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Value Creation for Intelligent Connected Vehicles: An Industry Value-Chain Perspective

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Great technological achievements commonly fail commercially because little attention has been given to designing a business model to take them to market properly. This can and should be remedied.
David J. Teece (*2010*: 192)

1 Introduction

Digital transformation is at the top of the list for automakers (Dremel et al. 2017; Hanelt et al. 2015; Svahn et al. 2017). Tech companies and original equipment manufacturers (OEMs), once separated by the digital/physical dichotomy, are now reconfiguring their positions and strategies in this fast-changing competitive landscape. As witnessed in the mobile phone industry a decade ago, for today's OEMs embracing digital innovation is not just an add-on feature, but rather an action to remain

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relevant. Owing to digital disruption, together with the imperative for sustainable mobility and the rise of the sharing economy, the global automotive industry has witnessed a paradigm shift.

Incumbents that cannot adapt to this new reality are risking the loss of competitive advantages to new entrants and business models that disrupt markets. Thus, OEMs and suppliers, ride-hailing firms, and tech companies are facing a battle for digital supremacy regarding future mobility (The Economist 2018). Despite growing expectations, such radical change has so far not been researched in depth by business and innovation scholars (Ferràs-Hernández et al. 2017). One explanation is that the market has just recently begun to emerge. For example, Uber still had a net income loss of $1.1 billion during the fourth quarter in 2018 (Hook 2018). The hype-pivoting disruptive technologies such as autonomous driving and blockchain have not reached mass adoption yet. However, it is not impossible to draw insights from pioneering investments and initiatives in this new business arena. An industry value-chain perspective can help to envision the potential business models, because the changes to value-added distribution provide a catalyst for value creation (Teece 2010). Value creation is an essential part of any successful business model (Teece and Linden 2017; Wirtz et al. 2015). This chapter focuses on the value creation and strategy for intelligent connected vehicles (ICVs).

The empirical cases presented are mainly from West Sweden. The automotive industry has been Sweden's largest export industry, with a share of around 14% of the national merchandise exports in 2016 (Pohl 2017:7). The West Sweden region has always been the center of the automotive industry in the country. It is the home of many leading OEMs and specialized subcontractors and suppliers as well as a growing number of tech start-ups. The region has the most significant share of the research and development (R&D) investment in the country's vehicle development and over a third of its national automotive labor force. The digital transformation has boosted the region's automotive sector in recent years in the area of connected vehicles, autonomous driving, and electric mobility. Therefore, the region offers a dynamic context for this timely topic.

The advent of digital technologies impacts the value added and creates space to capture new value points. By applying an industry value-chain perspective, this chapter aims to shed light on the emerging business

model development that varies in terms of the different parts of the automotive industry value chain; that is, the upstream and downstream value added. The implications can help automakers rethink their digital innovation strategies based on a full spectrum of value points, from the supply side to the demand side of aftersales services and new usage modes.

The study aims to contribute to the research on the business model innovation of smart, connected vehicles by using an industry value-chain perspective. An analytical framework of new value creation logic and strategies for the different value-added points of ICVs is proposed. Empirical cases from one of the world's innovation hubs within the auto sector add timely observations and reflections regarding this ongoing paradigm shift. The study provides pertinent analytical insights for academic researchers and industry practitioners at this uncertain phase of industry transformation.

The chapter is divided into five parts. After the introduction, the second part introduces the current studies on industry value-chain change that is driven by digital transformation in the automotive industry. Based on the changes in value-added distribution, the third section further elaborates the implications for ICV business value creation on the demand and supply sides. In this section, an analytical framework is proposed to facilitate the discussions about the empirical cases. After the method and data collection section, the fifth part discusses the empirical findings. The chapter ends with a conclusion and implication section.

2 How Does Digital Conversion Change the Industry Value Chain for ICVs?

Tomorrow's vehicles are intelligent, connected, and ultimately driverless (Kellerman 2018; Pohl 2017). For ICVs, digital technologies are embedded in the products and services offerings, as well as the processes that underpin them. The path towards such transition is built upon codevelopment of technological advancements and business innovation in the industry value chain (Habeck et al. 2014). Studies show that the digital domain will dominate the core value added.

