Automotive Digital 4 : Smart Cities, AR, VR, Robotics and Additive Manufacturing

This is the final part of a series of posts explaining new digital technologies and where they might impact on Auto OEMs and their distributors. This post looks at Smart Cities, Augmented Reality, Virtual Reality and 3D Printing, sometimes called 'Additive Manufacturing'
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For many, the 'smart city' is science fiction. They're wrong. It's closer to science fact: on the leading edge of what is, or soon will be, practical technologies. Smart cities will result from integrating a range of technologies. Some are system-wide, such as AI, Big Data, Connectivity. Others are are local, such as Robotics, AR and 3-D Printing. The core goal of the smart city is to integrate this wide range of technologies to deliver enhanced services. This begs three questions: For whom? By whom? And, who benefits?

Hong Kong protesters destroy 'smart' lamp-posts Aug. 2019 Businessinsider.my

There are significant concerns with both of the two dominant philosophies of why and how to develop 'smart cities'. City planners see the citizen at the heart of the enterprise: their avowed ambition is to enhance public goods and services for the benefit of all the citizens. Singapore and Dubai are examples of cities whose planners profess to have this aim in mind. In contrast, entrepreneurs, such as Jeff Bezos of Amazon or Elon Musk of Tesla, see the customer as the centre of attention: their ambition for smart city technology is to enable people to consume their products and services seamlessly from dawn to dusk.

RT Eirann Ethics of Smart Cities

With both philosophies <u>concerns</u> about dissolving personal privacy are high. Protestors in Hong Kong damaged 'smart' lamp posts over surveillance concerns. Even when you die, your data will live on. In the case of privately-owned platforms – Amazon, Google, AirBNB and Uber – their undoubted innovations are not value-neutral. These companies are well-recognised as self-serving businesses, not public benefactors. City planners underplay the shortcomings of digital platforms as well. Yes, digital improves efficiency in service provision, but at what cost? Digital builds bias in its algorithms and is so complex that it disenfranchises the less well-off or less well educated. Take the real-world impact of proliferating e-scooters, for example. Great for the young but a source of public nuisance, vandalism and pedestrian accidents for the rest. Or the depletion of affordable local housing to expand AirBNB provision.

Whichever way these competing outlooks develop, mobility, transportation, vehicles and traffic management are central issues to resolve in the common interest. City planners and the public want to reduce traffic congestion and air pollution as much as taxi fleets want them reduced to increase their revenue per vehicle.

What is a 'Smart City'?

smart city dimensions IBM

The narrowest view of a smart city is that it integrates information and communication technologies to deliver new and smart ways to manage complexity, increase efficiency, reduce expenses and improve quality of life. According to the <u>European Investment Bank Institute</u>, smart cities go beyond simply automating daily functions, such as paying utility bills or pre-booked car parking. They enable us to monitor, understand, analyse and plan the city to improve urban performances in real time. They take a broader view than technology. To be really 'smart', urban areas need to manage their development by supporting economic competitiveness, enhancing social cohesion, environmental sustainability and ensuring an increased quality of life for their citizens.

The smart city idea is that the 'Internet of Things' allows people and infrastructure to be connected in real time. As this occurs, the city itself becomes 'connected'. For example, if

there are potholes on your street, you currently have to write letters or make phone calls to your local government for the *chance* that they'll fix it. In theory, if you're in a smart city, you can open up an app and report it. This is the goal; that everything can be done through the use of technology. In a smart city, sanitation would know when certain dumpsters need to be emptied when the sensors tell them, citizens could report issues with a tap on a screen. Technology is implemented in a way that leads to a better quality of life for all.

What is different about smart city mobility?

A century ago, horses and carts dominated local transportation. In the intervening period auto OEM's conjured up cars and trucks, car parking, petrol prices, city streets and open roads. And more: "the freedom machine," mass transportation, car dealerships, internal combustion. Congestion. Accidents. Pollution.

