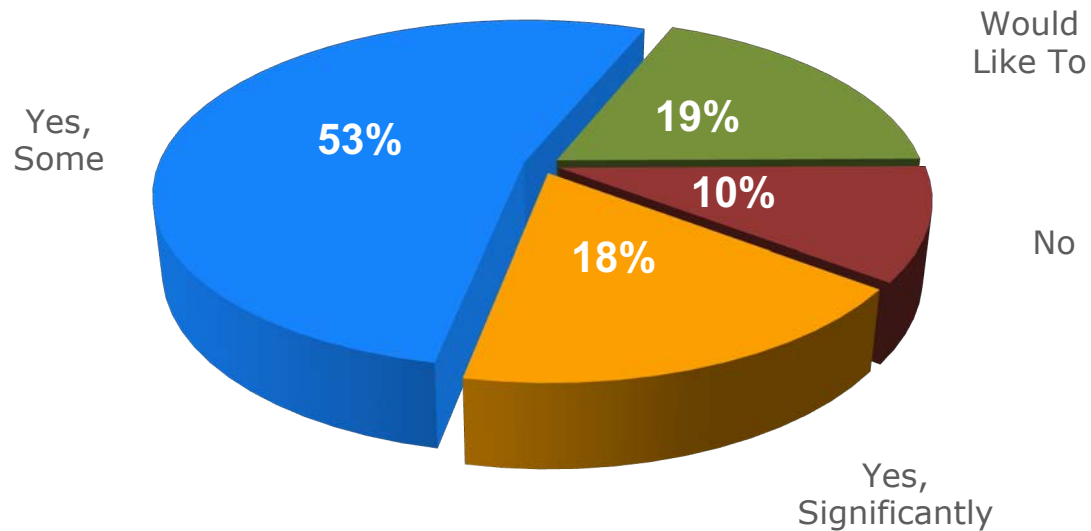


Evolving Order Strategies

Companies are Shifting Configuration toward Customers

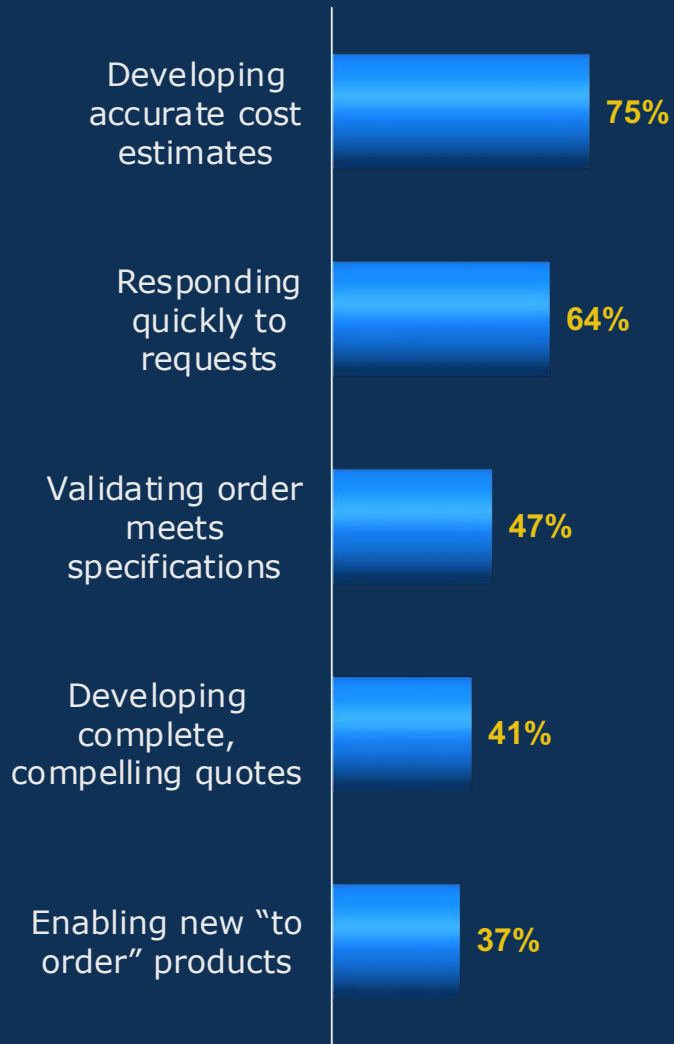
We investigated a trend for manufacturers to move configuration closer to the customer, such as from sales engineers to salespeople or from distributors to customer self-service. We found a clear desire to shift configuration "left" toward the customer. Having customers configure their own orders may be an opportunity for them to better validate their orders if they have the means to do that effectively via self-service. It can also help save time and increase efficiency, increasing quote response times and freeing up engineering time for innovation, again, if it is enabled properly.

SHIFTING CONFIGURATION CLOSER TO THE CUSTOMER



About one-half of all respondents have taken steps to shift configuration left, but only 18% have significantly moved in that direction. Overall, however, **90% of responding companies have, or would like to, shift configuration closer to the customer.**

TOP QUOTE/ORDER CHALLENGES WITH TO-ORDER PRODUCTS



Recognize Selling Challenges

Challenges Throughout the Order Lifecycle

With the bar set higher, it's essential to examine the challenges manufacturers face when selling and delivering to-order products. Configured products create inherent challenges across the product lifecycle. We'll start with the challenges with configured quotes and orders.

