Off-Highway Disruption

Roland Berger

WITH EXPERT TALK P. 8

June – 2020

Securing and Leveraging Supply

Technological disruption in the off-highway industry: what manufacturers can do about it

FIND OUR SLS APPROACH ON P. 9

In brief

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Electric vehicles have undeniably disrupted the entire automotive industry over the last decade. But while the technology has had more of an immediate impact on both passenger and commercial vehicle manufacturers, off-highway manufacturers

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of construction and agricultural vehicles are beginning to feel the effects. If not directly, then certainly via their supply chains, which are heavily influenced by the passenger vehicle industry. Here's everything you need

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to know about the supply-side economics of electric vehicles, and how off-highway manufacturers can shield themselves from eventual or otherwise unforeseen risks.

Title: LordRunar/iStock

Where disruptions are taking place

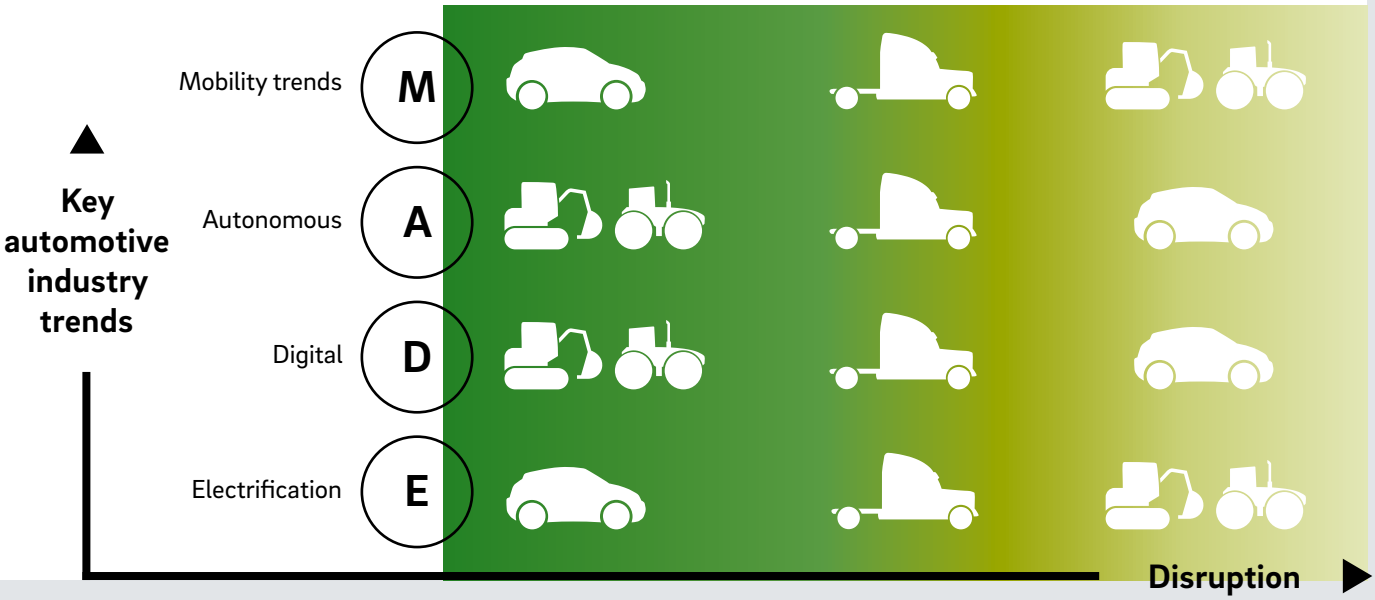
In light of the electric vehicle revolution, the automotive industry is facing unprecedented change. This disruption affects not only passenger vehicles (PV) and commercial vehicles (CV), but also off-highway (OH) vehicles used in both construction and agriculture. According to those we've interviewed, original equipment manufacturers (OEMs) find themselves in the middle of a perfect storm. And amid an uncertain geopolitical environment and slowing markets, senior leaders must develop both immediate and long-term responses to these important disruptive trends. That will likely include new business models, the use of autonomous and connected vehicles, and electric motor technology. Of course, all this must be done while maintaining margins that are acceptable to investors.

Not every trend applies the same intensity to every industry, however. Depending on the trend, OEMs may find themselves either in the center of the storm or a little further away. Nevertheless, the shock waves of each and every trend will affect all industry segments for the next decade and beyond.

