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DIGITAL DISRUPTION IN THE INDIAN PASSENGER VEHICLE SECTOR

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ABSTRACT

Purposes: Despite the continued focus of several recent researchers on how digital technologies are disrupting the global automotive industry, little is known about how the top Indian automotive OEMs are responding to the same. Few studies examine the role played by incumbents in market category emergence as digital technologies inevitably bring about. This research chooses the passenger vehicle sector of India's automobile industry to study the impact of these technologies on the business model of lead firms.

Design: Primary data from actual observations at over hundred automobile dealerships in India and secondary archival data were employed to develop case studies on the digital technology supported initiatives of five top car manufacturing companies in India. Porter's value chain framework and the business model analysis frame work, were used to arrive at industry level insights on the overall extent of deployment of digital technologies in the auto OEM industry in India.

Findings: Digital disruptive forces evident globally, are as yet weak in India. All the top Indian Passenger vehicle (PV) OEMs have made incremental changes to their business model. The extent of changes made, however, varies and shows a strong association with their current market standing in India. However, all Indian OEMs lag behind their global counterparts in their transformation journey.

Originality: Adoption of digital technology initiatives at firm-level in the Indian PV sector has not been comprehensively studied earlier and the few existing studies are either anecdotal or do not explore firm level responses. Our paper addresses this gap.

KEYWORDS: Digital Technology, Automotive Firms, Passenger Vehicles, Original Equipment Manufacturer (OEM), Business Model, Electric Vehicles (EV).

INTRODUCTION:

Tech tycoons say that over the next decade, conventional industries will face an onslaught from tech competitors wielding vast financial resources, new technologies and massive reserves of data. Six conventional industries have so far been eviscerated by digital innovation in the past two decades—music, video-renting, books, taxis, newspapers and clothes retailing (Economist, 2017). Digitization is forcing companies to rethink their traditional strategies and business models and embrace internet-based strategies to expand or improve their business. It enables rapid pace of product and service innovations, shorter product life cycles, and cross-boundary industry disruptions, necessitating new forms of business strategies (Hanelt et al., 2015). Products that were comprised of only of mechanical and electrical parts earlier, are being revolutionized by information technology and becoming complex systems that combine hardware, sensors, data storage, microprocessors, software and connectivity combined in various ways (Porter & Heppelmann, 2014). Inside companies, this has led to new business processes, new business models, and even new managerial models (Teece & Linden, 2017). New generation products come with embedded software that influences their functionality and additional supportive software may reside in the product cloud. A new era of competition has been unleashed by such 'smart, connected products' (SCPs). They change how value is created for customers, how companies compete and the boundaries of competition itself (Porter & Heppelmann, 2015) enabling traditional product-centric companies to augment their revenue streams by offering 'smart services'. With proliferation of SCPs, the significance of Augmented Reality (a set of technologies that superimposes digital data and images on the physical world) is expected to grow exponentially because it amplifies their power to create value and reshape competition. Despite deployment challenges, pioneering organizations, such as Amazon, Facebook, General Electric, Mayo Clinic, and the U.S. Navy, are already implementing Augmented Reality (AR) and experiencing a major impact on quality and productivity. Jeff Immelt, past Chairman of General Electric, once said- 'every industrial company must become a software company' (Porter & Heppelmann, 2014; 2017). Additionally, customers can now take a more active role as market players and reach (and be reached by) almost everyone- anywhere and anytime through social media channels such as Facebook, YouTube, Google and Twitter (Hanelt et al., 2015). SCPs will impact manufacturing organizations the most, reshaping not only competition, but the very nature of the manufacturing firm, its work, and how it is organized. Accordingly, traditional manufacturers would be required to build what is essentially an internal software company as all the elements of their value chain are impacted (Porter & Heppelmann, 2014; 2015). The value chain elements of a traditional manufacturer and the improvements enabled by SCPs are grouped under two broad heads namely value creation and value delivery. (Detailed in Table1)

Despite the pervasive changes that digitization and the internet triggers and enables, a comprehensive empirical review of the extent of adoption of digital technologies by top Indian automobile manufacturers appears to be lacking and the few that explore the topic (Agarwal & Weill, 2012; Gupta et al., 2018; Karthick & Ramakrishnan, 2017) are either anecdotal or do not explore firm level responses. This paper addresses this gap in the academic literature and explores the responses of leading passenger vehicle manufacturers in India to the digital disruption. The primary research question addressed is:

- How are top passenger vehicle companies in India responding to digital disruption?