Estimation and Speed Issues

From an order perspective, companies face estimation and speed challenges. Specifically, about three-quarters of responding companies have difficulty developing accurate cost estimates. This is a significant issue because developing accurate quotes is the most common profitability driver. *Stone Kane of Schumacher Elevator explains, "We used to face inconsistencies because every project is unique, and it's challenging to accurately estimate the engineering time required, particularly for more complex designs. Our previous system relied on a basic spreadsheet, which lacked dynamic pricing capabilities, meaning ten different salespeople could potentially generate ten different prices for the same project."*

In addition to the need for accuracy, about two-thirds have trouble responding quickly.

This is also a significant business issue because one-half of companies see rapid quotes as a differentiator. It's challenging to be both accurate and fast, but that's the reality. Accurate cost estimates and rapid quotes were already the top two challenges in the earlier survey, but both have grown in prevalence.

Ensuring Orders Meet Needs

Companies must make sure that configured orders are manufacturable, but also ensure they will deliver the value the customer's desired value. Almost one-half of responding companies, however, have difficulty ensuring that ordered configurations meets customer specifications. If the configuration isn't right up front, it will cause significant downstream issues that can impact cost, time, and customer satisfaction. **"Communication between engineering, sales, and tendering wasn't very detailed or accurate, and they didn't always pass those details onto engineering,"** Geoff Leach of Ingersoll Rand recalls. **"It would come up later and lead to expensive rework."** And if a company can't develop a valid configuration, how can they predict costs to develop an accurate quote?

Recognize Delivery Challenges

Inefficiency and Extra Engineering Work

In addition to selling challenges, let's review challenges related to engineering and manufacturing to-order products. The first category of challenges is the burden on engineering. The most common challenge, reported by about three-quarters of manufacturers, is too many "specials" that require extra engineering work. This is likely why companies are trying to shift from ETO to CTO. The next most common challenge, reported by about one-half of companies, is accommodating customer change requests.

"Projects evolve over time. It's not uncommon to deliver solutions that differ from the original plans," shares Stone Kane of Schumacher Elevator. Changes may occur because customer needs change or because of errors in validating orders or predicting performance. Either way, they are time-consuming and disruptive.

Over one-third of respondents also share that they struggle with long engineering lead times with too much manual effort, perhaps due to specials or lack of automation. These challenges impact engineering and delivery leadtimes, which are in the top three most common profitability drivers.

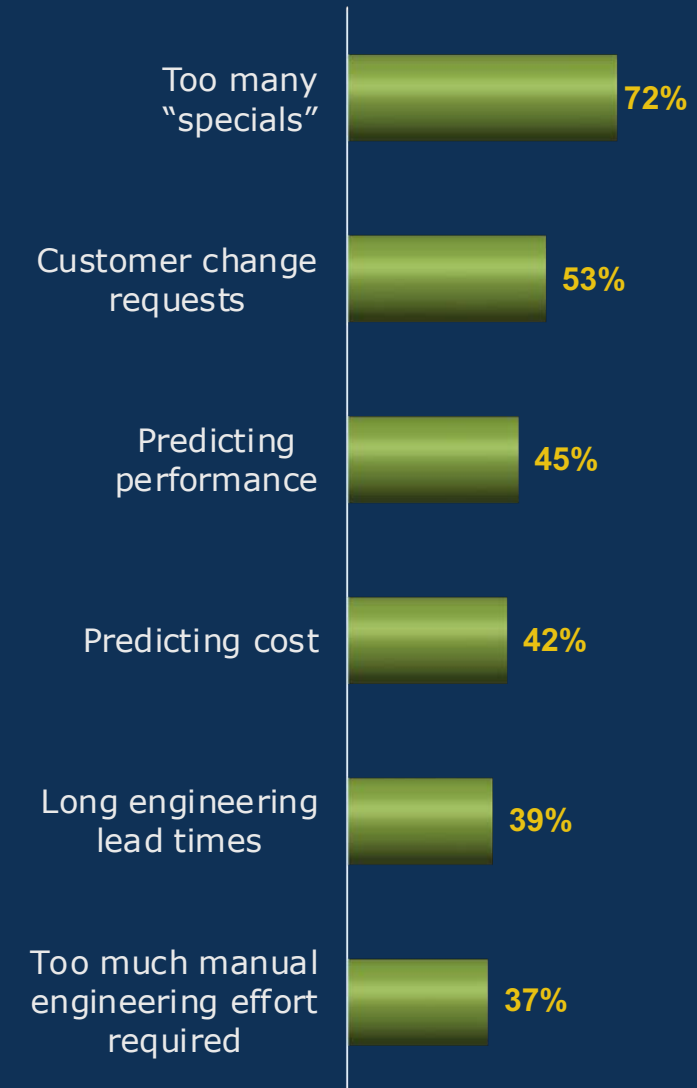
Predicting Performance and Cost

Predicting performance and cost are both issues reported by over 40% of responding companies. This is a big challenge considering that accurate quotes are the most common profitability driver and better meeting needs is the most common differentiator. Overall, to-order product challenges reflect both engineering workload and the inability to estimate cost and performance of to-order products, signifying that engineers are working hard to meet deadlines but can't determine the engineering information needed to drive profitable business.