Consider new business models, for example. Here, PV manufacturers are clearly feeling the pressure of ride-sharing apps, self-driving cars and even improving public transport. In short, the relevance of passenger cars as a mode of personalized transport is clearly under threat. In CVs, digital freight-matching platforms promise to uproot and revolutionize the existing power structure of the logistics industry ▶

Key trends and their impact on industry segments

Although not as immediate as in passenger vehicles, electric disruption is already affecting off-highway vehicles

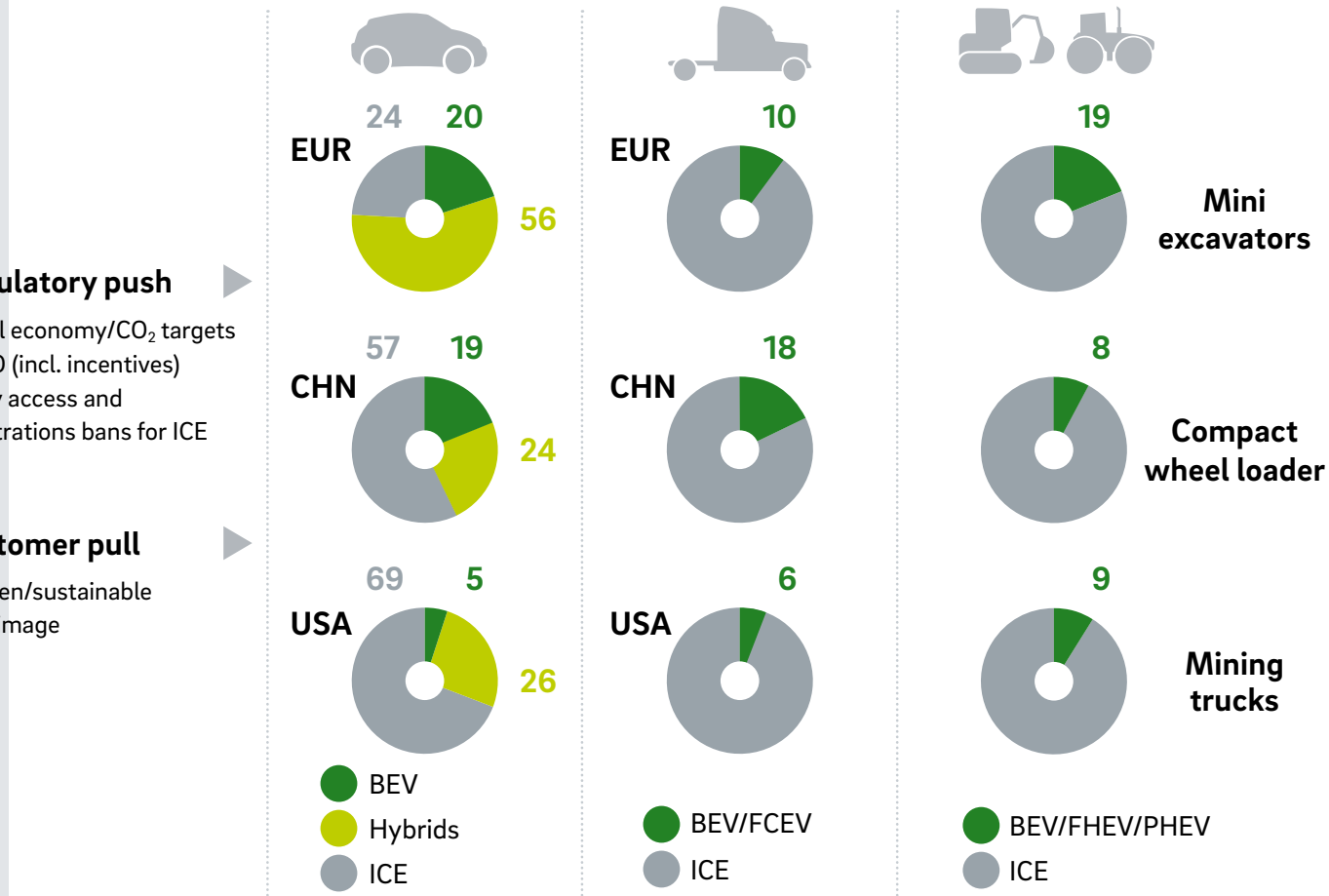


Source: Roland Berger

Electrification drivers and penetration

Electrification will differ by segment: while LV will see high rates by 2025, only selected OH use cases will get electrified

in percent



Source: Roland Berger

– a trend that will have long-term effects on the distribution of profit pools.