Carbon Footprint Atlanta US vs. Barcelona, Spain Source: **Morphcode**

Within the next two decades most of this will be obsolete and some will have gone. Just as we moved from horses to cars, we'll move from cars to mobility. Not everywhere. Not at the same time. Not everyone. But the 60% forecasted to live in cities by 2030 will have changed. Estimates are that around 50% of auto OEM earnings will be from mobility services by then. The way that they expect to achieve this is by generating earnings from 'smart mobility'.

"Smart Mobility" wants to raise the efficiency and service quality of urban transportation through the use and adoption of new mobility solutions. It aims to increase peoples mobility through efficient mobility management and targeted infrastructure investments.

In practical terms, it wants to deliver cheaper, faster, and environmentally friendly mobility using an integrated multi-modal offering. This could be new forms of transportation – such as electric vehicles, hydrogen-powered vehicles, autonomous vehicles, bike sharing, carpooling/car-sharing – and the infrastructure and communications needed to access them at will.

Ultimately, the intention is to achieve high-quality mobility services at optimal cost and to improve the flow of people and goods within a city or community, while at the same time reducing the environmental impact.

In short, reduce pollution and congestion. Improve the productivity and efficiency of vehicles and transit systems. Reduce costs for people but provide the right kind of transport on demand. Few would argue with that. Certainly not Auto OEM's.

Auto OEMs

Automotive OEM's think they can facilitate 'smart cities' by implementing the '**CASE**' strategy – Vehicles that are **C**onnected, **A**utonomous, **S**hared and **E**lectric. In March 2019, McKinsey estimated that to achieve a dominant position in all four aspects of CASE would cost a company around $70BN. Only Microsoft, the USA's 'FAANG' companies (the five most popular and best performing tech stocks in the market, namely Facebook, Apple, Amazon, Netflix, and Alphabet's Google) and some of China's BAIT's (Baidu, Alibaba, iQiyi and Tencent) could finance it independently. It would be beyond the resources of any single auto OEM, so a 'go-it alone' approach is unattractive. A strategy of joint ventures, partnerships and targeted acquisitions makes more sense.

The global spend on mobility each year is between $8Tr and $10Tr each year. Auto OEM's enjoy 25% of that. Fuel, servicing, insurance and financial services take another 10%. In many cases, the businesses are separate,working in their own silo. At its core, 'smart mobility' works across the silos. It connects vehicles, infrastructure and customers. For those who succeed in new mobility, the financial rewards are exceptional. Most auto OEM's have already recognized this. Here are just two examples.

Volkswagen: Despite Covid-19, Volkswagen "We" mobility service is up and running in the EU, the US and Asia. It plans to add e-bikes to the offering and connect it to its MOIA ride shuttle service. And VW has larger ambitions to become a global smart city mobility provider. It has already committed itself publicly to an investment of €15 billion in autonomous driving, e-mobility, digitalisation and other innovative mobility services across

China and Asia before 2030. Since 2016 it has been building its own urban district – 'Steimker Gärten' (Steimker Gardens) located ten minutes from its Wolfsburg HQ. This is its test bed for smart homes as well as smart mobility. It's partnering with Hyundai and US autonomous vehicle start-up, Aurora Innovation, to bring driver-less cars to market in 2021.


Woven City, Toyota

Toyota: Toyota are shadowing VW closely. They announced a 175-acre project – Woven City – advertised as a "living laboratory" to start in 2021. It will be home to a wide array of interconnected 'smart city' technologies, including robotics, AI, autonomous vehicles, IoT,

smart homes, smart construction and manufacturing, digital health, and sustainable energy. The project will be the test-bed for Toyota's digital mobility solutions and driverless and hydrogen powered vehicles. They also announced their new mobility brand – Kinto. This will only focus on sustainable mobility services including carpooling, autonomous transport, subscription-based travel among others and demonstrates Toyota's vision of itself beyond manufacturing and selling vehicles.

Seeing is believing: Augmented Reality, Virtual Reality and Mixed Reality.