Aided by several recent research papers specific to the global automotive industry and the value chain framework detailed in Porter & Heppelmann (2014; 2015), six changes are identified that are impacting automotive OEMs in India. Thereafter, the response of the top Indian passenger vehicle OEMs is pinpointed in line with the business model pillars identified by Hanelt et al. (2015). Finally the findings are synthesized to garner overall insights at sector level. The next section reviews recent literature on the subject.

LITERATURE REVIEW:

Automotive- a mature industry, is now experiencing significant changes driven by globalization, new governmental regulations, and advancements in electronic, communication, and drive-train technologies that shape (and are shaped by) shifting consumer preferences (Schulze, MacDuffie & Taube, 2015). Four disruptive technology trends, namely electrification, autonomous driving, diverse mobility and connectivity, are reshaping the sector, making consumer preferences shift (Gupta et al., 2018). Most of what customers value in the automotive sector, has resided in the hardware of vehicles and in the automakers' brands on which the fortune of players depend. However, future innovations will probably focus on disruptive technology trends, so the customers' perceptions of value will shift, increasingly putting incumbents in danger. Personal mobility is facing three major innovations that have disruptive potential: electrification, shared mobility and automation (Beiker et al., 2016; Sprei, 2018). The likely shift in consumer preferences towards software and entertainment systems in a car rather than what it looks like, may cause the industry's whole business model to come apart (Economist, 2016). Fundamental readjustments to the whole automotive value chain seem inevitable. However, there is lack of clarity as to where this journey will end- for example as in the case of market adoption of electric vehicles. Despite uncertainty, automotive leaders are required to make investment decisions today, in order to have know-how, production capacity and stable supply chains in place once markets demand them (Helbig, Sandau & Heinrich, 2017). Traditionally, vehicle engineering, manufacturing, and sales have been the core activities of automotive OEMs and the digital disruption has implica-

tions across every part of this value chain (Srivatsan et al., 2017). The dominant design of the automobile has been quite stable at the structural level- cars have an enclosed metal body, an internal combustion (IC) engine, a chassis providing both suspension and transmission, steering plus brakes, for vehicle control, etc. Chassis and engine development have been the traditional strongholds of automotive OEMs. As new power-trains threaten to replace the IC engine, autonomous vehicles come nearer to commercialization, and vehicle ownership gives way to mobility as a service, this typically vertically integrated automotive value chain is transforming (Beiker et al., 2016). Although overall profit for the global automotive industry is estimated to grow by 35%, profits from vehicle engineering, manufacturing and sales are estimated to shrink by 8% through 2025 (Srivatsan et al., 2017). However, the central role of OEMs in system integration is likely to continue (Schulze, MacDuffie & Taube, 2015).

New players: a potent mix of large high-tech companies and startups, have been attracted by this shift in consumer preference and the sheer size of the automotive sector. The car-making industry is under siege from technology companies and startups (McGee, 2018), a view echoed by many other sources. As software and communications become as integral to a new generation of vehicles as hardware, the tradition of OEMs being able to control and squeeze their suppliers is shifting (Gapper, 2015).

Taking reference of past literature, how each of six disruptive forces is reshaping competition and the value chain of passenger vehicle OEMs globally is elaborated below.

Diverse mobility:
The global market for personal mobility is worth as much as $10 trillion. However, the very concept of mobility is changing along with the mindset and attitude of customers and OEMs need to think of themselves as mobility providers rather than vehicle manufacturers (Schulze, MacDuffie & Taube, 2015; Srivatsan et al., 2017) and top global OEMs have initiated new business lines that provide mobility sans vehicle ownership (Teece & Linden, 2017). Global ride-sharing firm Uber's goal is to make travel so cheap and convenient that using Uber becomes an alternative to owning a car. Its vision is to become a major provider of transport services for both passengers and goods all over the planet. Chinese ride-hailing company Didi Chuxing is the largest in the world with 30 million rides offered on its platform every day far beyond the 15 million offered by Uber. What is more, it had 400,000 electric cars in its fleet last year and was aiming for one million in 2020. Chinese technology companies, already world class, have invested in Didi and also made competing investments in ride-sharing platforms with other big Chinese automakers like FAW, Changan and Donfeng. Using data and connectivity in new ways, such mobility services are shifting people from 'just in case' vehicle ownership to 'just in time' vehicle access (Chadha, 2017; Economist, 2016b; 2019).