2.1 Core Value-Added Shift to the Digital Domain

Porter and Heppelmann (2014:4) reviewed the new technology stack driven by the Internet of Things and concluded that smart, connected products alter the industry structure and introduce a new set of strategic choices related to how value is created and captured, hence exposing companies to new, competitive opportunities and threats. This paradigm shift is happening within the automotive industry now. New entrants are shaping the ecosystem of vehicle development, disrupting the "old fortress" that was dominated by the traditional OEMs and tier-one suppliers. They can include new OEMs such as Google and Tesla, tech-savvy start-ups, digital fleet platforms, venture capitalists, and research institutes. Ferràs-Hernández et al. (2017) investigated 156 start-ups and concluded that the competitive battle is in the digital arena to control critical technologies and the user interfaces of the future, and the disruption seems to be led by outsiders from the digital domain.

Recent trends of merger and acquisition deals in the auto industry indicate that trends have shifted from consolidation to expansion into new technologies, new services, and new business models (Zaleski et al. 2017). The traditional OEMs are incompatible in the offline world when it comes to making vehicles. This marks a truly global industry. The big OEMs have an elaborate global production and knowledge network as well as a top R&D budget to guard their market supremacy (Castelli et al. 2011). However, they are latecomers in the digital world, particularly regarding data processing and analytics, system integration and security, and digital platforms and services, in which the tech companies are the masters. Meanwhile, the tech companies lack the domain knowledge of producing the hardware—vehicles. Consequently, automakers add technology to their core capabilities through acquisition, investment, and the creation of strategic partnerships (Dawson 2016).

2.2 A Deeper and Extended "Smile Curve"

The digital conversion of ICV value creation will impact the value-added distribution. Kuang et al. (2018) illustrated this changing shape as a deeper and extended "Smile Curve" (Fig. 3.1). The new value added is most dramatic at the two ends of the value chain.

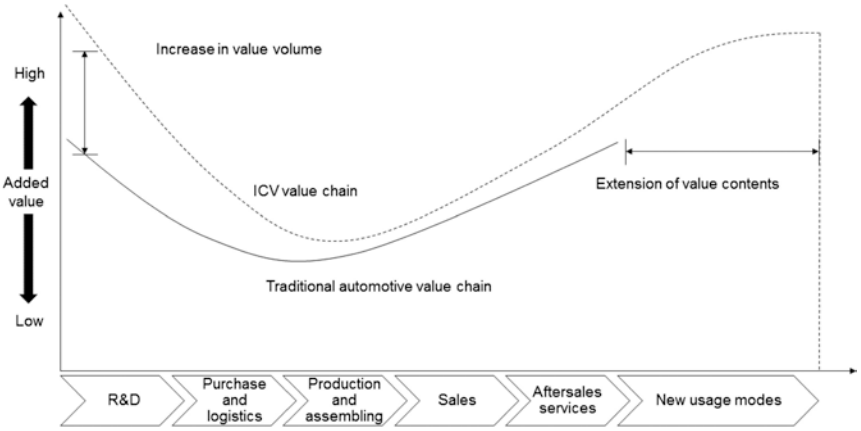

Fig. 3.1 Changes in industrial value distribution of ICV. (Source: Kuang et al. (2018:13))

On the supply side, the R&D of cutting-edge technologies such as autonomous driving, infotainment, and intelligent human/machine interface is likely to provide the competitive advantages for future auto leaders. At the same time, services such as vehicle management and device management are also active areas of the innovation race. Table 3.1 lists the major acquisition, investment, and partnership in the auto industry. It shows that traditional OEMs mostly invest in autonomous driving and enable connected device services. The tier-one suppliers focus on technologies for autonomous driving, infotainment, and human/machine interface, while new entrants participate in all fields, especially autonomous driving and connectivity and cloud-connected vehicle services.

On the demand side, the diversification of new service modes is expected to create high value-added potential for aftersales and new usage market. Examples can be found in maintenance, safety, insurance, vehicle rental, parking, second-hand transactions and recycling, assisting/autonomous driving, shared mobility, vehicle management, entertainment, navigation, and so on.

