

# **PARTICULARITIES OF DIGITALIZATION IN THE TIRE INDUSTRY**

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**Abstract:** The aim of this paper is to understand the extent to which the tire industry is affected by digitization and what are the possible responses of tire manufacturers. Our research methodology is based on the critical analysis of company reports and of the INTERNET sources related to market studies relevant to the industry, the analysis of future mobility trends as well as the digitization strategies adopted by the main actors in the industry. Our findings suggest that digitalization is transforming the tire industry, as it fits into the broader context of future mobility, a strongly digitized sector. In the face of this reality, tire manufacturers are adapting their organizational strategy in order to take advantage of new sources of value.

**JEL classification: M19, M29**

**Key words: digitalization, future of mobility, digital transformation, tire sector, business model**

## **1. INTRODUCTION**

Since the 2000s, digital transformation has become a topic for organizations (Patel and MacCarthy, 2000), aware of the need to implement transformations designed to facilitate their adaptation to the demands of a reconfigured competitive environment and new consumer behaviours.

The competitive environment has been mainly affected by new technologies, which have allowed the penetration of some actors who, thanks to innovative models, have become threats to traditional organizations. Disintermediation, reconfiguration models designed to create and capture value, operational excellence and new management styles are a source of risk for traditional organizations but also inspiration in their own transformation process (Naim and Boutteau, 2018, Burlea-Schiopoiu, 2003). New technologies have greatly influenced consumer behaviour, redesigning access to information, the purchasing path or preferences for certain types of products and services (Burlea-Schiopoiu, 2005). Throughout this process, consumers have become more demanding, expecting a fluid and personalized customer experience. The transformation of the mentality of individuals is accelerated by the younger generations, who bring with them a new approach not only to consumer experience but also to the way of working, thus acting as an agent of change within the organization (Burlea-Schiopoiu, 2013b; Burlea-Schiopoiu and Mahon, 2013). These are a source of change, to which we can add government or local policies as well as globalization, which has

caused a transfer of technology and the dissolution of physical barriers (Burlea-Schiopoiu, 2014).

Facing these transformations, organizations reacted defensively in a first phase, seeing in digital solutions a tactic meant to solve specific problems and to respond punctually to the emerging changes. With the acquisition of digital maturity, digital strategy has become an integral part of organizational strategy and organizations make efforts to align IT infrastructure with business priorities, management philosophy or organizational culture (Burlea-Schiopoiu, 2013a; Burlea-Schiopoiu, 2007).

Although the transformations brought about by digital do not affect all industries to the same extent and at the same speed, we cannot affirm that the tire industry is exempt from changes caused by digitalization. In this context, we ask the research question: to what extent does digitalization affect the tire industry and what are the adaptation strategies of manufacturers? In the following, we turn our attention to the tire industry, trying to understand if and to what extent it is affected by the changes produced by digital and if the relevant actors in this field initiate adaptation strategies. In this regard, we aim to understand, in a first phase, the global context of the tire market, to analyse the factors that drive its transformation and to identify possible strategic options for tire manufacturers (Burlea-Schiopoiu, 2008).

Our research methodology is based on the critical analysis of company reports and of the INTERNET sources related to market studies relevant to the industry, the analysis of future mobility trends as well as the digitization strategies adopted by the main actors in the industry.

## **2. WORLD TIRE MARKET**

The world tire market was worth 143 billion euros in 2018, an increase of 4% from the previous year, for a sales volume totalling 2.6 billion units. Tire sales are addressed to several vehicle segments: tourism (52%), two or three wheels (24%), trucks (19%) and specialized vehicles, such as mining, agriculture, civil engineering, aircraft, etc. (5%) (Xerfi, 2019).