Electrification:
Electric vehicles have the smell of disruptive technology and their emergence is favored by environmental concerns, lifestyle changes of urban area inhabitants and the general development of the internet of things. However, significant differences remain over the longer term, in their sales growth forecasts and some estimate global penetration to reach 50% only after 2040 (McGee, 2018). Such differences stem from three main obstacles- uncertainty over energy transition policies, the purchase cost of an electric vehicle (EV) and its limited range of autonomy that together with a poor charging infrastructure causes 'range anxiety' (Donada & Perez, 2018). Worldwide, one million EVs were sold in 2017 (IEA, 2018) which is less than 2% of total light vehicle sales. Globally, China leads in electric vehicle sales and the Chinese government uses several means to increase both the supply of electric vehicles and the demand for them. China's electric vehicle sales have grown tenfold since 2014 and last year it became the first country to see new energy vehicle sales surpass one million units, laying a claim to the EV industry's future. China is also one of the largest producers of lithium-ion batteries, a vital and the costliest component in EVs. (Hancock, 2019). However, the prices of lithium-ion batteries are falling as a result of higher volumes and better chemistry and going forward they may not need to be subsidized by the government as is the case in many countries now (Economist, 2017).

Connectivity:
Cars that are connected to each other and to the wider infrastructure, offer increased scope of car-usage based services, 'infotainment' related innovations, location-based and emergency services, and smart services and maintenance (Beiker et al., 2016; Srivatsan et al., 2017).

Autonomous Driving:
Formerly, automation in the automotive industry was associated with manufacturing processes in production lines. With self-driving, digital-enabled automation has moved forward in the value chain to actual product use (Hanelt et al., 2015). In future, Robo-taxis could offer a far cheaper and more convenient alternative to car ownership. Some predict that by 2035, 80% of people will use them in cities where they are available, and that urban car ownership will fall by 70% (Economist, 2018). Tesla founder Eon Musk expects that by middle of 2020 there shall be 1 million Tesla's self-driving robo-taxis on US roads, reaping benefits both for the company and its customers (Denning, 2019). Chinese technology companies are well on their way in developing autonomous vehicle technologies although they are a few years behind US firms progress-wise (Economist, 2019).

Digital marketing & sales:
Carmakers across the world eventually settled on a system of franchising in which independent dealers mostly sell just one maker's models. Now, almost all the motor vehicles sold worldwide each year, cross dealers' forecourts. Dealerships are separately owned franchisees that contract with OEMs to represent the brand, sell the vehicles, and provide maintenance and repair services to consumers. OEMs control the brand, dominate marketing activities, and shape dealership sales via incentives. However, dealers play a pivotal role in the car sale process and a customer's willingness to recommend to a friend results from how well the customer is treated by frontline (dealer) employees. (Economist, 2015; Hanelt et al., 2015; Jacobides et al., 2016). The used car business constitutes an additional source of revenue for car dealers facilitating exchange of old cars by customers. This sales & distribution model- a long-standing practice common across the global automotive industry is witnessing some recent changes. A profound change is being driven by the growing use of digital technology by consumers that will impact the auto retail business. Globally, companies like Tesla Motors, Audi, Daimler Benz, BMW AG & Hyundai Motor have piloted new concepts like virtual showrooms (AR enabled) and direct online sales to customers reducing the importance of dealers as intermediaries in the car sales process (Economist, 2015). Tesla, an US car company, directly sells its products to the final customer totally eliminating involvement of dealers (Porter & Heppelmann, 2014). Consumer surveys concomitantly indicate that the number of dealer visits made by customers before final purchase of the vehicle, has been falling over the years and 50% of buyers have made a decision on both brand and model before visiting a dealer (Srivatsan et al., 2017). Digital is now part of the entire car purchase journey. 89% of all car purchases in India are digitally influenced and 96% of buyers used internet search during their purchase journey (Sarkar & Gupta, 2018).