Augmented Reality Service Training Bosch
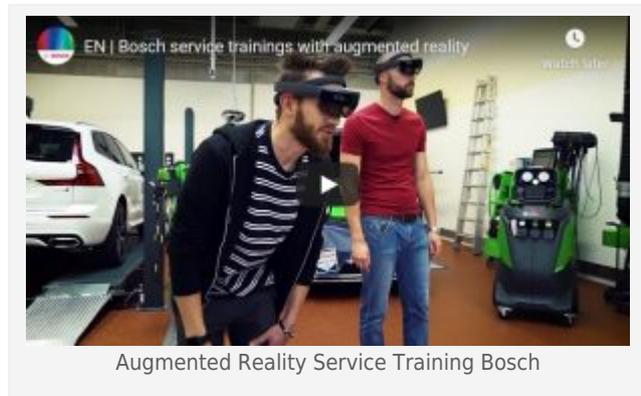
What's the difference? Virtual Reality (VR) is a completely digital experience – you're in a digital world. Augmented Reality (AR) is the 'real world' with a digital overlay. Mixed Reality (MR) is when both VR and AR are inter-twined. You move seamlessly from one to the other (AR)

AR and VR technologies have moved far beyond the world of gaming. The automotive sector accounts for 20% of the investments in the AR and VR space. The global market for automotive AR & VR solutions is expected to reach about $673 billion USD by 2025, according to Statista with an astonishing CAGR of 175.7 percent from 2018 to 2025.

Driving this investment by OEM's is the search for competitive advantages in five core AR/VR applications: Heads-Up Displays (HUD), Immersive Showrooms, Virtual Prototyping, Augmented Training and Service Support Tools. Three of these – Immersive showrooms, Augmented Training and Service Support Tools promise to revolutionise the retail and after-sales experience.
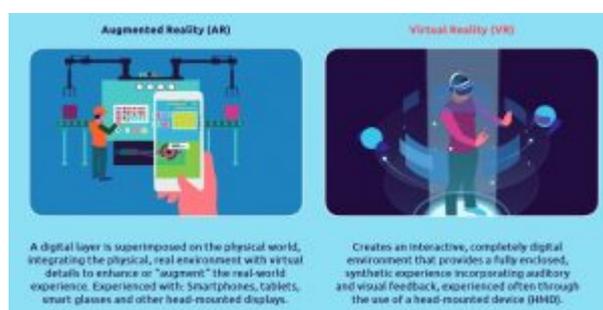
The business case is persuasive. SEAT report a 30% reduction in the time to produce new prototypes. Both Bosch and BMW are using AR to speed up service completion times and improve technical training. Volkswagen in cooperation with Metaio developed a similar AR-based application known as MARTA (Mobile Augmented Reality Technical Assistance). The system labels all vehicle parts with text and provides work instructions with additional information such as the tools to be used.

But these technologies will impact retail and after sales as profoundly as manufacturing. Digital scenarios can be layered on top of each other to simulate time, space and scale to produce an immersive simulation experience far richer than can be achieved in a

conventional showroom or sales reception. Sales and customer experience training can be transformed by placing trainees in immersive negotiating and presenting simulations to develop and hone skills. Simulators can replace basic and advanced skills training at lower cost than traditional classrooms. Its faster and more focussed than e-learning. Learners are emotionally as well as intellectually engaged.

The use of AR and VR act as a customer and employee bridge between the physical and digital worlds. It allows you to tailor the presentation to the customers specific interests, be they costs or climate change. There's no surprise that retailers are also expected to be major AR/VR investors.

Robotics

In 2005 90% of all industrial robots were installed in automotive production environment. So, automotive managers think that they're familiar with how robots are used: bots do the boring, heavy, repetitive jobs that human beings used to do, right? Wrong! Robots aren't limited to dirty, heavy dangerous lifting any longer. When you add them to 3-D printers and computers, they can do so much more; when you reduce their price, they pop up everywhere. They promise to revolutionise the parts business.