Tire sales fall into two categories: those designed for the original equipment of the vehicles (25%) and those destined for their replacement (75%). In terms of product characteristics, tires for the original equipment are generally designed and manufactured in partnership with the car manufacturer to which they are addressed, so as to maximize the driving experience and provide superior performance in terms of durability, safety, noise or manoeuvrability, according to the characteristics of the vehicle. Replacement tires are standard products, able to meet the characteristics of several types of vehicles without degrading performance. For a tire manufacturer, presence as an original equipment supplier is important both in terms of prestige - allowing a certain image to be conveyed depending on the brand or model of the vehicle fitted - and economically, as around 50% of consumers will be faithful to the original equipment tire brand. The strategy of tire manufacturers is consequently conditioned by that of car manufacturers, and the evolution of the tire market follows, with certain variations, that of car manufacturers. In this context, the evolution of the tire industry has been relatively favourable in recent years, amid the recovery of the world economy, the increase in car production and the increase in consumption.

Starting with 2018, there has been an attenuation of this trend, attributed to the slowdown in car production in mature economies such as the United States and Western

Europe, the slowdown in economic growth in Asia, and the rising cost of raw materials. However, the outlook for the industry remains positive in the medium term, with a projected increase of + 10% in volume (total 3 billion units) and + 30% in value (€ 185 billion) by 2023 (Xerfi, 2019). This outlook is due to a stable demand in the tire replacement market, increased car production in developing markets, as well as a demand from the value-added tire segment. Geographically, Asia dominates with a market share of 44%, followed by Europe (26%), North America (21%), South America (6%) and other regions (3%). Xerfi, 2019). The positive outlook for the Asian market is explained by the behaviour of the automotive industry, which is growing strongly. In 2017, Chinese car production amounted to 29 million vehicles, more than the sum of the productions of the next three global players (United States, Japan and Germany, totalling 26.5 million units). This evolution has been favoured by entry barriers imposed on foreign manufacturers and the transfer of technology from more developed foreign companies to Chinese ones. In response, tire manufacturers have increased their presence in the Asian market in order to be able to approach local carmakers and respond to their specificities in the local market.

The dynamism of the Asian market has materialized not only in the automotive industry but also in the tire industry, by asserting some local competitors who generally develop products located in the mid-range. In the face of this increasing competition, price volatility and international exchange rates, the alternation of periods of crisis and economic recovery, historic manufacturers are developing strategies to expand internationally and increase the value of products. Based on innovation, this choice allows them to focus on profitable market segments and differentiate themselves from standard (low cost) competitors or new manufacturers. In this respect, the outlook for the sector is positive, thanks to the transformation of mobility, the increase in car production and the development of value-added product and service segments. This trend is stimulated by a) the evolution of the car fleet towards vehicles equipped with +17 'tires, b) the development of electric and hybrid vehicles, c) the emergence of types of services based on connected tires and d) stricter regulations.

**Table 1: PESTEL analysis of the tire industry**

Factor	Positive Impact	Negative Impact	Relevance
1	2	3	4
Political	Supporting the automotive sector: infrastructure and economic facilities;	International trade affected by trade tensions and customs duties. Urban policies aimed at disseminating the use of vehicles in urban centres;	-
Economical	Stable economic growth, despite periodic slowdowns;	Rising commodity prices, fluctuations in the automotive industry;	+
Sociological	Vehicle-based transport increase in developing countries, the evolution towards vehicles with a high rim diameter;	The evolution of consumption habits that discourage possession;	+

Factor	Positive Impact	Negative Impact	Relevance
1	2	3	4
Technological	The emergence of new market segments that require tires with a high level of technology (connected, for electric cars, etc.);		++
Ecological	Awareness of climate needs requires ecological efficiency of tires;	Fragility of the supply chain in the face of climatic conditions;	+
Legal	New performance or equipment rules depending on weather conditions;	The complexity of the legislative framework, which varies according to regions;	+

Source: Xerfi, 2019, *L'industrie des pneumatiques*

The PESTEL analysis reveals a positive macroeconomic landscape despite short-term difficulties.