Rising internet penetration in India, both in urban and rural areas is making consumers evolve into a digitally savvy and largely mobile-first user which in turn is expected to play an increasingly important role in the areas of product marketing and customer relationship management. Urban markets have witnessed significant social media penetration with India being among the top users of social networking sites and consumers leveraging it to make informed purchase decisions (Srivatsan et al., 2017).

Digital after-sale services:
As the software content and connectivity of cars increase, it becomes increasingly possible to render smart services over the internet, reducing the occasions the cars need to return to repair centers for maintenance that enhances uptime. Additionally, they can limit costly warranty repairs through monitoring product use and performance on real-time basis by triggering preemptive service. In fact SCPs enable a fundamental shift from reactive service to preventive, proactive and remote service (Porter & Heppelmann, 2015).

OBJECTIVE OF THE STUDY:

As the fourth largest car market in the world, India is the fastest growing among the top five markets for light vehicles (cars, utility vehicles, vans and pickup trucks) with an estimated market size of about 4 million units in 2018 (Thakkar, 2019). Estimates indicate it will emerge as the third largest car market by 2021 (Gupta et al., 2018). Additionally, sales of used or pre-owned cars in India is steadily rising, and touched 4 million units during FY2018 making it roughly 1.25 times the size of the new car market (Baggonkar, 2018). Mostly unorganized so far, the share of organized players in the used car market, is steadily rising. With most developed country markets facing saturation, global automotive OEMs are increasingly focusing on emerging markets like India as a primary engine of future growth. This has resulted in intensifying competition among 18 incumbent mass-market firms vying for market share. Further, India is emerging as an export hub, particularly for small passenger vehicles. With digital technologies reshaping competition and companies as also changing the manner in which customers engage with automotive OEMs across the purchase journey-from product discovery and consideration to research, purchase and post-purchase transactions (Srivatsan et al., 2017), the effort of top auto OEMs to cope with such disruptive changes assumes increasing significance. The objective of this paper is to enhance our understanding of how leading passenger vehicle OEMs in India are improving their business models by embracing digital technology to enhance their competitiveness and customer value and whether such actions relate to their current and future market standing.

RESEARCH METHODOLOGY:

Beyond an analysis and appreciation of the disruptive effects of digitization across industries, published literature on future trends in the global and Indian automotive industry especially the ones related to the transformative impact on business models of incumbents was reviewed. Primary research included actual observations at over hundred automobile dealership showrooms across the country. This was complemented by secondary archival data from media reports, company annual reports and press releases. In-depth past work experience of two co-authors of this paper in the automobile product development and manufacturing domains as senior managers complemented our database and comprehension, and qualitative content analysis (Hsieh & Shannon, 2005) was employed as the

primary approach to develop case studies on the digital technology supported initiatives of five of the top car manufacturing companies in India. The value chain framework detailed by Porter & Heppelmann and the business model analysis framework detailed in Hanelt et al. (2015), thereafter aided us arrive at industry level insights on the overall extent of deployment of digital technologies in the auto OEM industry in India and its association with the market standing of the top manufacturers.

FINDINGS OF THE STUDY:

In India, new entrants such as ride-sharing and car rental companies, multi-brand service networks and group buying companies are already taking a lead to leverage the consumers' need for mobility, after-sales services and enhanced bargaining power. With specific reference to the Indian context, we now elaborate on the related individual initiatives and intentions of the top passenger vehicle OEMs against each of the six disruptive forces.

Diverse mobility:

