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THE GOOD, THE BAD, AND THE COMPLICATED

Dealing with car complexity

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Personalizing cars to the requirements and taste of the individual owner has long been a driving force in the automotive industry. But that goal appears to have spiraled out of control. As a result, car complexity has reached the point where there are so many options to choose from that it's gotten overwhelmingly cluttered — not just for original equipment manufacturers (OEMs), suppliers, and dealers, but for buyers, too.

Moreover, things are about to get even more cluttered: By 2025, the number of battery-electric vehicles (BEVs) coexisting with legacy internal combustion engine (ICE) platforms will probably boost the number of variants per carmaker by 50 — 100% worldwide.

This complexity affects not only end customers but also OEMs and suppliers, which must stock every possible option (or at least make them easily available). All this costs money and resources. Currently, roughly 30 — 40% of all OEM employees deal with variants and associated complexity issues, and more will be needed soon. This limits capital available for company transformation, new technologies, and new business models. By pursuing strategies to crack the complexity code, automotive players could optimize the process, increase profits between €500 and €750 per car, improve their supply chain, and create a better customer experience. Nowhere is the complexity challenge more striking than in the contrast between Germany's market and that of China. While automakers in China offer limited choices, German consumers often order and specify their cars themselves. In return, German car buyers are willing to wait months to get exactly what they want in their vehicle. However, the individual preferences of so many car buyers severely taxes OEM supply chain and logistics systems, especially during periods of stress, such as trade wars or the COVID-19 pandemic.

The lessons learned in Germany can help OEMs in other markets find the optimum balance between beneficial complexity and the value it can generate, and too much of a good thing. To provide a comprehensive picture of the case for optimizing complexity, this point-of-view examines the issue from the perspectives of the OEM, the supplier, and the consumer.

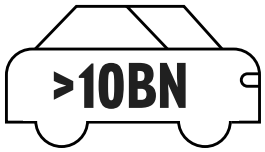
BIG CHANGES AHEAD

Automotive complexity is moving from the unmanageable to the unimaginable. Driven by customers' expectations, new regulations and new technologies, the new complexity is broader and bigger than ever before as it builds on current sources of complexity while adding new ones. These include the transition away from internal combustion engine (ICE) technology to battery-electric or fuel-cell power, which is currently underway, and autonomous vehicles (AVs), which drives current advanced driver assistance systems (ADAS) development to the next level. Other sources of complication include the emergence of car connectivity and over-the-air (OTA) software upgrades. Software, evolving and multiplying at exponential rates, has taken on new prominence in shaping the automotive industry, with OEMs struggling to manage an explosion of embedded code caused by the previous industry's "add a feature, add a box" electronics strategy.

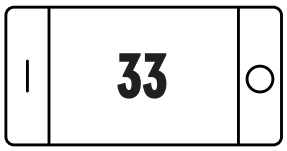
None of this complexity is taking place in a vacuum: Much of it serves a purpose, resulting in new automobile features and functions. But while it may make vehicles more attractive to consumers and compliant with regulatory requirements, OEMs need to keep it to an optimal, manageable level.

However, looking at other industries and their handling with complexity, it turns out that there are different approaches out there: Compared to the automotive industry, consumer electronics seem to need far fewer "hardware" configuration options and complexity than typical automotive OEMs, even in the premium market segments. Product individualization, for them, is more effective via software, apps and data. Looking at one of the recent consumer electronics product launches with typical automotive products' complexity and came to astonishing numbers. (See Exhibit 1.)

Exhibit 1: The car industry continues offering "hardware" complexity to wow customers



Options in configuring a car (typical premium OEM)[1]



Options in configuring a smartphone (e.g. Samsung S21 presented at CES 2021)[1]

[1]The numbers focus on hardware configuration options

Source: Oliver Wyman analysis

HOW CARMAKERS CAN OPTIMIZE COMPLEXITY

Any attempt to optimize automaker complexity must start with the customer. Determining how much complexity an OEM can tolerate depends first on the answer to another question: How much complexity do your customers really need? Understanding how much customers are willing to pay for a feature or option determines the optimal level of complexity.