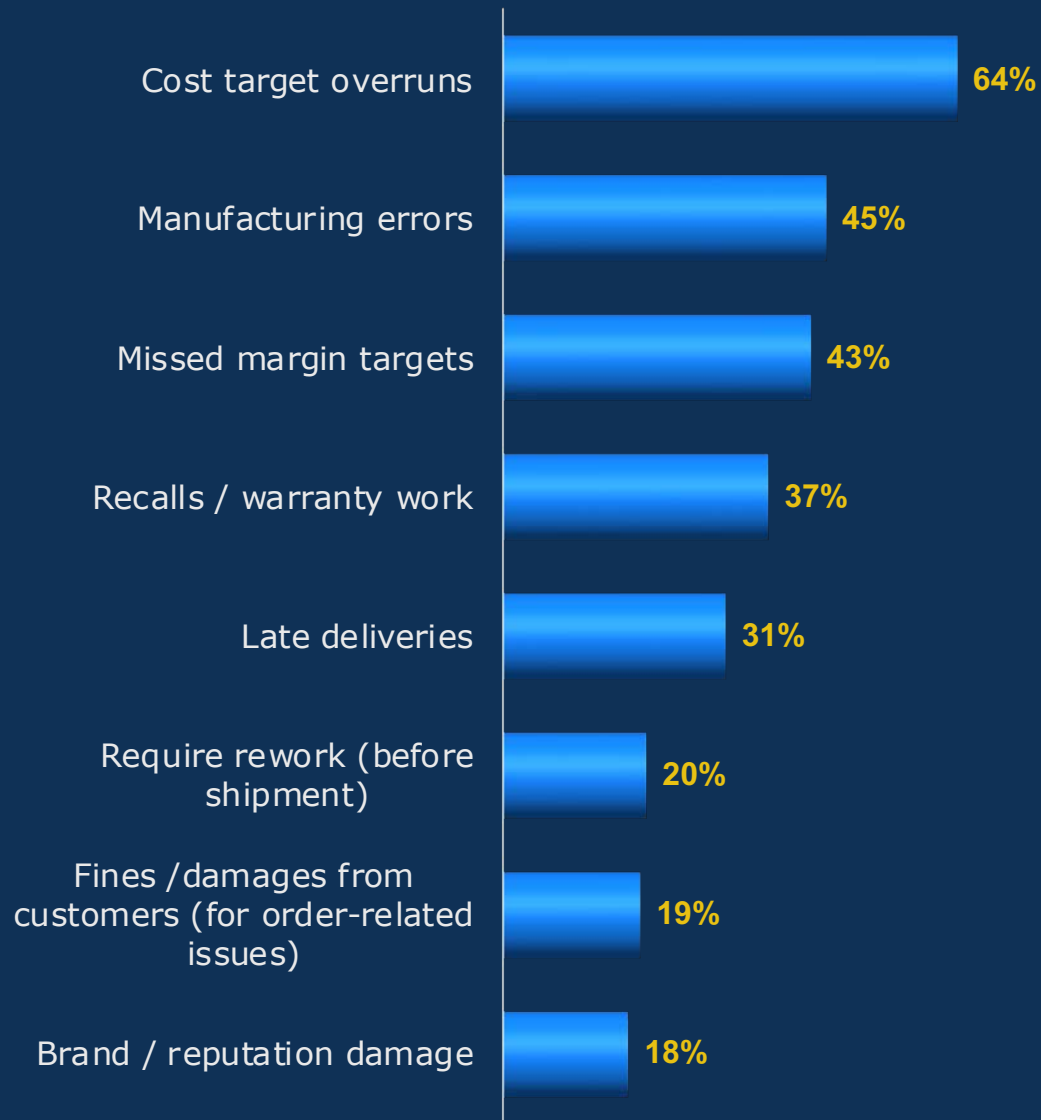
Additional Challenges

We discussed the most common challenges, but manufacturers reported many other challenges, including supply chain volatility, designing new configured products, providing complete / accurate information to manufacturing, coordinating with suppliers, increased software in products, and a lack of knowledgeable engineering resources. Designing and producing configured products is just hard.

TOP ENGINEERING / MANUFACTURING CHALLENGES WITH TO-ORDER PRODUCTS



TOP BUSINESS IMPACTS OF TO-ORDER PRODUCT CHALLENGES



Recognize the Business Impacts of Challenges

Cost Overruns

The number and frequency of order, quote, engineering, and manufacturing challenges lead to material business impacts. The most common, reported by about two-thirds of respondents, is overrunning cost targets. Perhaps it's not surprising given that three-quarters of companies say predicting costs is challenging. It's a significant business issue because offering accurate quotes is the most common profitability driver.

Errors and Quality Issues

From an execution perspective, the challenges lead to significant disconnects that cause downstream issues. For example, almost one-half of responding companies report manufacturing errors. This can happen if orders aren't validated properly or if inaccurate predictions require changes. Further, many companies find translating ordered specifications into executable manufacturing instructions hard. These issues can also impact delivery leadtimes, potentially because of the need for extra engineering or rework.

Not all of these issues, it appears, are caught in engineering or manufacturing. Over one-third of companies face recalls / warranty work because errors escape the factory. In some cases, they can also result in fines or brand damage, as can late product deliveries.