A few consulting estimations studied the different scenarios for growth trends in the auto industry by 2030 (Baker et al. 2016; Mckinsey & Company 2016). The numbers support the above assumption. The total

Table 3.1 Deals, investments, partnerships, and new entrants at the supply side

	Technology				Enabling services	
	Adaptive driver assistance systems	Technologies Infotainment	Human–machine interface	Communications, computing, and cloud	Connected vehicle services	Connected device services
OEMs (major automakers) Acquisition	**Acquisition** Audi/Daimler/BMW: Here (2015) GM: Cruise Automation (2016) **Investment** Volvo: Peloton (2015) **Partnership** Audi & Nvidia (since 2005) Bosch & TomTom (2015) GM & Mobileye (2015) VW & Mobileye (2015) BMW & Intel & Mobileye (2016) Hyundai & Cisco (2016)	**Investment** Ford: Livio (2013) **Partnership** Audi & Nvidia (since 2005)		**Partnership** Daimler & Qualcomm (2015) Hyundai & Cisco (2016) Toyota & KDDI (2016)	**Partnership** Ford & State Farm (2012) BMW & Pivotal (2015) Ford & Microsoft Azure (2015) Volvo & Microsoft (2015) Nissan & Microsoft Azure (2016)	**Acquisition** Daimler: Mytaxi (2014) GM: Sidecar (2016) **Investment** BMW: RideCell (2014) BMW: Zendrive (2014) GM: Telogis (2014) BAIC: Didi Chuxing (2015) Ford: Pivotal (2016) GM: Lyft (2016) Toyota: Uber (2016) VW: Gett (2016) **Partnership** BMW & Baidu (2015) BMW & Microsoft Azure (2016) Seat & Samsung & SAP (2016) Toyota & Microsoft Azure (2016)

Traditional suppliers	**Acquisition** Continental: Elektrobit (2015) Delphi: Ottomatika (2015) ZF: TRW (2015) Continental: ASC (2016) **Investment** Delphi: Quanergy (2015) Bosch: AdasWorks (2016) **Partnership** Valeo & Mobileye (2015)	**Acquisition** Harman: Aha (2010) Harman: S1nn (2014) Continental: Elektrobit (2015) Harman: Symphony Teleca (2015) **Partnership** Ha rman & Luxoft (2011) Harman & Microsoft (2016)	**Acquisition** Continental: Elektrobit (2015) **Partnership** Valeo & Safran (2013)	**Acquisition** Bosch: ProSyst (2015) Valeo: Pelker (2015	**Acquisition** Harman: Redbend SW (2015) Harman: TowerSec (2016) **Partnership** Valeo & Capgemini (2015)	**Acquisition** Harman: Aditi (2015)
New entrants from outside automotive	**Acquisition** Panasonic: Ficosa (2014) Google: FCA (2016) Nvidia: AdasWorks (2016) **New entrants:** Apple, Baidu, Google	**New entrants** AdasWorks, Baselabs, Vector, Velodyne, Wind River	**Investment** Intel: Omek (2013) **New entrants** Atmel, Fujitsu, Kyocera, LG, Toshiba	**Acquisition** Cisco/NXP: Cohda Wireless (2013) **New entrants** Cohda Wireless, Kymeta, Veniam	**Investment** Verizon: Hughes (2012) **Partnership** Airbiquity & Arynga (2016) **New entrants** Airbiquity, Allstate, Fleetmatics, Pivotal, Progressive, SiriusXM, Trimble, Verisk	**Partnership** Daimler Moovel & IBM (2014) Airbiquity & Arynga (2016) **New entrants** Airbiquity, Apple, Contigo, Dash, Google, iTrack, Lyft, MyCarTracks, Uber

Source: Baker et al. (2016:35–36)

revenue streams from new value points can vary from $1.5 trillion (30% of the total revenue pool) to $3.5 trillion (45% of the total revenue pool). Despite the difference in math, it is clear that value creation is moving from traditional one-time vehicle sales and aftermarket value to a diverse range of recurring revenues from new usage modes.

3 Implications for ICV Business Value Creation

3.1 Demand-Side Value Creation Logic Shifting to the Network Effect, Long-Tail Effect, and Multi-Sided Platforms

Network Effect

On the downstream side, the convergence of digital forces into the physical auto industry value chain has just begun. This conversion leads to the coupling of the physical value chain and virtual value chain (Rayport and Sviokla 1995). The virtual value chain often mirrors the structure of the physical one, but with different value creation logic—the network effect (Shapiro and Varian 1999; Xu 2012, 2017). The network effect indicates that the value of a product and service increases according to the number of others using it. It amplifies the scaling effect of the user networks. As fast scaling requires the accumulation of positive feedback loops, it thereby emphasizes first-mover advantages.