Xtree, a start-up in France, added a 3-D printer to a robotic arm to 'print' woven concrete street furniture. They also 'print' architect designed buildings. When you add a deposition module to a robot arm, it can make whatever you want in any material that can b made to flow.
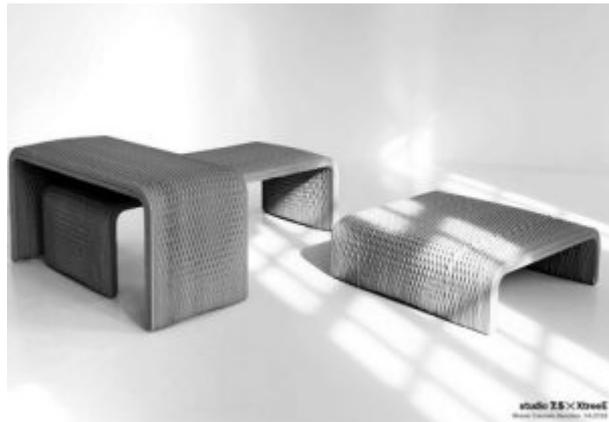
Rethink Robotics "Sawyer" co-bot

Hahn Group's, Rethink Robotics focuses on co-bots – robots that work alongside humans to carry out chores. Their 'Sawyer' co-bot (collaborative robot) is one of thousands working alongside humans to inspect, lift, package or monitor products and processes in the workplace. Robotic Vision added 3D cameras to robotic arms so that its manufacturing robots can "see, think and do".
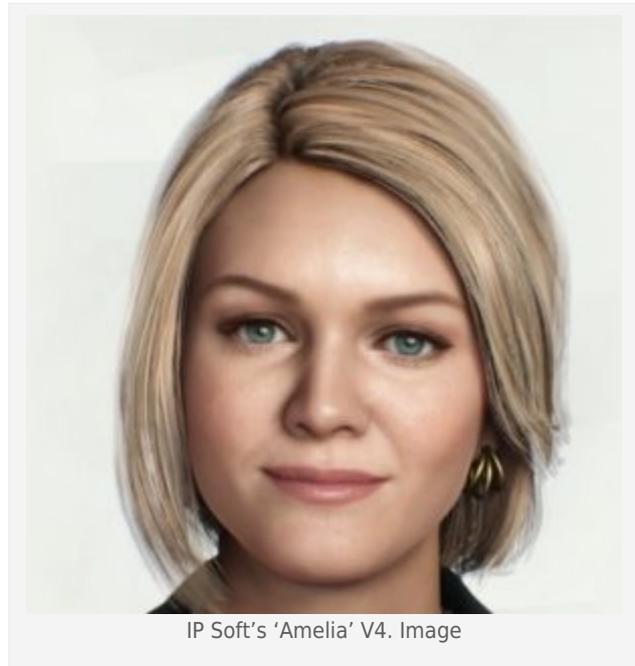
IP Soft's 'Amelia' V4. Image

Robots are coming to service and retail as well. 'Amelia', Ipsoft's AI bot and arguably, the first digital employee handles routine customer interactions for a variety of businesses. No downtime, no deviation, always word perfect.'She' can answer calls and handle simple requests, such as for an address or store hours. Most importantly, she knows when to bring in a human to respond to more complicated inquires.

With Covid-19 accelerating online sales by 40% or more, according to Nielsen Research, retailers need to consider new 'normal' options depending on the evolution of the pandemic. If a smartphone is now a retail outlet, what is the role of a shop or a showroom? Some argue that retail will become more experience-focussed. Will buyers want to visit another box in the suburbs filled with products? Or, will people will get only leave home to buy when there is a remarkable experience and retail is exciting again? In any event, big data may have an increasing role in retail. 'EmoVu' is a customer tracking software that records emotional responses to products and displays. The creators, Eyeris, are a major AI innovator in the autonomous vehicle and retail space working for Bosch, Toyota, JLR, Honda and Mitsubishi among others. Or, what about Tally, hailed by Simbe Robotics as the "first robotic autonomous shelf auditing and analytics solution."

Additive Manufacturing (AM)

3D Printing has been around since the 1980's. It made the leap into 'additive' manufacturing when major manufacturers in China and the US added low cost computer design interfaces and sales volume allowed costs to fall. So, it's yet another technological advancement made possible by the transition from analogue to digital processes.

AM uses computer-aided-design (CAD) software or 3D object scanners to direct hardware to deposit material, layer upon layer, in precise geometric shapes. As its name implies, additive manufacturing adds material to create an object. By contrast, when you create an object by traditional means, it's often the opposite: removing material through milling, machining, carving, shaping or some other means.