This optimal point balances the benefits of complexity to the OEM and customers, against its disadvantages. For example, to an OEM, individualizing products and services can lead to a competitive advantage: Customers enjoy greater choice, allowing them to personalize and make their purchases unique. On the downside, broader choice complicates OEM supply and logistics networks, making forecasting difficult, and niche features can trigger hidden costs and cannibalization. For customers, overcomplexity makes purchase decisions more difficult and results in confused and frustrated consumers.

That's why the customer buying experience should be as simple as possible: Too many OEMs rely on overly complicated online car configurators, with unnecessary rules that get in the way.

CAPTURING SAVINGS ACROSS THE VALUE CHAIN

Reducing complexity yields benefits across an OEM's entire value chain — from research and development (R&D) and procurement and production logistics, to quality and sales/aftersales.

Research & Development: Companies can seek new synergies and reductions in nonrecurring R&D expenses by "recycling" current innovations: using shared platforms and establishing guidelines to reduce or avoid one-off development projects. While these processes are already in place at all OEMs, the vast complexity hinders the efficient implementation.

Procurement: By streamlining and consolidating the number of suppliers and orders and taking steps to reduce inventories, tooling, and business investments, OEMs can optimize inventories, prices, and costs.

Production and logistics: Car manufacturers can introduce lean thinking to consolidate vehicle architectures, reduce variants, and cut logistics requirements.

Quality: To boost quality, OEMs should focus on reducing errors, downtime, rework, and scrap. They should also concentrate on minimizing space requirements, and on cutting warranty cases, recalls, and the overall cost of quality.

Sales/aftersales: Companies should focus on delivering a clear, customer-oriented product and service offering. Such an offer should be comprehensive, balancing the need to provide for individuality and efficiency against the cannibalization of high-demand product variants by less popular (and less profitable) offerings.

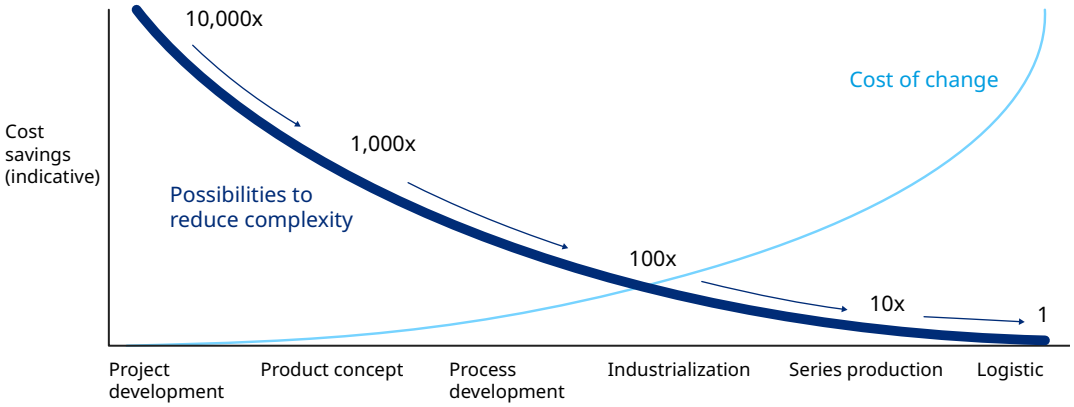
Our experience suggests the sooner in the product development process a company attacks complexity, the bigger the impact. (See Exhibit 2.) Things are still fluid early on in development: OEMs can still add or subtract features and functions easily. But this fluidity rapidly hardens in the later stages of the development process.

Companies also need to distinguish external "visible" complexity from internal varieties. External types are easy to spot, consisting of too many models, engines, transmissions, colors, wheels, and trim packages. Internal complexity comes in a more subtle form: across cars, series, models, markets, shared platforms, parts, and components. While the emphasis with external complexity consists of streamlining and consolidating, the internal challenge involves finding ways to do things better and cheaper.