Although, penetration of shared mobility in India remains low compared with China and the United States, a major shift is under way in densely populated cities where the use of e-hailing cabs costs less, comparatively, than driving a personal car (Gupta et al., 2018). Indian cities have witnessed a silent revolution in the taxi-rental market with the advent of mobile application-based (app) taxi hailing services. Taxi aggregators like Meru, Uber and Ola have managed to capture a huge customer base by simplifying the process of taxi hailing (Karthick & Ramakrishnan, 2017). Middle of last year, Uber passed the 500 million rides mark in India and expanded to 29 cities working with half a million drivers in less than four years. India's homegrown competitor, Ola cabs, is growing just as rapidly (Chadha, 2017). Hyundai recently invested in self-drive car sharing company 'Revv' in India and launched Hyundai subscription- an entirely new way of getting a brand new car, without having to buy or own one (Hyundai, 2019) and later invested $300 million in India's biggest cab aggregator Ola Cabs, as part of a strategic partnership between the two companies. With this deal, both Hyundai and Kia Motor Company will work with the Bengaluru based start-up for developing customized electric vehicles and charging stations appropriate for ride hailing applications. The agreement will see the three companies collaborate on developing unique fleet and mobility solutions, building India-specific electric vehicles and infrastructure, as well as nurturing best in class opportunities and offerings for aspiring driver partners with customized vehicles on the Ola platform (Ghosh, 2019). Mahindra invested in Zoomcar to deploy self-drive electric sedans in Pune and introduced leasing for retail buyers (Mahindra, 2018b). Tata Motors has a partnership with Zoomcar for EV supply (Tata Motors, 2018) while Maruti Suzuki has collaborated with both Ola &Uber to train driver partners.

Electrification:

Electrification has just started to take off in India (Gupta et al., 2018) and though never articulated as a formal policy, India originally had the ambition of having all new vehicles on Indian roads powered by electricity by 2030. The FAME II scheme pertaining to the Faster Adoption and Manufacturing of Hybrid and Electric vehicles has been notified recently and came into effect from early April 2019. The new scheme envisages incentives for EVs based on minimum top speed, range per charge, and acceleration as well as their energy consumption efficiency. The incentives are applicable for vehicles with 'advanced batteries' (excluding lead acid ones). 95 percent of electric 2-wheelers receiving incentives in the past are likely to be impacted compelling manufacturers to come up with new models and enhance localization to be eligible for rebates under the new scheme (HBL, 2019). Subsequent discussions between senior government ministers and NITI Ayog officials include the following propositions to further push adoption of EVs in India:

a) A ban IC engines in 3-wheelers by 2023 and 2-wheelers by 2026

b) Extension of the electrification drive to all the delivery vehicles and state buses

c) That 40 percent of the vehicles used by cab operators be EVs by 2026

d) That all cars sold for commercial purposes after 2026 be Evs

A draft notification from the government to this effect is expected to be circulated shortly for wider consultation with relevant stakeholders. Meanwhile, several industry leaders, mainly from the 2 and 3-wheeler manufacturing sectors, have expressed serious apprehensions at the proposal for such an accelerated pace of EV adoption indicating that it might have serious repercussions for the industry particularly from consumer demand perspective (Surendar, 2019).

Meanwhile, sales dropped 40% in India during FY 2018 to 1200 electric cars, which is insignificant compared to total new car sales. The lack of charging infrastructure and awareness around electric cars are viewed as the main reasons. Additionally, as of now, no Indian firm produces lithium-ion batteries- the primary driving force in an EV, and the top 5 global manufacturers are based either in South Korea or China (Economist, 2017). Estimates project a 15- 25% penetration level of electric vehicles in cars, compact SUVs and passenger vans in India by 2030 (Gupta et al., 2018).

At present, only Mahindra Electric Company sells electric cars in India and has a tie-up with LG Chem- a top global manufacturer of lithium-ion batteries. Tata Motors has started producing and supplying electric sedans (Tigor) against a government tender. None of the existing cars offer a range over 120 kilometers. On the value creation front, Suzuki is setting up a lithium-ion battery plant in Gujarat in partnership with Toshiba Corporation and Denso (TOI, 2018). Subsidiary Maruti Suzuki has started testing electric cars while Hyundai plans India debut of its KONA electric SUV with a range of 400 kms on 9th July2019 (Shah, 2018a). Honda plans to launch EVs into India only by 2023.

Connectivity:

Connectivity is still in the early stages of adoption in India. A minuscule share of Indian vehicles, have factory-fitted connectivity features (Gupta et al., 2018) and estimates of its current penetration in India vary between 1 to 3% of the total car population (Piparsania, 2018; Statista, 2018). However, all the top five passenger vehicle OEMs offer connectivity features in some of their products in India (ETA, 2019; Honda, 2018; Mahindra, 2018; Maruti, 2018), while early 2017, Tata Motors collaborated with Microsoft India for roll out of in-car connectivity (Microsoft, 2017). Mahindra has agreements with Ford on power-train sharing and connected car solutions in India and during 2016, launched a connected vehicle platform named DiGiSENSE becoming the first OEM to create an ecosystem of technology partners (Mahindra, 2018). However, many Indian connected car owners are oblivious of the benefits of the technology and fail to see how it could enhance their everyday lives (HBL, 2018).