Long-Tail Effect

The second mindset change for value creation is the long-tail effect (Brynjolfsson et al. 2014). Traditionally, many consumer markets are dominated by a few bestsellers, which reflects the Pareto principle (e.g. the classic 80/20 divide). Owing to the increase in product selection and lower search costs on the Internet, such sales concentration has been reduced to a more extended distribution of sales of niche products. The

long-tail effect is user-centric. Traditional automotive value chains are producer-driven (Dijk and Yarime 2010). The big auto brands lead the product innovation and strategies. For ICVs, this is no longer the case. The long-tail effect extends the range of personalized on-demand services based on user preferences and data analytics. Therefore, it is user-centric and data-driven.

The third game changer is the platform mindset. When vehicles become the platform of on-demand real-time personalized services, they are no longer just physical products, but also the platform upon which to connect with digital resources. This took place in the mobile phone industry a decade ago. It might even be the case that the future auto leaders will dominate the vehicle platform, as with today's Android/iOS oligopoly on the mobile device platform.

Multi-Sided Platforms

The platform mindset alters the value creation logic for producers. According to economic theories, traditionally producers are one of three types: vertically integrated firms, resellers, or input suppliers. The economy of platform introduces the multi-sided platform (MSP) business model (Hagiu and Wright 2015). MSP enables direct interactions between two or more distinct sides that are affiliated with the platform. Therefore, MSP changes the nature of the transaction and then redefines the interorganizational boundaries. Hagiu and Wright (2015) suggest that MSP can best achieve motivating unobservable efforts by a variety of actors because they can adapt their own decisions to their private information (Fig. 3.2).

MSPs generate recurring value creation such as e-hailing, car sharing, and data-connectivity services including apps, remote services, and software upgrades (Mckinsey & Company 2016). Therefore, automakers are shifting their role from product developers to system and service integrators. For instance, Shelly (2015) suggested that developing cutting-edge software and integrating the car with the Smartphone ecosystem would provide strategic differentiation factors for automotive leaders.

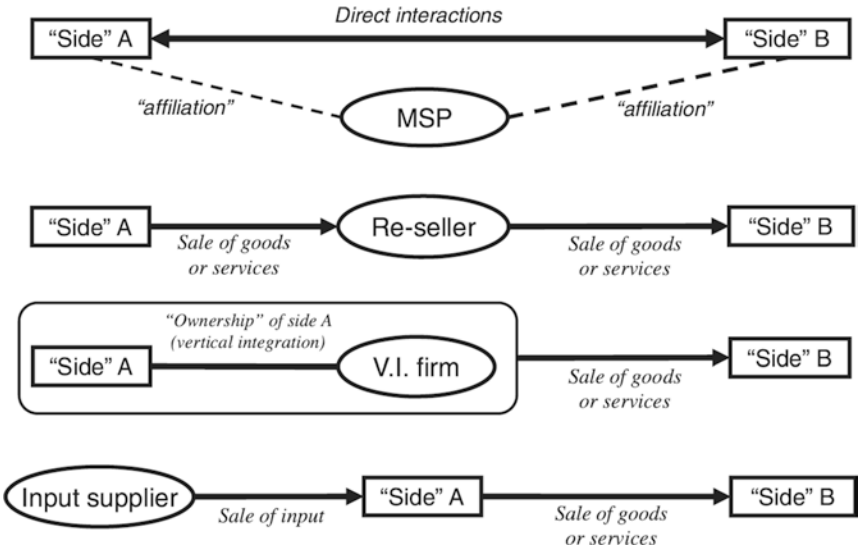

Fig. 3.2 MSPs versus alternative business models. (Source: Hagiu and Wright (2015:165))

3.2 Supply-Side Value Creation Logic Adding Horizontal Integration

The R&D activities in the traditional automotive industry represent a textbook example of vertical integration (Castelli et al. 2011; Williamson 1971). Vertical integration in the business model design tends to bring R&D units together under common ownership. One example is Geely auto's acquisition of Volvo from Ford in 2010. A joint venture R&D center China Europe Vehicle Technology (CEVT) was created afterwards, which was considered to be a strategic asset creation for innovation upgrading (Yakob et al. 2018)