Regarding autonomous driving, the confined environments of either mining or agricultural vehicles make them a primary candidate. Although autonomous solutions have been available for some time, they are expected to sharply rise in the commercial vehicle industry over the next five years while significantly reducing total logistics costs during the same period. Connected solutions, for their part, have similarly generated significant interest from and value for customers in the agricultural and construction business. In recent decades, OEMs have invested heavily to build profitable platforms that allow farmers to improve their operating efficiency and total yields. In the commercial vehicle industry, connected solutions have become table stakes as well, even though convincing profits are still somewhat elusive.

Electric vehicles are an especially stark example of disruption, with passenger vehicles clearly in the lead. Driven by strong regulation in Europe and China, and by incentives and customer interest in the US, electric passenger vehicles have become both a necessity to meet emission norms, as well as an acceptable, if not exciting, consumer choice. Of course, China's desire to leapfrog technology development in the automotive industry, the leadership role of Tesla, the Volkswagen diesel debacle and the justified global

concern around climate change have all done their part to accelerate the global appeal of electric passenger cars. Consequently, about 20% of all passenger vehicles sold in Europe or China are expected to be fully electric by 2025, and another 56% or 24%, respectively, are expected to behybrids during the same period.

Positive use cases in the electric CV industry are more challenging, however. Depending on driving patterns, diesel and electricity prices, and road tolls, the number of electric medium-duty and bus applications will likely increase globally. In Europe and China, some regional-haul trucks will also be electrified in the coming years as the total cost of ownership of these trucks continues to shrink when compared with that of traditional diesel trucks.

Although the overall trend towards electric off-highway vehicles remains less dynamic than either PV or CV, several environmental and regulatory factors are already forcing off-highway manufacturers to strongly consider the transition to electric. In fact, emission regulations tend to eventually migrate from PV to CV to OH vehicles, especially as pressure to reduce greenhouse gases at both construction and agricultural sites intensifies. Cities such as London, for example, are already pushing for increased local emissions and noise reductions from OH vehicles. Furthermore, housing societies' push towards clean, quiet and maintenance-free turf solutions may lead to an eventual change in powertrain technology as well. Additionally, autonomous "swarm solutions" for weeding and seeding machines are equally good candidates for battery technology.

Either way, all indications suggest that the electrification of off-highway vehicles will increase in the future, even though applications will be limited in the short to mid-term (*see graphic at right*). During this period, drive applications will likely be limited to compact construction and turf equipment. Other immediate applications will likely be focused on power management, e.g., for small fans and blowers, precision control, such as variable-rate technology, and self-propelled implements. Overall, the number of direct use cases of electric off-highway vehicles seems manageable for the foreseeable future.

But it won't last.

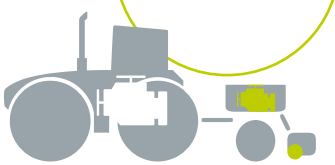
Disruptive components: specific off-highway use cases

Electrification in the off-highway segment will not be as broad as in the LV segment, but very use-case-specific

Environment integration

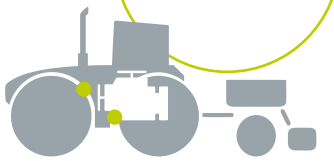
> **Self-propelled implements**
Pulled implements can be equipped with e-motors to provide additional traction

> **Precision control**
Electric motors provide better controllability, e.g., for precision seeding equipment



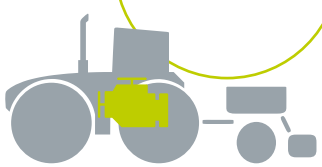
Auxiliary integration

> **Power management**
Mechanically driven auxiliaries (e.g., fans, blowers) can be replaced by electrically driven ones