In the right applications, additive manufacturing allows complex parts to be created on-site to agreed specifications. The ultimate goal is no slow-moving parts stock and never again out of

stock.

HRE3 Titanium Wheel

But you can only make parts in thermoplastics right? Wrong. Although thermoplastics drew the most attention in the early days, material options continue to grow. Additive manufacturing (AM) now uses metals, ceramics, glass, composites, graphene-embedded plastics, paper, concrete, food, yarn and bio-inks – used to create artificial organs and soft tissues – among others. In 2017, NASA announced the successful testing of an igniter made of multiple metal alloys. Here's a video of the 3D printing of a high-performance titanium wheel for HRE3 which shows what can be done today in automotive parts.

Motor Industry impacts?

Many industry participants foresee two options, a binary choice between evolution and disruption. The optimists assume that existing players in the automotive supply chain – suppliers, OEM's and distributors will be 'competing as usual' and they expect *evolution*. While accepting the industry will experience a faster rate of change they do not expect it to be revolutionary. The pessimists start from a different assumption. They think that new players – from digital giants to tech start-ups – have much to gain from breaking down the existing chain. As a result they forecast *disruption* of the automotive supply chain in many markets.

Scenario 1: Evolution – 'Competing as Usual'

In this scenario, major suppliers and OEM's have less to fear – at least in the short term – than distributors and retailers. Digital tools and pivoting towards 'CASE' as a strategy 'blueprint' offers both threats and opportunities to suppliers and manufacturers alike. The financial contribution from traditional high profit components, such as engines, may erode and there are risks that new suppliers – battery manufacturers, software developers and infrastructure providers may capture more of the vehicle profit. On the other hand, Industry 4.0 processes offer reduced production costs and mobility services may provide manufacturers with new income streams. In a 'competition as usual' scenario one of the largest risks facing "upstream" firms is that they fail to develop new 'CASE' technology themselves and have to pay high fees to third-party providers.

The outlook is mixed for downstream businesses – distributors and retailers. In their 2016 report, 'The Future of Automotive', Microsoft argued that four changes would require responses from dealers who wished to survive: first, connected cars would require personalized services and increasing use of big data to develop customer insights; second, evolving mobility services would require more personalized services; third, dealers would need to invest in digital training tools for their staff; and, finally, predictive maintenance, would require new services and standards. A faulty vehicle would be almost unacceptable.

PWC went

	Today–2018 Traditional retail dealer	2023	2028+ Mobility service partner
Business model	• Traditional retail dealer • Bonus/margin structure		• Agent model • Qualitative incentive/bonus structure
Channel approach	• Multichannel sales approach	**Ongoing change towards an 'agent model'**	• Integrated omnichannel sales approach
Products/ services	• Product-driven • Focus on selling cars and related products		• Service-orientated • Mobility advisor focusing on personalised services
Customer data	• Non-unified CRM view • Individual customer data		• Holistic CRM view • Shared customer data

urther in their 2018 report, 'The Future for Automotive Retail', they concluded that, "OEMs and dealers need to establish an even more collaborative and integrated sales model to be successful". They forecast "a continued downsizing from the current dealer franchise network coupled with a switch to an agent model. The dealer will become a mobility service partner focusing on tasks such as test drives, vehicle handovers, mobility service offerings etc., acting as the direct link between the OEM and customers. The OEM will be in charge of car sales and marketing activities, pricing concepts, branding and shared back office services". They foresaw lower retailer profits, compensated by lower investments and risks. Their report was silent on how dealers should finance the transition to a lower cost, agent role given their existing huge investments in edge of town retail stores across the globe.