Autonomous Driving:

The Government of India is not in favor of fully autonomous vehicles (AV) and neither industry nor regulatory players are confident of rapid AV sales uptake due to fear of job loss, weak traffic infrastructure and lack of self-discipline in the driving culture (Gupta et al., 2018). The government would rather protect the jobs of millions of drivers than see a technological marvel on the streets as driverless technology could render millions of Indian drivers jobless. However, the government is working towards introducing a mandate which will bring Advanced Driver Assist Systems (ADAS) in all cars by 2022 (FE, 2018). The Institute of Driving and Traffic Research (IDTR)—a joint venture between the Department of Transport of State Governments and car manufacturer Maruti Suzuki India Ltd. founded in 2000—have piloted “HAMS”, a Microsoft Research product, to monitor the training of drivers and improve their driving skills. HAMS uses visual artificial intelligence (AI) to monitor the drivers as well as their driving (Microsoft, 2017).

Jaguar Land Rover, a subsidiary of Tata Motors is testing a fleet of connected cars that can 'talk' to each other, on UK roads (Tata Motors, 2018b) while Mahindra, India's largest tractor manufacturer, showcased its first driverless tractor during late 2017 (Banerjee, 2018).

Digital marketing & sales:

Within automotive dealerships, use of technologies such as AR, virtual reality (VR) and customization- showing people the full range of products with all accessories and features in a relatively limited space, is slowly yet surely picking up. Hyundai Motor, the second largest domestic car manufacturer, recently piloted online sales of passenger vehicles in India through a digital marketing initiative named HyBuy. Customers were enabled to directly order the car of their choice on the designated company website and choose the preferred dealer for delivery of the final product (Hyundai, 2017). Targeting 10% of its India sales through the online route (Narasimhan, 2017), the company was also one of the first in India to roll out the concept of virtual showrooms in Delhi (Hyundai, 2016) whereby giant television screens replace physical display of new demo vehicles at dealerships. Such outlets, often at prime locations and shopping malls with high footfalls, facilitate customers to interact on features, prices and even test-drive the model of their choice in a virtual reality environment. By seeing virtually how products will look or function in a real setting before buying them, customers can have more accurate expectations, more confidence in their purchase decisions, and ultimately greater satisfaction (Porter & Heppelmann, 2017). Other Indian origin OEMs like Mahindra and Tata Motors are also aiming similar enhanced digital interfaces for their product display (Mahindra, 2018). As the head of the passenger vehicles business of Tata Motors said during a recent interview with the press:

> *“If we are going to create a AR/VR thing in Select City Mall (in New Delhi) which has a footfall of one lakh people every day and even if 10% of the footfall visits our AR/VR, then you will have 10,000 people every day,”……..* (Ghosh, 2018).

During 2015, Maruti launched NEXA, a car distribution channel to cater to premium customers expanding to 250 outlets across India by FY2017. NEXA showrooms have multiple digital display kiosks where trained relationship managers use digital aids like iPads connected to large television screens while explaining product features. The company's long term goal is to make 20% of its total sales through NEXA outlets. Additionally, Maruti is buying parcels of land in major Indian cities to facilitate future dealerships & service workshops (Maruti, 2018b).

Digital after-sale services:
Digitally delivered after-sale services and/ or use of AR by service technicians is still at its nascence, if not non-existent- an observation based on our 100 plus visits to car dealers across the country. Maruti introduced the NEXA service in 2017 which is currently being ramped up across the country. Plush NEXA workshops with premium lounges use digital technology to enhance customer service and transparency (Maruti, 2018b). Meanwhile it trains its entire sales and service personnel at its Digital Academy (Jha, 2015), and revamped its pre-owned car business through roll out of digitally integrated, stand-alone True Value outlets across the country. Customers can now access details of all the cars available at True Value outlets nationwide (Maruti, 2018b). Hyundai and Mahindra are substantially expanding used car dealerships and have associated digitized websites. Additionally, Mahindra has moved into the multi-brand used car sales and service businesses through two subsidiaries MFCWL& MFCS. All five top firms have implemented service alert and booking systems over the mobile phone.
On its part, the government has mandated 'High Security' registration plates for all vehicles manufactured after 1st April 2019. This plate will be laser printed and fixed on the vehicle by a special anti-theft lock obviating forgery (ET, 2018).