Identifying the Top Performers

Tech-Clarity's Performance Banding Process

To understand best practices processes and technology, we use a benchmarking process we call "Performance Banding." We look at responding companies' performance against metrics that represent success in our research topic. We create an aggregate score across these metrics and identify (approximately) the top 25% as "Top Performers." We then look at what these leaders do differently from the poorer performing companies, the "Others."

Benchmarking To-Order Top Performers

To understand which companies profit more effectively from their configured products, we benchmarked the financial performance for to-order products over the last 24 months as compared to their competitors for:

- Revenue growth
- Profitability

We analyzed the results and identified the highest-performing 16% of respondents based on a logical cutoff in performance scores. We then analyzed what these Top Performers do differently to make recommendations to "Others."

We found that the Top Performers take different approaches related to order processes, engineering techniques, and technical enablers, which we believe help them achieve superior financial performance. The remainder of the report will share those findings.



The Top Performers are the **16%** of responding companies that have **most improved the revenue and profitability of their to-order products over the last 24 months.**

Top Performers are Transforming Order Processes

Top Performers are Shifting CTO Orders Left

The vast majority of manufacturers would like to shift configuration closer to the customer. Top Performers are ahead of the curve in this trend and are 74% more likely to have significantly shifted configuration left. **“Configuration extends to tendering and sales people, they select the options best align with customer specs based on standard options, which are controlled by engineering,”** says Geoff Leach of Ingersoll Rand. **“We were able to do that because the configurator provides guard rails and gives engineering more control, which cuts down on margin erosion.”**

We also found that the top-performing companies are 61% more likely to view customer self-service as a differentiator. We analyzed who typically configures responding companies' to-order products to better understand this transformation. *At Schumacher Elevator, Sales creates a project and adds the specs, finishes, and other parameters and then the configurator estimates a price and generates a proposal. “There’s also been talk about having customers and architects use it directly,”* shares Stone Kane.

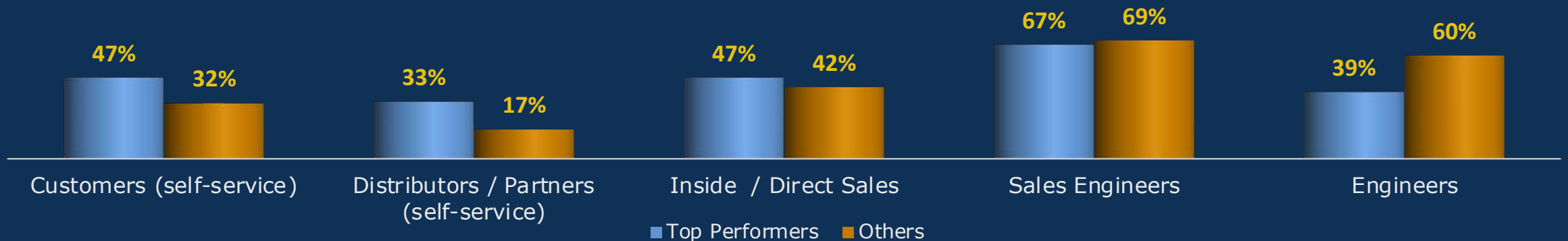
We found that Top Performers are 46% more likely to have customer self-service for their to-order products and about twice

as likely to have self-service for distributors and partners. As a result, they are about one-third less likely to have engineers configure orders, freeing up engineering resources. However, they are just as likely as Others to have sales engineers or sales do so.

Shifting Left has Business Benefits

These findings show a correlation between shifting configuration left and achieving better business performance. This indicates that transferring order configuration away from engineers toward customer self-service has significant business benefits.

WHO TYPICALLY CONFIGURES TO-ORDER PRODUCTS





Top Performers are Transforming Engineering Techniques

Top Performers Design Differently

Top-performing companies are more likely to take advanced approaches to product design that make engineering and producing configured products more effective and efficient. Specifically, they are more likely to use both modular and platform design approaches.

This was also the case in the previous survey. As shared in the earlier report "platform and modular design approaches allow order engineers to more readily reconfigure products. Modules developed with standard interfaces can be replaced more easily to address specific customer needs, for example by substituting a more powerful motor or higher torque gear assembly." Compared to 2016, however, more companies in both performance classes follow these approaches, suggesting that processes are more mature and that the bar has raised.

Top Performers Configure Differently

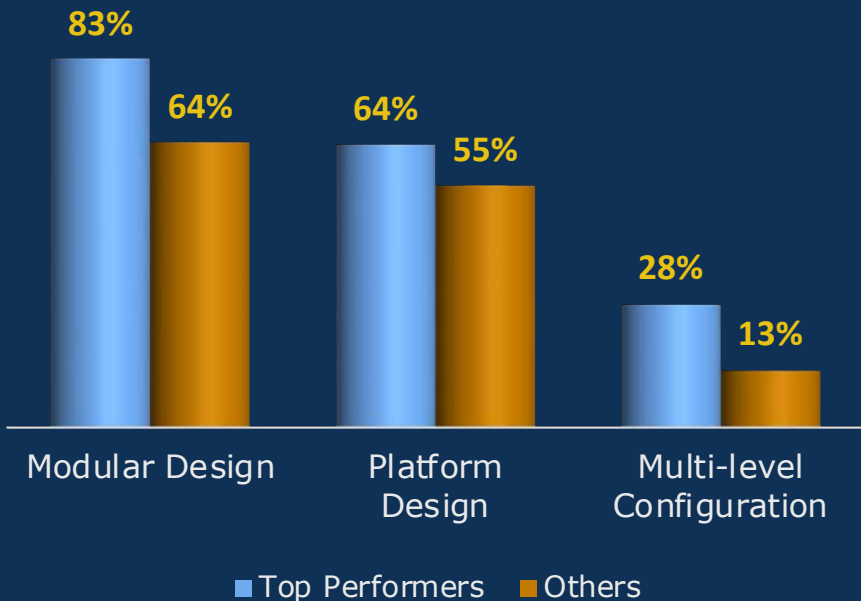
In addition, we found that Top Performers are more likely to engage in multi-level