Scenario 2: Disruption – 'Competing with Digital Giants'

Applied tech companies, such as the US's Microsoft and the 'FAANG' companies, the Chinese 'BAIT"s plus a host of pure tech firms, like Oracle, Cisco and TSM have dominated the growth in market capitalisation for almost two decades. Their combined market value, roughly $6Trillion for the US firms alone, enables them to consider ac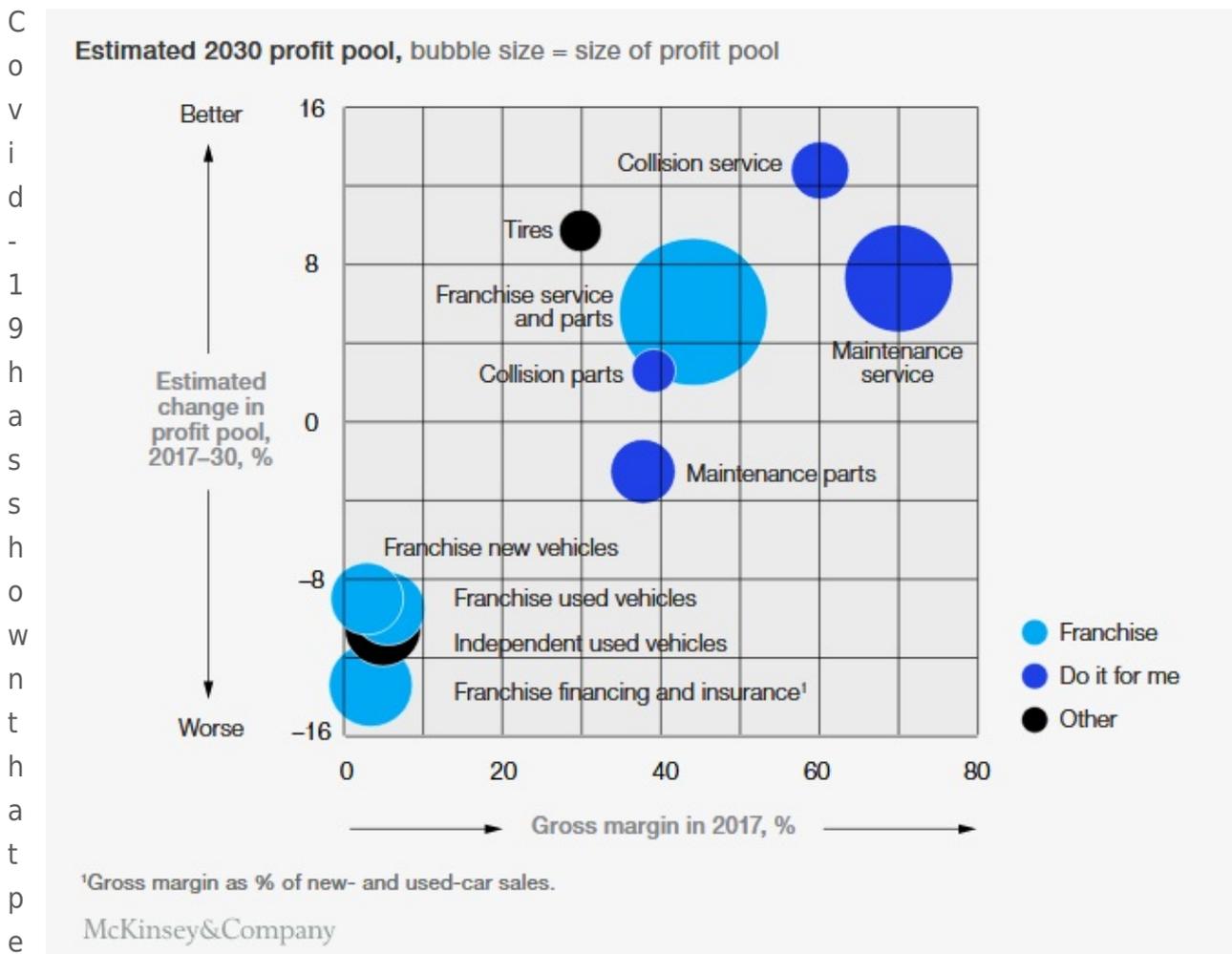quiring almost any other firm on any global stock market, including any traditional automotive manufacturer and supplier.