DISCUSSION & ANALYSIS:
All five major car manufacturers in India have deployed several digital technology enabled initiatives to enhance customer value. Table 1, summarizes the value chain elements identified and digital initiatives taken by the top 5 Indian Automotive OEMs. Case studies of the top five firms help to identify a total of about 25 different initiatives taken in response to the digital disruption.

Table 1: Value chain elements identified and Digital initiatives of top Indian automotive OEMs

		Value chain elements impacted by SCPs	Digital initiatives of top Indian automotive OEMs
Value Creation	Product Development	Low cost Variability Evergreen design New User Interfaces & augmented reality Ongoing quality management Connected service Support for new business model System interoperability	Infotainment systems; Partnering with global auto OEMs; Connected vehicle options; Multiple operating systems on same product; Global design centers; Collaborating with technology companies. Reduced cycle time from conceiving of Design till Launching of Product.
	Procurement & Manufacturing	Smart factories Simplified components Reconfigured assembly process Continuous product operations	Increasing number of models rolled from the same line
Value Delivery	Logistics & Warehousing		Partnerships with logistics & infrastructure providers
	Marketing & Sales	New ways to segment & customize New customer relationships New Business Models A focus on systems, not on discrete products	Separate channel for premium customers; Partnering with ride hailing companies; Multi-brand used car sales and service; Offering EVs as shared taxis; Digital showrooms; Online sales of new cars; Digitally integrated used-car outlets; Marketing thru social media; Entering car leasing/ sharing business; Partnering for shared 3-wheelers;
	After-sale Service	One-stop service Remote service Preventive service AR support New Services	Differentiating after-sales for premium customers; Service alerts over mobile
	Human Resources	New Expertise New culture New compensation models	Hiring personnel from world's leading auto OEMs & technology companies; Digital training of personnel; Use of digital tools for training
	Security & Safety	ABS, engine Lock, Finger print sensors to start ignition	

Source: Adapted from Porter & Heppelmann, 2014; 2015 & authors own research

Competitive convergence is evident in case of many of the initiatives deployed suggesting that firms may be imitating each other. However, there are some unique initiatives noticeable which only one or at best two of the top firms have deployed. Primary among them are creation of new segments, value creation infrastructure building (Example- lithium-ion battery plant of Suzuki), initiating new business lines for multi-brand used cars sales and service, and direct investment in car sharing businesses. Maruti Suzuki stands out having deployed most such unique initiatives. In fact it is the only Indian company to invest in lithium-ion battery facilities and poses threat to top Indian battery suppliers like Exide who are contemplating entering the area (TOI, 2018). Further, it is the only OEM to start a separate channel for sales & service (NEXA) and appears to be unique in its efforts to buy parcels of land at prime locations for future dealerships. Whereas most others are following the route of virtual showrooms to counter the negative impact of rising real-estate prices in big Indian cities, Maruti is actually investing in real estate to meet the same ends. As Porter & Heppelmann state- strategy is all about doing different things or doing things differently from rivals. This is clearly evident in case of Maruti and to some extent Hyundai (launching Hyundai subscription with Revv and investment in Ola cabs) and Mahindra (with its multi-brand used car sales & service business and leasing for retail buyers). These firms appear to have distinctive strategies that differentiate them from rivals. A direct association is discernible with their market standing in India, where they constitute the top three in terms of sales volume with Tata Motors and Honda Cars India occupying the fourth and fifth positions respectively (Shah, 2018). Honda Cars India has implemented the lowest number of initiatives and except for being the first to roll out in-car connectivity (among mass-market car firms) has little to distinguish itself and is the smallest among the five in terms of sales volume. Our findings thus suggest an association between unique business model changes made by some of the OEMs and their current market standing. With electrification expected to be the next wave of change in India, Maruti is poised to have a favorable future business model compared to the others, as a result of Suzuki's investment in a lithium-ion battery plant in India. Closely following would be Hyundai and Mahindra who are better poised in the mobility services area because of the actions already taken. Table 2 uses the business model (BM) framework outlined by Hanelt et al., (2015) and maps each OEM on the initiatives deployed under each of the four BM pillars.