The core capability shift to the digital domain requires automakers to adapt to a more open development environment for technology innovation, which pushes horizontal integration in R&D activities. OEMs cannot possess all knowledge, competencies, and know-how only to develop technologies, but also to collaborate with resources

within or outside the traditional industry boundaries for example with the specialized service providers, data analytics, system integrators, and network service providers. Strategic partnerships can be formed between traditional OEMs, between traditional OEMs and new OEMs, or with tech companies. They codevelop cutting-edge smart vehicle operating systems, driverless technologies, and in-car infotainment systems. Examples include Google's first partnership with a major automaker to test self-driving technology with 100 Chrysler minivans; Audi, BMW, and Daimler's $3 billion purchase of Here's digital mapping services; and the joint venture between Intel and BMW to develop self-driving systems (Dawson 2016).

Open Innovation

The value creation of horizontal integration relies on open innovation (Chesbrough 2006) and innovation ecosystem building. Open innovation is a digital era mindset that promotes the use of external ideas as well as internal ideas and internal and external paths to market. It counters the traditional closed-door research units that run as silos. The open innovation practices can vary from transactional to collaborative (Brunswicker and Chesbrough 2018). Narsalay et al. (2016) suggested four modes of open innovation strategies:

1) Traditional IP contract: a market transaction typically used when a single owner controls a specific needed technology.
2) Open-innovation partnership: a bilateral relationship used when projects are ill-structured and complex but relate to well-known technological solution areas (e.g. Huawei, IoT, and HP/DreamWorks).
3) Open innovation platform/contest: a competition used when a problem requires access to the long-tail effect of solution knowledge (e.g. Bosch technology contest and Samsung ARTIK contest).
4) Open innovation community: a collaboration among different parties used when joint problem-solving is required to tackle truly perplexing problems (e.g. Ford OpenXC).

Innovation Ecosystems

Open innovation focuses on firms' R&D activities, while innovation ecosystem building is a company strategy that alters the governance structure of the production network. According to the global value-chain theory (Gereffi et al. 2005), there are five types of the governance structure of production networks (from tight to loose): (1) hierarchy, (2) captive, (3) relational, (4) modular, and (5) market.

Hierarchy and captive are somewhat typical structures in the traditional automotive industry supply chain management. The MSP business model is expected to embrace the relational, modular, or even market governance structures. Since MSPs enable direct interactions among different sides, they enhance the ability to codify complex transactions and motivate adaptations among sides. Therefore, MSPs increase the ability to codify complex transactions and enhance the capabilities of the supply base. According to Gereffi et al. (2005:86), relational forms occur when product specifications cannot be codified, transactions are complex, and supplier capabilities are high. Modular forms arise when the ability to codify specifications extends to complex products and technical standards simplify interactions by reducing component variation and by unifying component, product, and process specifications. Market forms can be expected when transactions are easily codified, product specifications are simple, and suppliers are fully capable.

The future leader ought to be a cross-boundary orchestrator in relational (e.g. science park, innovation district), modular (sub-contractor outsourcing), or distributed (market) innovation ecosystems. This governance structure can overlap with the MSP platform at different sides of integration.

Table 3.2 summarizes the different value creation logic and strategies for the demand side and supply side of the ICV value chain.

Table 3.2 A framework of new value creation logic and strategy for the supply and demand side of ICV value added

Value-added side	New value creation logic	Value creation strategies
Demand-side (e.g. aftersales and new usage modes)	Network effect	Fast scaling, First-mover advantages
	Long-tail effect	User centric, Data centric
	Multi-Sided Platforms	Recurring revenue streams, system and service integrator
Supply-side (e.g. R&D activities)	Horizontal integration	Orchestrating innovation ecosystem (relational, modular, or distributed), Open innovation (contract IP, innovation contest, innovation community, innovation partnership)

Source: Author

4 Method and Data Collection

This research performs a qualitative case study of the digital transformation in the automotive industry in the West Sweden region.