They have an established record of buying up smaller firms to capture or leverage technology or application breakthroughs. As of 2019 Microsoft had acquired 225 firms, Google 236, Apple

109, Amazon 85 and Facebook, a mere 79. Their targets are eclectic. In 2016 Microsoft paid $26.2BN to get access to LinkedIn's 575 million subscribers. Amazon paid $13.7BN to add Wholefoods multinational supermarket chain in 2017. Google bought Motorola for $12.5BN in 2012 to acquire its smartphone patents. Facebook paid $22BN in 2014 for WhatsApp. McKinsey suggested back in 2016 that, when OEM's have no choice but to partner with Digital Giants, there will be ample opportunities for the digital firms to create a dominant position. They already have the access to software engineers, investment capital, and a knowledge 'eco-system'. Auto OEM's must buy or build theirs from scratch. McKinsey concluded, "Consequently, today's OEMs and tier-one suppliers must abandon strategies aiming at total control of vehicles and instead pick and choose where and how to play by shedding assets, streamlining operations, and embracing digital acquisitions. If McKinsey are correct, Auto OEMs will be of reduced importance. They will be partners, not dominators.

The Outlook for traditional distributors and retailers?

Few would argue that dealers of any size or location represent the leading edge of retail or customer experience. But, many customers, habituated to the 'try before you buy' method of car buying, still report that seeing, touching and driving a car in a showroom is the most valuable element in the car buying experience. They may want to dispense with sales consultants, but they aren't quite ready – especially those over 45 years old – to dispense with dealers. And, when it comes to the final specification and transaction, most still prefer to complete face-to-face at a dealer But, could this change?

Estimated 2030 profit pool, bubble size = size of profit pool

Estimated change in profit pool, 2017–30, %

Better / Worse

Collision service
Tires
Franchise service and parts
Maintenance service
Collision parts
Maintenance parts
Franchise new vehicles
Franchise used vehicles
Independent used vehicles
Franchise financing and insurance[1]

Gross margin in 2017, %

Franchise
Do it for me
Other

[1]Gross margin as % of new- and used-car sales.

McKinsey&Company

Covid-19 has shown that peo

ple are willing to abandon their weekly supermarket shopping trip – a tradition of half a century – in favour of online ordering and risk-free fast delivery at little or no cost. Supermarkets too have recognised that online sales enables a much lower cost base. What would be needed for something similar to happen with car sales? Not much. Factory vehicle prep and refurbishment centres separated from vehicle sellers to deliver standardised quality levels. Vehicle exchange warranties. On-board vehicle monitoring of speed and condition Enhanced vehicle delivery and hand-over services. Tesla has already made clear that it does not intend to appoint dealers or service and repair outlets.

There are growth opportunities, but none are risk-free. Dealers have to take a measured approach to the risks of direct sales from manufacturers in the brands that they represent. Their survival within the network will depend on each individual business case. As more sales shift to online, new and used vehicle profits will be more transparent – and therefore lower. Until the widespread adoption of EV's, after sales revenues could expand – and margins could be maintained – if dealer operations are consolidated and become more efficient. Although after EV's dominate the market, say 2035, after sales profits are likely to fall.

What should retailers consider?

There are four management tasks facing every retailer:

Decide their strategic role. Re-imagine the retail landscape and define the space you want to occupy.Where do they want to be in the chain in the next ten to twenty years. Who do they want to serve? With what products and services? With what geographic coverage? Consider nothing to be off-limits. You're a franchised dealer now but you may not be in the future. You run a workshop at present but you don't have to in the future. Look way beyond existing brands and partners across all the main markets – Europe, the US and China and the Far East. Research brands and concepts outside the existing Top Ten.

Review the emerging digital tools and capabilities. Do whatever it takes to gain more experience and knowledge of emerging digital tools. What opportunities and threats do they offer? What strengths and weaknesses do you need to succeed in your target role. How are start-ups and existing players leveraging digital tools to develop their own future? Widen your horizons.

What skills will managers need in your business? How will people acquire these skill sets? Sketch out a strategic plan for each 5 year period. If you want to remain in retail, evolve into an omni-channel retailer that could handle on-line and offline buyers seamlessly now. Begin to gather data on customers rigorously and systematically, not randomly and ad-hoc. Start working towards the first milestone. Stay flexible

In short, start walking up the learning curve. After all, its your future.