*Regulatory developments* call for improvements with an effect on performance, environmental impact, noise, safety, etc. Tire performance is communicated to the consumer through labels borrowed from the consumer market industry, to facilitate adoption and understanding. Manufacturers are thus encouraged to replace toxic compounds with more efficient ones, which improve lifespan, performance or environmental impact. Although some adaptation costs may be significant, the result is beneficial for industry leaders as the demand for high value-added tires is stimulated.

*The dependence on the automotive sector* is reflected by the annual sales curves, which follow those recorded by vehicles. The automotive industry is decisive in several respects: a) the presence as a supplier of original equipment influences the choice of brand in the replacement, b) the preference for certain categories of vehicles has an impact on the production of a particular tire segment, c) the development of electric or connected vehicles encourage tire manufacturers to develop high-tech products, favouring the evolution of service-based consumption.

*Transforming the future of mobility.* The increase in the level of motorization, recorded mainly in Asian countries, automatically favours the demand for tires. In the long run, however, the transformation of consumption habits worldwide and especially in developed economies risks putting pressure on tire development strategies. The future of mobility, materialized in favour of the use of shared vehicles taxis and the preference for rent versus possession, is favoured by 3 macro-economic factors:

- Changing consumption preferences, especially among the younger generations, which favours flexibility of use versus possession
- Urbanization, combined with the regulation of vehicle use in urban centres
- New technologies, based on connectivity, that develop a new field of possible applications for car manufacturers and tire manufacturers

In this context, tire manufacturers rely on innovation to offer high-tech products, able to open up perspectives on new business models based on services instead of products, thus compensating for a loss in volume through a gain in value.

*Direct competition* is particularly intense, the top ten world leaders representing, in 2017, 54% of the market share (in value), the top three players (Bridgestone, Michelin and Goodyear) representing 28%. However, these positions

decreased compared to 2013, when they stood at 63% and 38%, respectively, a sign of fierce competition between actors (Xerfi, 2019).

The deterioration of the position of historical leaders is determined by two factors: on the one hand, the rise of Asian manufacturers, marked by the development of international markets, which they flooded with cost-competitive tires, and on the other hand the efforts of medium level manufacturers (Hankook, Maxxis) to offer products with increased value, thus threatening the positions of premium manufacturers. The consequence of these strategies has been an upward transformation of supply, towards more expensive and cost-effective tires, as well as an innovation race that follows the trends of future mobility.

*The new participants*, mainly of Asian origin (Koreans, Singaporeans, Indonesians in the first phase, especially Chinese in recent years), have exerted intense pressure on traditional manufacturers since 2000. Their rise has been fuelled by technology acquired through the acquisition of historic manufacturers (e.g. Pirelli by the ChemChina conglomerate in 2015). Relying on this strategy, the new entrants invaded European and North American markets with affordable products. To compensate for the loss of volume, historical leaders have adopted a strategy of differentiation by value, relying on technological products with added value, still inaccessible to new contenders. The evolution of the pneumatic industry towards mobility solutions is consequently motivated, in part, by the trivialization of the final product.

*Public policies* affect the tire industry by:

- Economic measures to regulate the import of tires from Asian manufacturers and intended to protect domestic markets against dumping and subsidies levied by them on domestic markets.
- Rules on the use of tires (especially according to seasons) as well as homogeneous communication on a set of performances (by introducing performance labels)
- Regulations on mobility and use of vehicles in urban areas

Tire manufacturers operate in a B2B (business to business) market with a B2C (business to consumer) brand image. In these conditions, the relationships they maintain with customers are particularly important. Depending on the market approached, they are divided into car manufacturers and retailers. Car manufacturers are less important in terms of tire consumption (even if significant in terms of volume - 25% of the market - profitability is almost null) but relevant in terms of partnerships between they can establish with tire manufacturers. Retailers provide access to the market and have a decisive role on the price charged to the final consumer. To reduce their pressure, some manufacturers have opted for vertical integration of distribution networks, physical or virtual.