Drive function

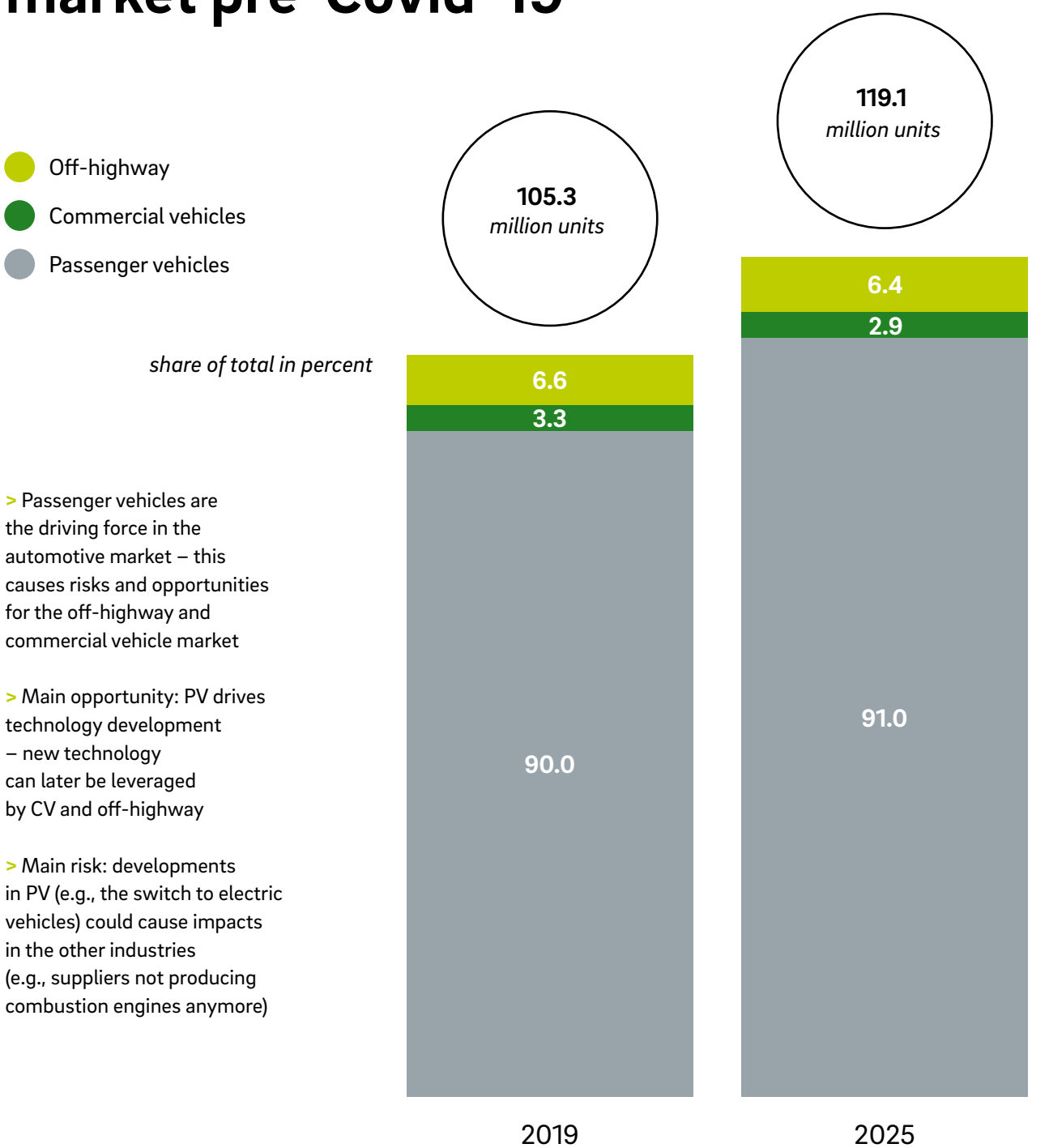
> **Compact construction equipment & turf**
Diesel-hydraulic drive can be replaced by battery-powered hydraulic drive, e.g., urban construction equipment



Source: expert interviews, Roland Berger

Total automotive market pre-Covid-19

Developments in the PV segment are highly relevant for OH as they drive >90% of the units in the automotive market



> Passenger vehicles are the driving force in the automotive market – this causes risks and opportunities for the off-highway and commercial vehicle market

> Main opportunity: PV drives technology development – new technology can later be leveraged by CV and off-highway