configuration, also known as "product in product." This technique allows configuration at the product, assembly, module, or even systems level. It is a form of modular design where configured modules can be used in higher-level assemblies or systems to make those underlying designs more consistent. This is a more complex form of configuration that increases standardization and reuse. Although it takes more time to set up, it drives repeatability and saves significantly on engineering individual orders.

Better Engineering for To-Order Has Business Benefits

The approaches employed by the Top Performers show that manufacturers who design more strategically for configuration are achieving better business performance. We believe that taking the time to design for configurability helps reduce operational complexity to help deliver to-order products more effectively.

ENGINEERING TECHNIQUES FOR TO-ORDER PRODUCTS



Top Performers are Transforming Technical Enablers

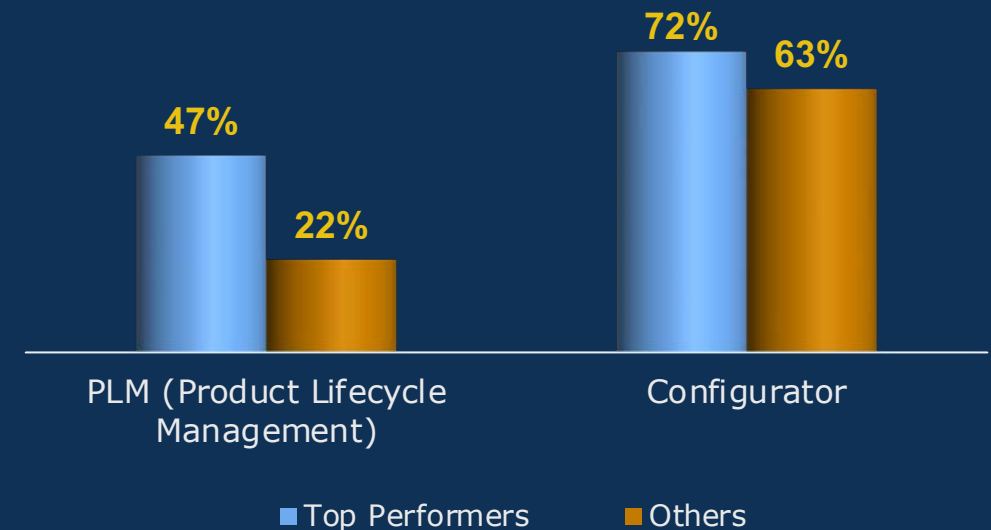
Top Performers Support To-Order with Configurators and PLM

Top Performers are also leveraging different technical enablers. The most common way Top Performers and Others take orders and develop quotes is by using a sales configurator. Sales configurators typically handle customer and order parameters very well. However, this is not the most differentiating approach among the Top Performers.