The West Sweden region is the capital of Sweden's automotive industry. According to Business Region Göteborg,[1] the region is one of the world's most knowledge-intensive regions per capita for vehicle development. With more than 25,000 direct employees in the automotive sector, the region contributes to over 60% of the country's total automotive R&D investments. It is the home base to the world's leading OEMs and specialist subcontractors and suppliers, such as Volvo cars, the Volvo Group, CEVT, National Electric Vehicle Sweden (NEVS), SKF, Autoliv, Zenuity, Semcon, Ericsson, and HCL. In recent years, the booming automotive sector has attracted foreign direct investment, especially from the China Geely Group. A new 70,000 sq. meter Geely Innovation Centre is

[1] Source: https://www.businessregiongoteborg.se/en/focus-areas/automotive-and-transport (Retrieved March 17, 2018).

under construction. The digital transformation also opens up new opportunities for new entrant start-ups. Today, the region claims itself as a world-class leader in areas such as electrification, autonomous driving, and connected cars. The West Sweden region has almost the entire vehicle development ecosystem. Therefore, it is an exciting place to explore the latest business models that are emerging for future mobility.

The case study method offers rich and in-depth data on complex social events, and people's perceptions are therefore mostly used to conduct explorative studies (Bryman and Bell 2015; Patton 2014). Multiple data collection methods are typical for qualitative case research (Eisenhardt 1989). Interviews and archived materials such as reports, website information, and news releases were applied for this study. Between November 2017 to March 2018 fifteen interviews were collected, the interviewees being business owners, innovation managers, and business developers from the leading OEMs, new OEMs, tech companies, tech spin-out firms, and start-ups in the region. The interviewers were not from the industry. People from public agencies and innovation arenas related to the regional automotive innovation system also provided their opinions. Therefore, the selection of interviewers provides a broader picture of the current development in the automotive sector.

5 Discussion

5.1 Value-Added Distribution

In the West Sweden region, the automotive industry transforms in its core, owing to the disruptive technology shifts and fast-changing consumer behaviors and needs. The expectations are high, and the pace of technology innovation is faster than ever. Traditional OEMs are entering the uncharted waters of fierce competitions with the new entrants. The race heats up in new usage modes, such as shared mobility, connected services, and autonomous driving. Even though uncertainty is high, they must bet and move quickly. Therefore, both supply-side pull and demand-side push affect the value-added distribution.

One observation from the region is that many of these new entrants are spin-outs from the old OEMs and tier-one suppliers. They can be joint ventures between the OEM and tier one. For instance, Zenuity, specializing in developing new advanced driver assist systems and autonomous driving technologies, is a joint venture between Volvo cars and Autoliv that began in April 2017. Zenuity identifies itself as an automotive new entrant. The rationale for this initiative is to share risk in developing cutting-edge technologies and to move quickly. A business development manager from a new entrant said, "In the old days, the development cycle at OEM was around seven years, and now they can reduce it to three years, but it is still too slow for us… we are talking about months." Zenuity aims to launch the unsupervised highway pilot in 2021 and the unsupervised urban pilot in 2023.

City Trollhättan, where Saab auto was established, has witnessed a wave of new venture creation in the automotive sector since Saab went bankrupt. A majority of these new establishments were funded by former Saab engineers. For instance, the powertrain team created T-Engineering (acquired by Chinese Dongfeng Motor in 2014), while the infotainment team initiated Swedspot. They are both fast-growing auto new entrants in the region. T-Engineering develops in-vehicle control systems, and Swedspot develops embedded user interfaces and on-board diagnostics (OBD) sockets for connected car services. The most prominent new entrant is NEVS (acquired the Saab assets in 2012), which focuses on producing pure electric vehicles and providing mobility services. Most of the new entrants are driven by the new usage modes.

The increasing links between China and investment in the region will have a profound impact on the value-added distribution for the automotive sector. The major foreign direct investment to the automotive sector for West Sweden region is from China. The most prominent investors are Geely auto, Dongfeng motors, and the owners of NEVS—Hong Kong-based National Modern Energy Holdings and the Tianjin Binhai Hi-tech Industry Development Area. For example, the creation of a new "born digital" car brand Lynk & Co was a joint venture between Geely auto and Volvo cars. The first generation of Lynk & Co targeted young urban Chinese consumers. NEVS formed a partnership with China's ride-hailing giant Didi Chuxing for its electric car-sharing platform, which is expected to operate more than 1 million electric vehicles by 2020.