> Main risk: developments in PV (e.g., the switch to electric vehicles) could cause impacts in the other industries (e.g., suppliers not producing combustion engines anymore)

Source: IHS, Roland Berger

How off-highway vehicles can respond

While the immediate impact of electrification on off-highway vehicles is somewhat limited, off-highway manufacturers cannot relax, as there are several indirect challenges pertaining to their supply base. Since passenger vehicles drive more than 90% of the total volume in the automotive market, developments in the passenger vehicle market are extremely important to the automotive supply chain, off-highway vehicles very much included. On the plus side, this allows off-highway manufacturers to more easily adopt the technology developments taking place in passenger vehicles at a lower cost when adapted to their own off-highway requirements.

On the negative side, technological disruptions in PVs, such as the shift from internal combustion engines to electric ones, will have a major impact on resource allocations and automotive supplier investments. This is especially relevant to technology adoption timelines that will vary significantly between passenger vehicles and off-highway ones.

"Key suppliers are re-focusing their powertrain portfolio towards predominantly electric components. Others re-focus on different domains by shifting their existing portfolio towards technologies that are less likely to be disrupted."

DR. WILFRIED AULBUR, SENIOR PARTNER

Over the last decade, automotive suppliers have already started to invest meaningful resources in electric vehicles. Some suppliers are natural hedging by extending an existing electric component business to offset the coming decline in the conventional powertrain business. Others are re-focusing their powertrain portfolio towards predominantly electric components. Others still may re-focus on different domains by shifting their existing portfolio towards technologies that are less likely to be disrupted. Lastly, we already have seen several new suppliers enter the field with a strong focus on power electronics and electric motors.

While the timing of supplier activities varies greatly between early movers (those taking action before 2011), mid-level adopters (those before 2015) and late adopters (those after 2015), in all cases suppliers are moving resources away from traditional parts and investing heavily in new technologies. In some cases, suppliers have even spun off their "old" business to fully concentrate on supplying future technologies to the rapidly growing electric vehicle market.

For off-highway manufacturers, these developments are a double-edged sword hanging over their heads. On one hand, investment in their business may be curtailed and they may find themselves working with the suppliers' C rather than A or B teams. In the long term they will likely face significant supply constraints or other unforeseen disruptions. On the other hand, they might have to identify partners to leverage potential technology developments that will only become relevant for the off-highway segment down the line. ▶

Expert talk

WITH DR. WILFRIED AULBUR, SENIOR PARTNER

Since electric vehicles are mostly a passenger and commercial vehicle issue, do off-highway manufacturers need to worry? Yes. Although electric vehicle disruption has largely impacted only passenger and commercial vehicle manufacturers so far, the technology is already making its way to off-highway vehicles. The bigger issue, however, is that since passenger vehicles influence 90% of all automotive supply chains, off-highway vehicle manufacturers will feel indirect impacts in the near future. This is a relevant challenge and potentially an opportunity that forward-thinking manufacturers are taking seriously.

How should off-highway vehicle manufacturers respond, both in the short and long term? I believe they have an obligation to not only understand what disruptions are taking place, in addition to electric vehicles, but how those disruptions are impacting their entire supply chain and what it means for them. I also believe off-highway manufacturers must evaluate their current and prospective suppliers to see which are best prepared to support OEMs to adjust to changes in market demand. To do that, Roland Berger has developed a proprietary and proven methodology approach that we call "Securing and Leveraging Supply" (SLS).

What's one thing you know for sure? In an uncertain world, flexibility and speed are an absolute necessity. We combine this belief with a clear commitment to client success, whether it's in the field of growth, operations or innovation. In the case of off-highway manufacturers, our SLS approach is a proven way to evaluate potential risks and opportunities and to ultimately stay ahead of disruption before it's too late.

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In our experience, OEMs are usually ill-equipped to manage these supplier-related technology challenges. To that end, Roland Berger has developed the "Securing and Leveraging Supply" (SLS) approach to overcome these issues.

As you can see from the graphic on p. 9, the securing supply aspect of our approach concentrates on two key risks for off-highway OEMs: the market risk and the individual supplier risk. Let's examine the market risk first.

We assess the market risk by analyzing the development of internal combustion engine components in the relevant markets, such as passenger vehicles, commercial vehicles and off-highway. Our market models quantify the impact of electric vehicles on the volume development of key components. High-risk components are those where we see a significant drop in PV market size by 2025, while conversely the demand for CV and OH in general, and for specific OEMs in particular, is either flat or growing.