Table 2: OEM-wise deployment of unique Business model change initiatives

BM pillar	OEM	Unique Initiatives
Value proposition/ Product (How product/ services create value)	Honda	Connectivity solutions in cars (first Indian OEM)
	Hyundai	Launches Subscription based car ownership with Revv Associate company Kia Motors to shortly debut in India Connectivity in sub-compact SUV Venue

	Mahindra	Multi-brand used car sales & service (MFCWL and MFCS) Investment in Zoomcar Leasing for retail buyers (KUV100NXT and XUV500) E-mobility service Glyd launched
	Maruti	First to introduce AMT option in cars Mild-hybrid technology in Ciaz sedan Connectivity equipment as additional option in some models
	Tata Motors	Connectivity in SUV Harrier
Customer Interface (Target segment & way of reaching)	Hyundai	Virtual showrooms Online sales of cars
	Mahindra	Bring the showroom home
	Maruti	NEXA sales & NEXA service Training driver partners for Uber & Ola
Infrastructure (Competencies, Resources & Partners)	Hyundai	Partnering with Chennai Port Trust Invests $300mn in Ola along with Kia Motors
	Mahindra	Partnering with Ford, Microsoft, Dassault systems, & Wipro Tie-up with LG Chem for lithium-ion batteries
	Maruti	Partnering with Toyota & Microsoft Investment in real estate Partnering with Mundra Port & SEZL (MPSEZL) Digital Academy
	Tata Motors	Partnering with Samsung, Microsoft, Uber & Zoomcar
Finance (Costs & Revenues)	Hyundai	Launch of EV Kona planned in 2019
	Mahindra	Has EVs in its current line-up
	Maruti	Direct manufacturing investment by Suzuki Lithium-ion battery plant Investing in real-estate for future dealerships Testing EVs on Indian roads
	Tata Motors	Supplied Tigor EVs against a government tender

Source: Hanelt et al., 2015 and authors own research

Finally, Table 3 summarizes the overall scenario that emerges with regard to the adoption of digital technologies by Indian customers and OEMs.

Table 3: Overall digital technology adoption & readiness of car OEMs in India

Element	Country implementation status	Customer Acceptance	OEM readiness	Initiatives
Diverse mobility	Common-growth phase	High (urban areas)	Low	Few
Electrification	Nascence; Push from Govt	Low	Moderate	Some
Connectivity	Nascence	Low	Moderate	Few
Autonomous vehicles	Distant possibility	Uncertain	Low	None
Digital Marketing & Sales	Initiated, Ramp-up stage	High	High	Several
Digitally delivered After-sale services	Nascence	Not known	Moderate	Few

Source: Authors research

Implications of the study:

Past literature has indicated a lack of understanding on the digital transformation of primarily physical industries like the automotive industry (Hanelt et al., 2015). This research provides an empirically rooted understanding of how major passenger vehicle OEMs are transforming in the Indian context and how they are preparing for future disruptions expected from the proliferation of digital technologies.

Limited to exploring the digital initiatives of major automotive OEMs, our work does not include consumers or other related organizations such as software and mobility platform providers who are intimately connected to the industry. Secondly, our data is mostly limited to country level initiatives of the top Indian manufacturers and does not take account of the global initiatives of their parent (in case of MNCs). A natural future extension would be to explore how the entire mobility ecosystem is transforming manufacturers in India amid an increasingly digitally enabled world.

CONCLUSION:

Most digital disruptive forces evident globally, are as yet weak in India. The top passenger vehicle OEMs in India have all responded to digitization and other environmental changes through incremental changes to their business model. The extent of changes made, however, varies with the top firms ahead in terms of the variety and level of the initiatives deployed. Notwithstanding the steps taken, all the top Indian manufacturers trail behind their top global counterparts not only in terms of R&D investments, but also incorporating the concept of 'mobility as a service' into their business model. They are also at a stage of nascence with respect to the introduction of smart, connected products and Augmented Reality and are as yet struggling to cope with the digital revolution that is transforming the automotive industry worldwide. Additionally, despite strong intentions, government policy action to ensure rapid adoption of EVs in India, appear to be at preliminary stages unlike the case in China.

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