The threat of substitutes does not come from a product perspective but from the approach addressed to the need for transport, marked by trends such as shared mobility or use versus possession. The number of cars used in shared mobility is estimated to reach a market share of 8% (130 million in 2030 versus 22 million in 2016), causing an estimated decrease in the number of registrations between 160 and 450 million cars. Despite this change, tire consumption should remain stable, thanks to the increase in the number of kilometres driven by this type of vehicle. The trend of shared mobility does not threaten the volume of the market but transforms the nature of supply, as shared

vehicles require services such as predictive maintenance or remote monitoring, possible through new technologies.

The relatively low importance of suppliers can be explained in terms of the vertical integration strategy practiced by industry leaders, who have integrated the strategic segments of the value chain (raw materials, components of the finished product, manufacturing technology or applications based on new technologies).

### **3. TRIGGERS OF THE DIGITAL TRANSFORMATION OF THE TIRE INDUSTRY: THE FUTURE OF MOBILITY**

Mobility will be influenced in the coming decades by the convergence of social, economic, technological and environmental macro-trends. Even if most theorists and practitioners agree that the current landscape will be transformed, the volatility, ambiguity and complexity of the determinant forces prevent a consensual perspective on the future of mobility. However, certain factors with transformative potential are distinguished. Despite their independent presentation, a unilateral perspective should be avoided, as macro-trends will act by accelerating and potentiating each other (McKinsey, 2016).

The number of personal vehicle registrations is declining. The stagnation of the percentage of vehicle numbers relative to the number of inhabitants is a noticeable trend in mature markets such as Western Europe or North America.

Even if developing economies or the Asian market are still dynamic, reaching a plateau of new registrations in the coming years is predictable (McKinsey, 2016). This trend is associated with a decrease in the use of vehicles, materialized by reducing the number of kilometres travelled annually to the advantage of other means of transport (US Department of Transportation). New ways of financing are developing, personal vehicles being purchased mainly in leasing system, with or without the option to purchase at the expiration of the contract. In parallel, a mode of consumption based on the sharing economy is shaping up (Shaheen et al., 2018).

*Consumer needs* are changing, the transformation being even stronger among the younger generations (Jeekel, 2015). Thus, consumers (a) demand a reduction in transport costs and the development of efficient solutions, without being willing to invest extra for their purchase; (b) perceive the car less as a symbol of social status rather than a functional response to the need for transport, necessity and functionality prevailing over experience (c) call for the association of digital services with the use of motor vehicles.

*The development of the sharing economy*, already present in a pre-digital world in terms of acquisitions that required considerable investment, has been trivialized by the awareness of the dangers of exacerbated consumption and smartphone innovations (Winkelhake, 2017). This evolution opens up interesting perspectives on new business models, among the best known being Airbnb, Uber or Ebay. In the automotive sector, various applications such as car2go (Daimler), DriveNow (BMW), Flinkster (Deutsche Bahn), BlaBlaCar (Europe) or Didi Chixing (China) are exploring the potential of this market, estimated at 5.5 billion euros in terms of passenger transport and 2 billion euros in parking costs (Winkelhake, 2017).

*Public policies* for managing the future of mobility encourage the reduction of individual car ownership, limiting traffic in urban centres or favouring mobility based

on alternative energy sources. Appropriate policies and incentives are implemented at national and local level, resulting in the development of hybrid and electric vehicles and the increase in the number of shared vehicles (Shaheen et al., 2018).

*The development of new technologies*, such as the Internet of Things, Cloud, Artificial Intelligence (enhanced by the development of 5G Internet), electronic advances (based on 3D chips or carbon nanotubes) or alternative energy sources favour the emergence of connected, autonomous and electric vehicles. Connectivity, digitization and electrification of cars are identified as the strongest trends in the automotive sector, in a study conducted by KPMG on 1000 professionals with a leading role in the automotive industry (KPMG, 2019).