Next, we analyze the supply base for high-risk components. In particular, we focus on suppliers that have a high exposure to the PV segment, derive their scale benefits by leveraging PV investments for OH and earn less-than-average profit margins with the components in focus. As such, this type of supplier is likely to take action by either selling the business or shutting it down or by consolidating the space ("last man standing" strategy). These high-risk suppliers are marked for detailed analysis to understand their likely course of action in light of the electric industry transformation.

The dependency of OEMs on the suppliers in focus is then established and potential mitigation steps are evaluated. Options for mitigating a potential supply chain risk start with consolidating spend with an existing supplier. Another option is re-sourcing. Here an alternative supplier must undergo the same kind of analysis before being deemed a more suitable answer. Other potential actions include equity investments in suppliers, an outright purchase of them or even building in-house capability. While some of the actions can be pursued by a company alone, others may make sense in a consortium of competitors in line with the developments that are currently happening the in PV industry. Business case evaluations ▶

Roland Berger's Securing and Leveraging Supply approach

Helping identify what and where disruptions are taking place and what to do about it

OEM Challenges

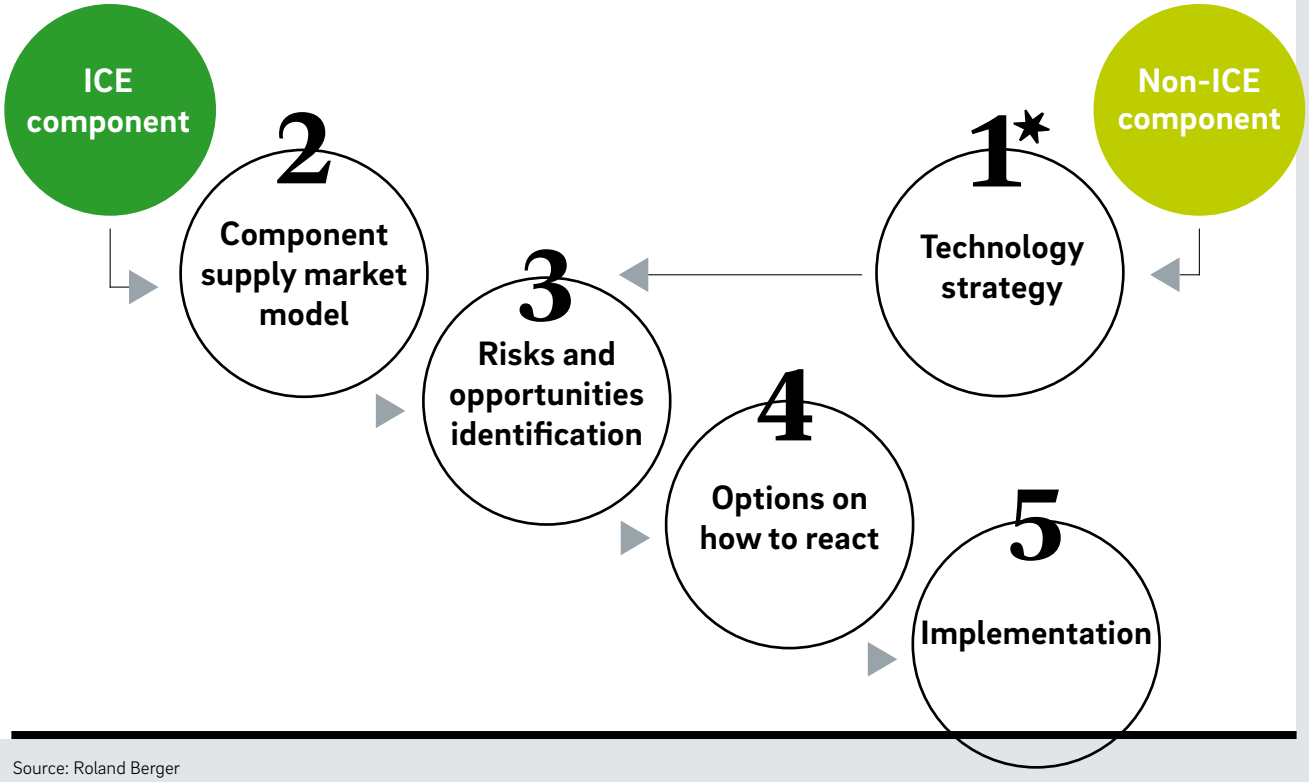
> LV electrification could impact the OH segment also as suppliers shift investment focus away from ICE technology