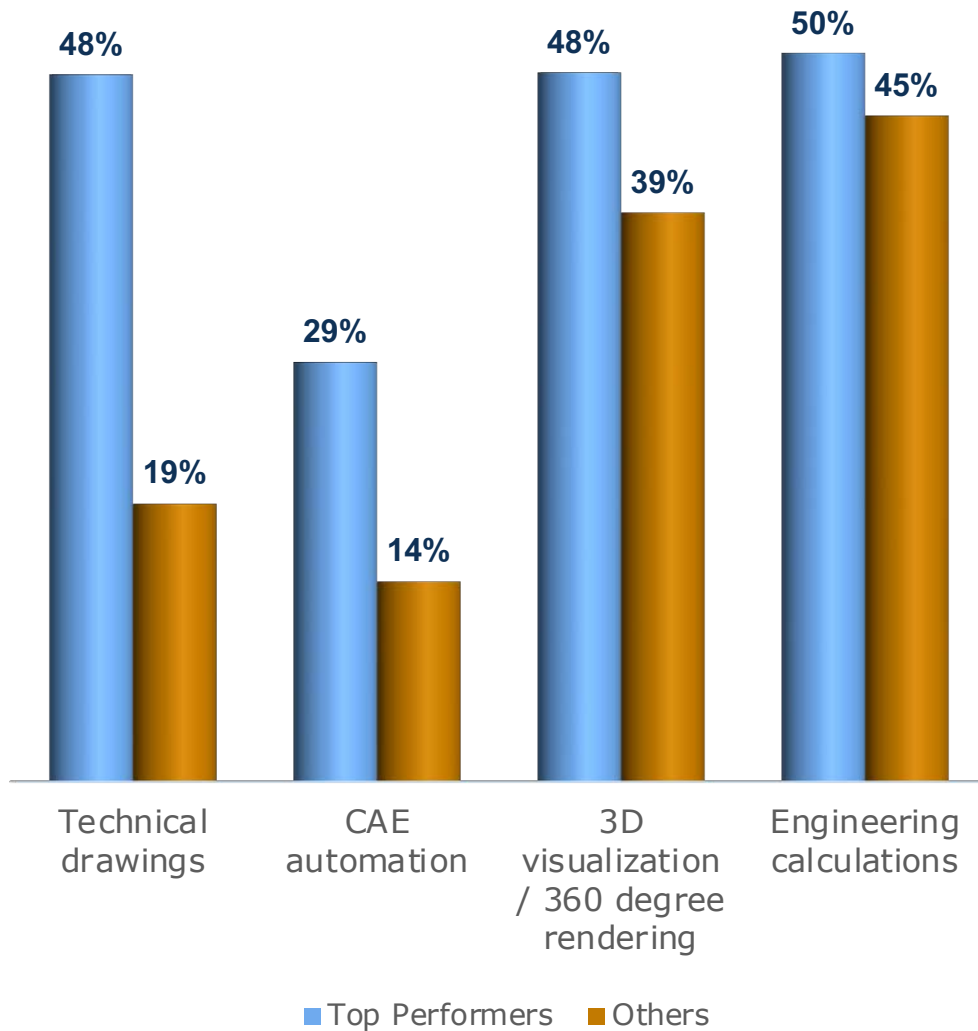
Top Performers are more than twice as likely to use PLM to develop quotes. This is likely due to the need to get designs right so they can use them for cost, leadtime, and performance predictions. ***"Having one source of truth to find information can save you a lot of money and opens up the door to hand off the data downstream in a consistent manner to improve leadtimes and efficiency," explains Stone Kane of Schumacher Elevator. "Otherwise, a lot of money can be left on the table due to poor communication ."***



TECHNICAL ENABLERS FOR TO-ORDER PRODUCTS



MOST DIFFERENTIATED CONFIGURATOR CAPABILITIES USED FOR TO-ORDER PRODUCTS



Top Performers are Transforming Technical Enablers

Top Performers Use More Configuration Capabilities

Beyond sales configurators and PLM, companies use other technologies like technical configurators. Researchers found that the most differentiating use of configurators was not which type of configurator they used but what capabilities they used it for.

The most common uses, pricing and quotation, are important but not very differentiating. What sets Top Performers apart is using more advanced configurator capabilities, including technical drawing creation, CAE automation, 3D visualization, and engineering calculations. These capabilities go beyond simple options and variants to leverage an engineering product model. More importantly, these specialized capabilities help support the top to-order differentiators and profitability drivers, including estimating costs, leadtimes, and performance and driving speed, efficiency, and quality.

"We added a considerable amount of automation to create models and documentation," explains Goff Leach of Ingersoll Rand. "We were able to reduce engineering hours by about 75% because we have CAD automation that works hand-in-hand with our PLM."

The Basics Aren't Enough for Higher Business Value

The Top Performers and Others commonly use standard capabilities like capturing order specs. They are essential features and add value but do not necessarily lead to better business performance. We believe that configuration maturity has increased and these features have become basic requirements to compete, but driving a competitive advantage now requires more advanced capabilities.

Product Configurators Drive Significant Value

Value Achieved from Product Configurators

While Top Performers are gaining more significant competitive advantages through their best practices, both Top Performers and Others reported valuable business benefits. Companies don't have to be Top Performers to overcome to-order challenges and improve to-order execution.