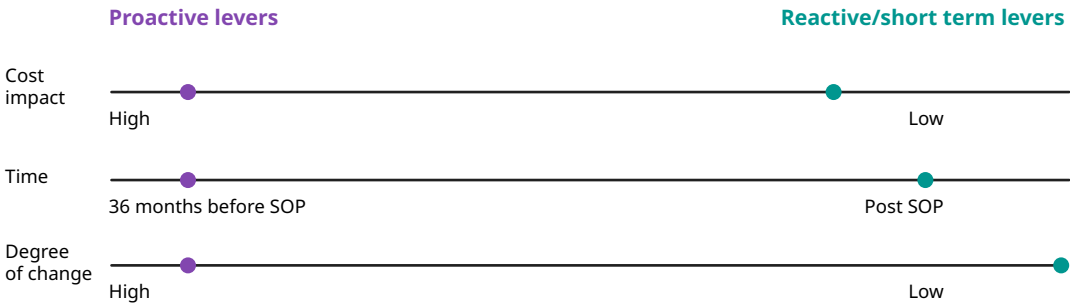
To find the perfect balance, an OEM needs to explore customer analytics, using data to understand the sales history of customer segments and undertaking market research such as strategic choice analysis. They should seek out their dealers' views and the opinions of experts inside the company. Companies should conduct breakeven analyses to determine which levels of product variety will deliver the most profit.

Exhibit 2: Proactive levers have the highest cost impact, but also short-term measures can realize significant savings

Overview on complexity cost savings along development cycle
Possibilities are highest in project development phase and decrease significantly



Proactive levers have the highest impact



Source: Oliver Wyman

MODELLING COMPLEXITY

There's a temptation on the part of company managers to attack complexity by hacking away indiscriminately to improve profitability, but doing so often does more harm than good. Without priorities and research, companies have little or no transparency regarding the extent to which such cuts affect customer purchase decisions.

Instead, it's best to model complexity costs and calculate the effects of reduction measures. A modular model can be tailored to the OEM's specific needs to gain a detailed, holistic, and granular view that includes the cost per variant, the value a feature adds, its savings over time, and all relevant cost elements, purchasing effects, and economies of scale (See "Streamlining Complexity" box below). The model simulates customer migration effects, such as switching to variants/models or to a competitor's products. It integrates with the development process and can span a company's entire value chain, from R&D to aftersales, providing the OEM with a "price list" for complexity costs across product variants and associated functional areas.

"Streamlining Complexity"

One automaker used the model to make an early decision to discontinue a powertrain variant that saved the company roughly €14 million in complexity costs over the lifetime of the vehicle. The company's savings would have been even larger had it discontinued the powertrain entirely rather than only on one car line — a step it is currently considering. In another case, an OEM used the model to optimize the build complexity of an entry-level vehicle and reduced costs by approximately €20 million over the product lifecycle. In this case, the savings came from across the value chain.

PROVEN WAYS TO REDUCE COMPLEXITY AND COST

A proven way to reduce complexity involves evaluating relevant information on an end-to-end basis and including both a customer and a cost perspective. To understand the likely customer response to removing a car option, complexity reduction teams model the percentages of customers the OEM could "upsell" to a better equipped vehicle, those that would simply do without the option but stay with the same vehicle, and the ones that would abandon the brand and seek a competitor product. The team then overlays these findings with cost data from individual departments along the value chain to determine the change's total cost impact over the lifecycle of the vehicle. (See Case Study 1: Less Is More.)

While efforts to reduce complexity outright — cutting assembly lines, products, features, or equipment — have the biggest impact, other approaches, such as harmonizing standardization, bundling options, and modifying build rules also generate results. Harmonizing standards across markets, models, and country variants can play a role. Bundling options and making more features standard equipment can simplify build schedules and make customer choices less confusing. And modifying rules of option combinations can help the customer experience, as much as it can avoid internal complexity. (See Case Study 2: Using an End-to-End Approach.)

Automakers can rely on smart tools to aid decision-making and provide recommendations for customers. These tools range from smart, personalized recommendation systems to automated tool support for configuring stock vehicles. Other aids include forecasting techniques enhanced via artificial intelligence, big data, and advanced analytics, which can ensure that each vehicle configured and built finds an owner ready and willing to buy it.

SOFTWARE'S ROLE IN REDUCING COMPLEXITY

Software can provide new functions and features "virtually" by activating them via over-the-air (OtA) upgrades. In fact, the emergence of software as the key differentiator will both aid the automotive industry in its push toward individualization and confound it, as embedded lines of code multiply to unwieldly levels of complexity.

Case Study 1: Less Is More.

To cut costs, one OEM's complexity-reduction team analyzed the impact on sales of removing some seats from a car model. The team projected the customer "take rate" for this option on the model under consideration was low — less than 20 percent. More importantly, it determined the returns from customers switching to more expensive models in the OEM's line and those staying with the vehicle despite the lack of these seats would more than offset the loss of customers that shifted to competitors. Cost savings over the model's lifecycle would tally about €180 million.