> Off-highway OEMs need to develop a supply base for their electrification use cases

Roland Berger solution

> **S**ecuring and **L**everaging **S**upply approach (SLS)
– Captures different market dynamics
– Proven more relevant than other approaches

1 Components prioritization & high-level-risk



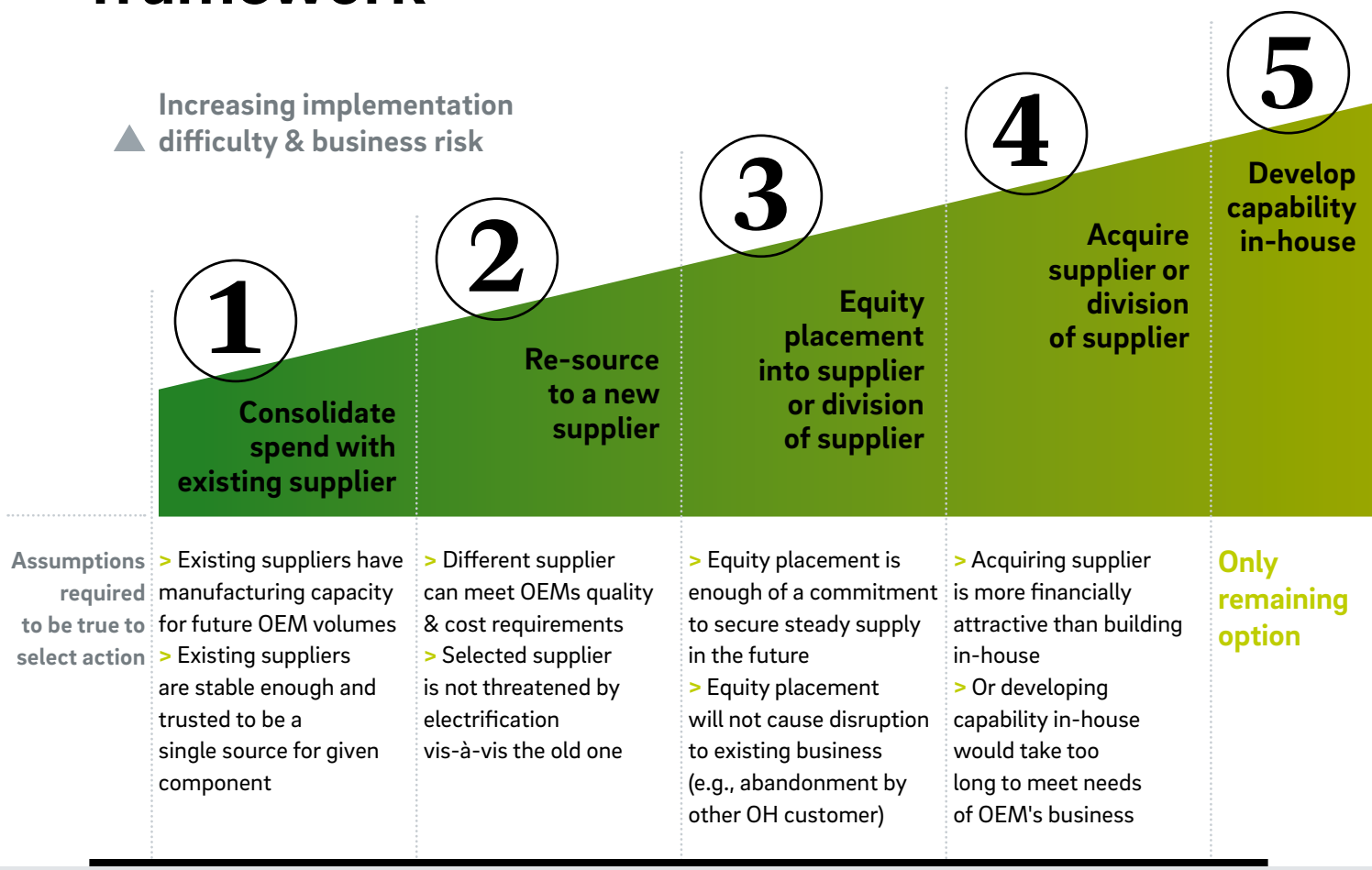
Source: Roland Berger

provide additional inputs regarding risk exposure and timing of actions. These are then complemented by a monitoring process that combines external views (e.g., the Roland Berger trend radar MADE) with internal insights (e.g., supplier discussions, structured reviews, technology days).