5.2 Demand-Side Value Creation

Digital lifestyles are redefining the relationship between customers and their cars, as well as what a car should be. Today, people use their smartphones for almost everything but making a call. So why should cars still be only for driving? Some emerging trends can be found in areas such as car buying and learning how to own and use a car.

First, *sales go online*. This trend reflects the network effect logic. The most well-known example is Tesla, which does not have any dealerships. Most cars today are still sold at the dealers' network, but sales online are rising. Geely and Volvo's Lynk & Co tested the online format in 2017 for its premier launch on the Chinese market. According to the official news release, the company encountered huge success, receiving 6000 orders in just 137 seconds. Volvo cars' website also offers a personalized online booking option.

Second, companies *go subscribing*. Instead of buying a car, customers can subscribe by paying a monthly fee for different vehicle use and service packages. Subscription is a typical MPS value creation logic to generate recurring revenue streams. Private leasing is a way to create recurring revenues too, but it does not represent a platform mindset. Through private leasing, consumers are buying cars with a package of services. Therefore, it is still a form of one-time vehicle purchase. Subscription shifts the mindset of buying a car to getting access to a variety of vehicle services. For example, Volvo has launched its Care by Volvo subscription services. The plan is based on a 24-month subscription. After two years, subscribers hand the car back, or they can switch to a different Volvo after 12 months. The service package includes insurance, maintenance, repairs, tire changing, and connected car services. In this way, ownership is not what customers buy, but they subscribe to a platform of various vehicle services.

Similar to smartphone subscriptions, a vehicle version of *app stores* is often provided. Since connected car services on a vehicle app store can be quickly updated and added, it uses the extended long-tail effect logic for value creation. Today, most leading car brands provide apps.

Third, companies *go sharing*. Compared with subscribing, shared mobility goes a step further to disrupt car ownership. It can be realized in a peer-to-peer sharing platform, or fleet platform, or ultimately by driverless cars. When reaching that point, most of the population won't need to own a car anymore. The shared mobility enables the long-tail effect logic that is data driven and user centric. The more advanced the platform is, the more data driven it becomes. NEVS, as a new entrant OEM for sustainable mobility, claims to measure the success of how many vehicles are sold by how many trips are generated. They design business models by differentiating between ownership service and non-ownership service. Value creation for non-ownership vehicle usage involves much more than sharing. When the vehicle space turns from private to semi-public or public, it opens new opportunities for a variety of value points, such as advertising, insurance, safety, retailing, and entertainment, and even requires a different design for cleaning. This introduces unlimited possibilities.

No matter whether a company goes online, offers sharing, or provides subscriptions, the demand-side value creation sets the prerequisite for future auto leaders to be system and service integrators. From the history of the smartphone industry and other digital platforms, we know that the winners are few and first-mover advantage is crucial. Most digital platforms such as Google, Facebook, and Uber reached fast market dominance before developing mature business models. This "scaling first then profit" mindset could impact the auto sector now.

5.3 Supply-Side Value Creation

In recent years, the horizontal integration in R&D development has gained increasing visibility. Different from the demand-side value-creation logic that is driven by understanding consumer needs and data analytics, the supply-side logic goes beyond what the consumer wants. The R&D of cutting-edge technologies for tomorrow's mobility must be ahead of the consumer's needs. As the pace of technological change speeds up and the disruptors are outsiders, the level of uncertainty is high. The traditional OEMs are forced to open up, and the West Sweden region is no exception.

Currently, *open innovation partnership* and *open innovation community* offer the most common paths for horizontal integration in R&D activities. For instance, Volvo cars and Google formed a partnership to bring Android into infotainment and user experience development. HiQ is also helping Volvo with autonomous driving technology development. Furthermore, Volvo's collaboration with Ericsson on connected car services can be traced back to 2012. A recently acquired partner for the company is the Swedish Nobel Media for research in enduring innovation. As mentioned earlier in the chapter, NEVS formed a partnership with China's Didi for electric shared mobility.