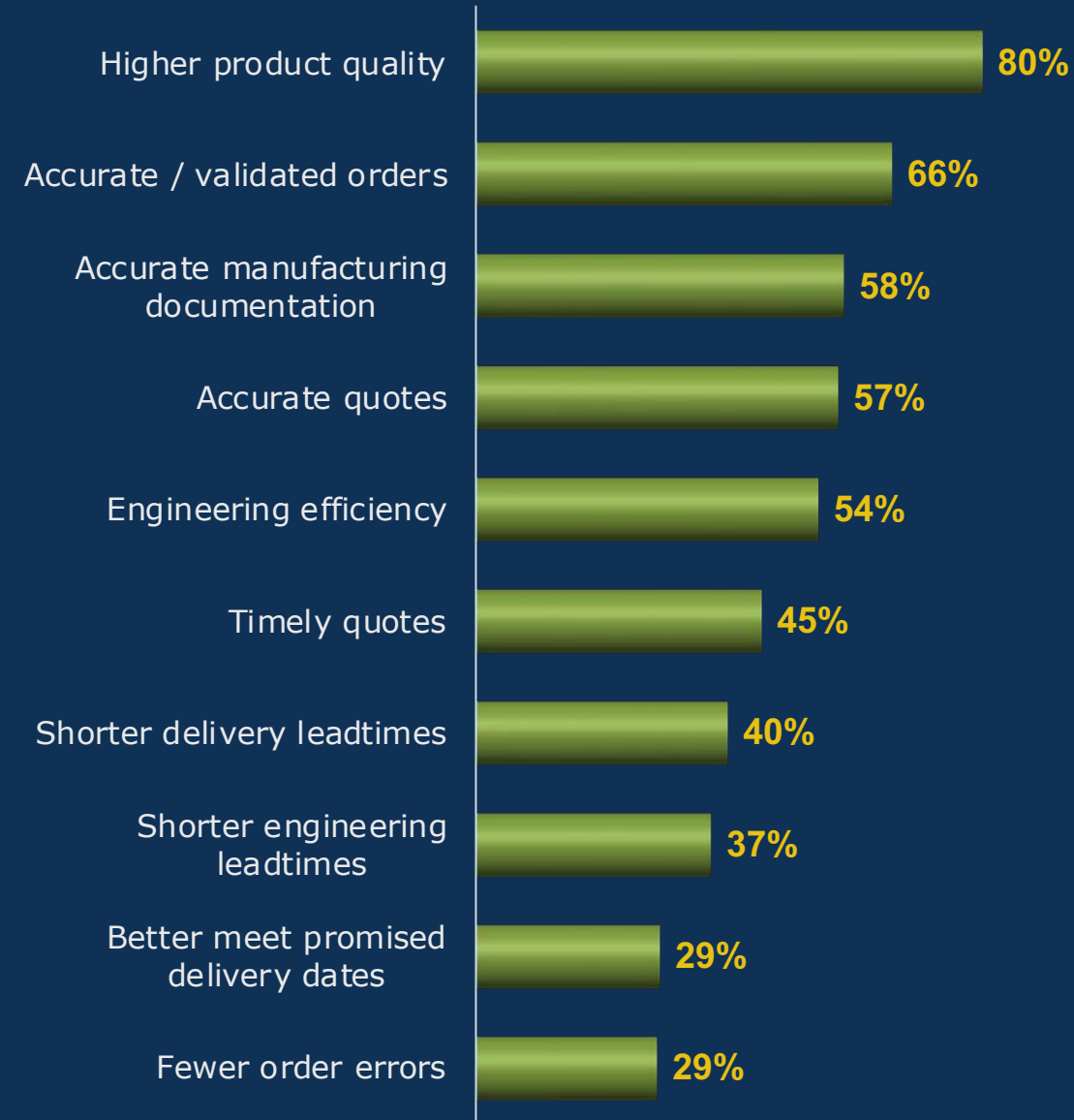
The benefits reported from using configurators are clear, and range across different facets of to-order business, including:

- Higher product quality
- More accurate and better-validated orders
- Accurate manufacturing documentation
- Accurate and timely quotes
- More efficient engineering
- Shorter leadtimes

For example, Geoff Leach of Ingersoll Rand shares that costing and pricing are now based on their engineering configuration so they get exact costs.

It's important to recognize that configurators add multi-faceted benefits. Responding companies typically reported achieving multiple benefits, including others not included in this list.

BENEFITS ACHIEVED FROM CONFIGURATORS



Product Configurators Drive Significant Value

Top Performers Achieve Higher Strategic Value

Top Performers reported even higher value in several strategic areas. These benefits align well with the top differentiators and profitability drivers, including cost, leadtimes, and quality, showing that adopting best practices drives even greater business value.

Top Performers reported higher than average benefits in:

- Lower product cost
- Shorter delivery leadtimes
- Fewer order errors
- Greater engineering efficiency
- Higher product quality

For example, *Schumacher Elevator's Kane explained that their bottleneck was custom engineering. But "that is no longer the case. By leveraging technology, we've significantly improved our engineering and manufacturing workflows, improving our team's efficiency and resulting in increased profitability," he shared.*

Geoff Leach explains the benefits at Ingersoll Rand. "We cut down our engineering hours from about 1,000 to around 250, it's a huge time savings. We have been able to lower cost, which can translate a lower price or more margin," says Leach.

These enhanced benefits are likely a key reason for Top Performers' better financial performance.



You don't have to be a Top Performer to achieve these valuable business benefits. **These values were reported across all respondents, both Top Performers and Others.** You don't have to be in the top 16% to get significant business value from product configurators.

Conclusions

Configuration is Growing

Our research shows that the amount of configuration in products has been steadily growing and continues to increase. There are a variety of reasons for offering to-order products, but the most prominent is to capture more business. Selling to-order products helps manufacturers better meet customer needs to earn their orders.

Configuration is Challenging

The survey results show that selling and delivering to-order products remains challenging. Manufacturers face a variety of challenges when designing, quoting, selling, and producing their configured products. Some of the most significant challenges relate to predicting cost and performance and the ability to execute quickly despite complexities like change requests.

Configuration Strategies are Evolving

Respondents report adopting new strategies that reduce to-order complexity to address these challenges, including shifting from ETO to CTO products and guided selling. We don't believe these approaches are to reduce the ability to meet customer needs, but to address them more efficiently.

As evidence, we still see that quite a few companies are increasing the level of customization in their products.

Configuration Strategies are Maturing

To support these strategies, companies are adopting best practice order processes, engineering techniques, and technical enablers. These practices include shifting configuration toward the customer and adopting proven engineering practices like modular design. Best practices also extend to technology, including configurators and PLM, and more advanced configuration capabilities that rely on an engineering product model. These best practices help manufacturers more rapidly and predictably deliver customized products that meet customer needs with less of the engineering burden typically associated with ETO.