Case Study 2: Using an End-to-End Approach.

Taking things one step further, an automaker initially embraced bundling in its complexity reduction efforts, but soon realized focusing on complexity reduction in terms of eliminating unnecessary variants in assembly lines, powertrains and other areas could deliver three times as much cost savings. Ultimately, it discovered that by undertaking an end-to-end, system-wide transformation of its entire value chain to reduce complexity, it could more than double the impact of its complexity reduction efforts. This proven end-to-end approach can deliver approximately €500 to €750 in savings per vehicle, drawn from across the value chain.

In response, the automotive industry is on the cusp of embracing a new electronic architecture: moving from the current architecture where many features have their own digital control unit and software, to a centralized electronics architecture like those used in aviation and aerospace. This approach requires greater central computing power but can dramatically reduce software and electronic hardware proliferation. A sign of the need for a new architecture is apparent in one of the more annoying electronics/electric challenges OEMs face: managing the wiring harness, which continues to grow dramatically as it connects the many feature-specific control units scattered throughout the vehicle.

Beyond the vehicle itself, software can also play a role in guiding shoppers, using AI to suggest enhancements in configuring cars and providing a more intuitive and valuable interaction.

SUPPLIERS: BALANCING PAIN AND GAIN

Suppliers face a delicate balancing act when it comes to complexity. They can benefit financially from the OEM desire to offer more to every customer, but the operational pain of satisfying those desires can hurt both their credibility with automakers and the bottom line. Tier-1 suppliers often serve as auxiliary innovation engines for their OEMs, developing new features and concepts that enable automakers to differentiate their products. Such innovations expand suppliers' margins, as the advances earn price premiums and only later become commoditized.

But innovation, unless managed, carries a complexity cost. OEMs increasingly expect their supply base to bring forward attractive, customer-preferred innovations, but to do so requires

that suppliers understand the end customer as well as, if not better than the automakers themselves. That costs money, and since not all innovations will be of interest to their OEM customers, these efforts can clutter a supplier's portfolio of offerings without creating value.

Operationally, suppliers march in lockstep with their OEM customers, gearing up to provide the features and options demanded in the quantities specified. If the OEM guesses wrong in its forecasts, the supplier either needs to throttle back production or speed it up dramatically. Today's increasing levels of complexity can complicate this process and the supplier's relationship with the carmaker.

Given their need to understand the end customer, suppliers require transparency into the end customer's desire for differentiated product offerings and what they are willing to pay for them. At the same time, incumbent suppliers must streamline their internal processes across their own value chains, pushing for leaner processes and cleaner organizational structures. They also need to keep an eye on all the new players circling the industry, from start-ups to tech giants, each trying to outcompete and out-innovate them to gain a place at the OEM's table.

CUSTOMERS: TOO MANY CHOICES?

At what point does the sheer array of options and features simply overwhelm car buyers? Consumers are of two minds on this question. First, they want the same levels of individualization available on social media platforms and other digital venues, which rely on software-driven virtualization to personalize offers — an avenue only partially available to automotive industry due to the lack of a standardized digital architecture. Second, many realize too much variety can make choosing difficult — and expensive.

Another concern among consumers adds a new layer of meaning to the complexity question: sustainability. Growing segments of buyers want to know the products they buy will be environmentally friendly or neutral — cutting complexity can appeal to these shoppers but doing so will require OEMs and suppliers to move toward sustainable and connected products.

MAKING COMPLEXITY PAY

The industry will never return to the days of one-size-fits-all utility, which means dealing with complexity will remain a fact of life. However, maintaining a consistent balance between necessary complexity and profitable growth can enable OEMs and suppliers to compete in the rapidly changing market.

Companies need to create a sustainable culture that seeks out and eliminates destructive levels of complexity, rather than dealing with it as a one-off effort. We expect OEMs to reduce their overall complexity by 30 — 50% by 2030. And if they go about it intelligently, few consumers will notice the difference — thus freeing up the resources necessary for tackling the fundamental industry transformation that lies ahead.

Oliver Wyman is a global leader in management consulting that combines deep industry knowledge with specialized expertise in strategy, operations, risk management, and organization transformation.

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