An open innovation community often overlaps with relational innovation ecosystems. The physical community can be based on geographical proximity such as innovation arenas at a science park. A virtual community can take the form of an industry alliance that is based on business networks. MobilityXlab, founded by Volvo Cars, Ericsson, Volvo Group, Veoneer, Zenuity, and CEVT, is a recent establishment to bring pioneering start-ups closer to the founders. It is physically hosted by the Lindholmen Science Park, where the founding partners all have a physical presence. In March 2018, Geely auto, which owns Volvo cars and CEVT, revealed its smart ecosystem network for the first time at the Sanya Geely global ecopartner conference. Geely's smart ecosystem covers a broad spectrum of industries, new media, and tech entrants, including the big tech Tencent, e-commerce giant JD, telecom ZTE, insurance CPIC, global industry leader Bosch, HP, Autoliv, and BASF. According to the news release, the conference has attracted over 4000 participants from all over the world, including suppliers, distributors, finance, and internet companies.[2] Geely is building a 70,000 sq. meter global innovation center at Gothenburg to bring its ecosystem partners together.

However, the reality looks more complicated than the open/closed dichotomy. Going open does not equal horizontal, and vice versa. There can be many grey areas. For example, Zenuity is created as a joint venture by Volvo cars and tier-one Autoliv to focus on R&D for autonomous driving. Since Autoliv is the tier-one supplier for Volvo cars, from

[2] Source: http://global.geely.com/2018/03/16/geely-auto-launches-2018-bo-yue-suv-with-leading-gkui-interface/ (Retrieved March 31, 2018).

a supply chain perspective it is vertical integration. But from an organizational perspective, this joint venture can be categorized as interorganizational horizontal integration. Another example is CEVT, which was created in 2013 as Geely group's first overseas R&D center to supply Compact Modular Architecture (CMA) modular technologies for both Geely and Volvo cars. As a subsidiary of Geely, it is a clear vertical integration case. However, owing to the post-acquisition strategy that "Volvo is Volvo, Geely is Geely," CEVT thereby also represents a horizontal integration regarding actual organizational boundaries.

Opening up innovation processes is a delicate task. The combination of horizontal and vertical integration is a consequence of the changing competitive pace and landscape. Opening such processes provides the means to get access to ideas, resources, and Intellectual Properties (IPs) outside the organizational boundary so that the OEMs can maintain a softer leadership style in the battle for the best and fastest technology innovation.

6 Conclusion

This chapter discusses the ongoing digital transformation for value creation in the automotive industry. The innovation of this contribution is the use of an industry value-chain perspective to construct an analytical framework for ICV value creation. Owing to the disruptive technology innovation and changing customer expectations and needs, the growth of ICV value added is most dramatic on the demand side of the aftersales and new usage modes and on the supply side of R&D activities. The Smile Curve of ICVs then gets deeper and bigger.

Value creation on the demand side is shifting from one-time vehicle sales to recurring revenue streams. The study suggests that such a shift requires new value creation logic; that is, the network effect, the long-tail effect, and platform mindset (MSP). The cases in the West Sweden region show the trends of *selling online*, *go subscribing*, and *go sharing*. Automakers are developing app stores and transforming their role from vehicle producers to system and service integrators.

Horizontal integration on the supply side is increasing, since automakers have realized that they cannot have all the competence and know-how

alone. R&D embraces open innovation. The old OEMs and new entrants in the West Sweden region form open innovation partnerships and open innovation communities to develop cutting-edge technologies for the future mobility. In reality, such an openness movement is supported by a mix of horizontal and vertical integrations, for example through the creation of new R&D centers by OEMs and tier-one suppliers through the establishment of global innovation centers to support interorganizational R&D collaboration within the same group. The open mindset is extended to overall company strategies. Leading OEMs are entering the race of building innovation ecosystems. Innovation arenas are founded to bring pioneering start-ups closer to the big players. The global ecopartner network is constructed to support cross-boundary collaborations. The role of the automaker is thereby transformed into an ecosystem orchestrator.

Speed is crucial. Strategies such as "scaling first then profits" are commonly used in the digital platform economy. When vehicles become the next digital platform, automakers can play this card too. The automotive industry is traditionally a very cost-controlled industry. To play the platform card, it requires an entirely different mindset as well as risk evaluation methods, operational processes, and organizational culture. All changes cannot happen at once, and this will impose significant challenges to the traditional OEMs.

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