Configurators Drive Business Value

The final conclusion from the survey is that configurator technology leads to significant benefits for both Top Performers and Others. **"Our configurator enables us to estimate projects with increased speed and accuracy,"** explains Stone Kane of Schumacher Elevator. **"That increases our**

opportunities to secure more jobs."

These benefits add strategic competitive advantages because they align well with the to-order differentiators and profitability drivers. **"Our configurator led to lower cost and leadtime savings, it's working,"** concluded Geoff Leach from Ingersoll Rand. Although Top Performers report more significant advantages, companies from all performance levels report achieving benefits from product configurators.

We believe that the use of product configurators is a basic necessity for designing, selling, and delivering to-order products, but that companies who adopt proven best practice engineering, order, quote, and technical enabler gain significant advantages that translate directly to **improved revenue and profitability.**

About the Research

Data Gathering

Tech-Clarity gathered and analyzed responses to a web-based survey from 234 companies that manufacture to-order products or provide related engineering services. Responses were collected by direct e-mail, social media, newsletters, paid outreach, and online postings by Tech-Clarity and Siemens.

Industries

The respondents represent a broad cross-section of to-order industries. 72% were from Industrial Equipment / Machinery,

45% Automotive / Transportation, 36% Energy / Utilities, 25% Building Products / Fabrication, 20% Aerospace / Defense, 13% Electronics / High Tech, 8% Marine, and others including Life Sciences / Medical Devices, and Federal Government.*

Company Size

The respondents represent a mix of company sizes, including 7% from less than \$150 million, 6% between \$100 million and \$250 million, 15% between \$251 million and \$1 billion, 47% between \$1.1 billion to \$5 billion, and 24%

greater than \$5 billion. 2% did not disclose their company size. Company sizes were reported in US dollar equivalent.

Geographies

Responding companies report doing business in North America (71%), Western Europe (62%), Asia (38%), Eastern Europe (8%), Australia (8%), Latin America (7%), Africa (5%), and the Middle East (4%).*

Title

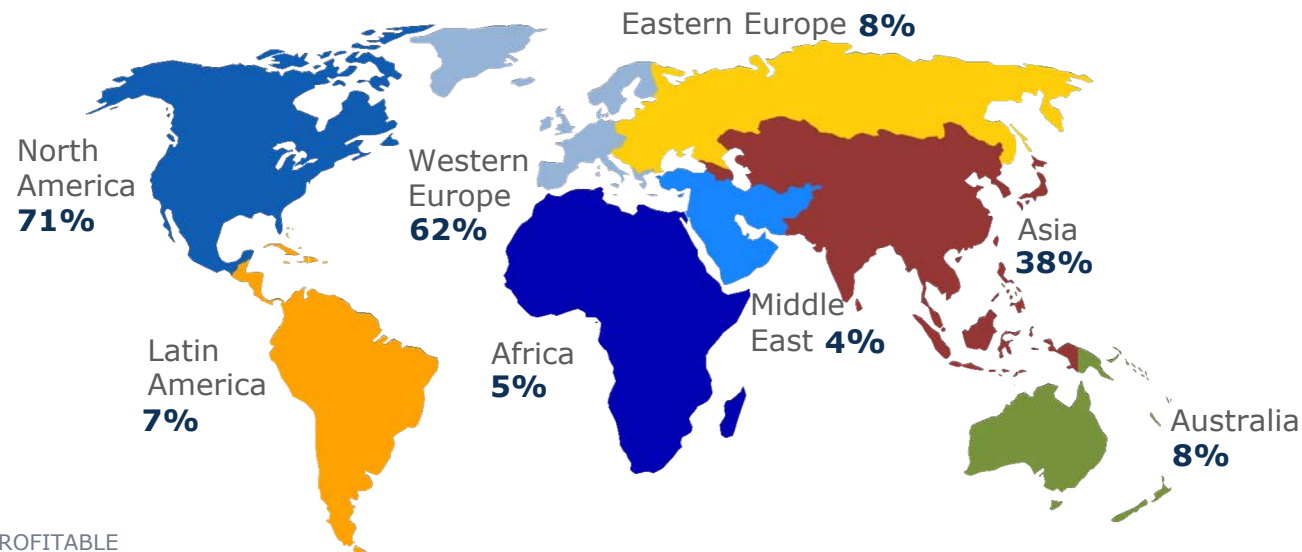
The respondents comprised of 20% Executive or VP level, 50%

Director level, 25% Manager level, and 5% individual contributors.

Organizational Function

Of the respondents, 38% were in Manufacturing, 31% Product Design / Engineering roles, 15% Industrial Design, 6% Project Management, 4% Sales, and the remainder were from a variety of other roles including Information Technology (IT) and General Management.

* Note that the values may total greater than 100% because companies reported doing business in multiple industries and geographies.



Acknowledgements



Jim Brown
President
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About the Author

Jim Brown founded Tech-Clarity in 2002 and has over 30 years of experience in the manufacturing and software industries. Jim is an experienced researcher, author, and speaker and enjoys engaging with people with a passion to improve business performance through digital enterprise strategies and supporting software technology.

Jim is actively researching the impact of digital transformation and technology convergence in the manufacturing industries.



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Tech-Clarity is an independent research firm dedicated to making the business value of technology clear. We analyze how companies improve innovation, product development, design, engineering, manufacturing, and service performance through the use of digital transformation, best practices, software technology, industrial automation, and IT services.

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