On the leveraging supply side of our approach, we focus on identifying opportunities for technology partnerships with suitable suppliers. However, we can easily include other ecosystem participants such as start-ups in our analysis. In the context of electrification, let's take hydraulics as an example. As we have seen earlier (*graphic p. 5*), there are use cases in which a replacement of hydraulics solutions with electric motors is possible. While the impact of such changes is too small from a revenue perspective to threaten the off-highway suppliers, a systematic analysis of potential technology partners in the supply base is warranted. The question to answer is not, "Will my supplier still be there tomorrow?" but rather, "Which supplier has the right capabilities to develop tomorrow's solution?"

RB reaction framework

Our five-step framework determines mitigating actions to the various levels of disruption-driven supplier risk



Source: Roland Berger

Looking ahead

The automotive value chain, whether you work with passenger vehicles, commercial vehicles or heavy off-highway machinery, is being disrupted by new business models, autonomous driving, digitalization and electric vehicles. While the impact and timing of these trends varies between segments, they will undoubtedly cause serious ramifications for both OEMs and their many suppliers.

For example, as cabless trucks and tractors emerge as a new sub-segment, manufacturers must identify new ways to differentiate their product offering. The provision of post-sale services to autonomous vehicles will require tight vehicle integration with OEM service networks via connectivity and predictive maintenance solutions. And electric vehicles will require new service models and a massive re-training effort for all personnel.

Furthermore, increased vehicle investment will likely consolidate total fleet sizes and necessitate improved solution-selling capabilities of the sales network. Procurement will need to find ways to extract additional value and identify new opportunities from a supply base that is adding significantly more value and owns more IP than it had in the past. Manufacturing will have to become more adaptive and flexible to adjust capacities to reflect the higher utilization of automated vehicles. Engineering will need to work more closely with both business strategy and procurement to mitigate risks and realize new opportunities. Additionally, increased investment towards developing new and sometimes self-cannibalizing technologies will surely require new partnerships and collaboration between both commercial vehicles and off-highway OEMs, in much the same way as we can observe this already in the passenger vehicle space.

From a procurement perspective, our SLS approach helps your organization gain a greater understanding of the technological disruption taking place. That includes both the most imposing supply chain risks, as well as the greatest supply chain opportunities, found in technological collaboration. While our approach is technology-agnostic, we have concentrated it on the recent rise of electric vehicles, which is a particularly pressing technology for off-highway OEMs.

In short, our approach provides a pragmatic and accurate way to future-proof your procurement strategy and can be easily integrated with existing supplier evaluation processes. Since it is closely linked to the most relevant technology disruptions and commodity strategies, it also provides one of the most dynamic outlooks available today.

Although the automotive industry is caught in a perfect storm of technological disruption, we believe our Securing and Leveraging Supply method can enable proactive procurement teams to make confident decisions regarding their future agility, flexibility and ultimate success in the modern automotive industry.

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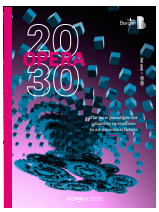
Further reading at www.rolandberger.com

MADE

New Mobility, Autonomous driving, Digitalization and Electrification: these megatrends have the potential to turn the automotive industry upside down.

Automotive new normal

Covid-19 has put enormous pressure on the automotive industry. Companies must now plan strategically for the long term to adapt to the "new normal" era.



OPERA 2030

OPERA is a comprehensive model for operations based on five key perspectives that help companies stay adaptive in uncertain times.

Procurement endgame

Digitalization, automation, commoditization and industry-specific disruptive forces are reshaping the procurement function, offering the chance to put strategy at the top of the agenda.

Photos: Roland Berger GmbH

Publisher ROLAND BERGER GMBH, Sederanger 1, 80538 Munich, Germany, +49 89 9230-0, www.rolandberger.com