- A connected vehicle is able to communicate bidirectional with systems outside it via an Internet connection. Currently, only 30% of new vehicles are connected, the estimated percentage for 2030 being 100% (KPMG, 2019). The connection of the vehicle can be of several types: vehicle to infrastructure, vehicle to vehicle, vehicle to Cloud, vehicle to pedestrian, vehicle to anything. Technological applications fall into two categories: those involving the vehicle and users and those involving the vehicle, users and the ecosystem. Their purpose can be dedicated to (Viereckl et al., 2014): travel management (optimization of traffic, routes, fuel consumption, etc.), trade (depending on the route), vehicle management (ease of use or maintenance), predictive maintenance (based on the collection and exploitation of data using algorithms), security (notification of infrastructure or traffic conditions), entertainment (consumption of digital content), driving assistance (parking, directions), personal comfort (adjustment of passenger compartment conditions, intervention in case of fatigue or incapacity of the driver).
- An autonomous vehicle is able to perceive and adapt to the external environment, thanks to a set of sensors and video cameras, so that it can travel the defined route without or with very little human intervention.
- An electric vehicle uses an integrated source, in the form of a battery, solar panels or an electric generator, to create the electricity needed for propulsion.

Under the influence of these factors, the automotive industry undergoes a series of transformations referred to under the acronym CASE (Connected - connected -, Autonomous - autonomous, Shared - shared, E - Electric - electric or hybrid). In this context, car manufacturers need to re-evaluate their strategy and redefine their role as: (a) manufacturers focused on the finished product (b) service-based manufacturers (c) basic mobility providers (d) mobility providers targeted on services.

As we argued in the previous section, the tire industry is conditioned by the automotive industry. The analysis of the transformations it is going through can facilitate the understanding of the need to adapt the industry we have chosen to study. The future of mobility, transformed by the introduction of new technologies, influences the tire industry from two points of view: on the one hand, the digitalization of vehicles influences the product from the point of view of the evolution of tire characteristics; on the other hand, the transformation of transport consumption habits opens the opportunity for a business model that values services instead of finished products (Burlea-Schiopoiu, 2019).

#### 4. DIGITIZATION OF TIRE MANUFACTURES: A NECESSARY EVOLUTION IN THE CONTEXT OF THE FUTURE OF MOBILITY

In the following, we aim to understand how macro-industrial trends, along with the transformation of consumer behaviour, entail the need for digital transformation of tire manufacturers.

**Table 2. Tire manufacturers' response to the digitalisation of the automotive industry**

Trends in the automotive industry	Answer based on	Details	Finality
1	2	3	4
Connected vehicles	Data, collected through the connection of products and infrastructure,	Introduction of connected tires, by installing ovens capable of monitoring parameters such as wear, compliance with weight requirements, parallelism, etc.	Transforming mobility > transforming business strategy >
Shared vehicles	stored in the Cloud and processed using Artificial Intelligence.	Development of solutions based on Cloud technology, intended for fleet management.	transforming innovation strategy >>
Autonomous vehicles		Adapting the behaviour of the vehicle to road conditions, real-time monitoring of vehicle performance.	transforming the business model.
Electric vehicles	Product adaptation.	Development of light tires with low friction resistance, which benefits the life of electric batteries.	

*Source: The author*

Much of the response developed by tire manufacturers lies in the **digitalisation of the ecosystem** and the **possible synergies** between the various components. Data is a key element in addressing the opportunities created by connected and autonomous vehicles as well as shared mobility. In terms of electrification, the answer lies less in the integration of new technologies than in adapting the product in order to meet the particular needs of hybrid and electric vehicles.

The digitization of the ecosystem allows the creation of a massive flow of data, whose capture, storage and processing is of strategic importance. This digital capital is the material from which the new value propositions are built and that will shape future business models. To take advantage of these opportunities, the challenge for tire manufacturers is both technological (integration of new technologies into existing equipment, secure data collection and processing, etc.) and strategically (creating synergies between different technologies and actors in the automotive ecosystem in order to formulate economically exploitable value propositions).

**New technologies** are a key element. The Internet of Things, enhanced by 5G networks, allows data collection by integrating connected components (sensors), directly into the products or infrastructure of the automotive ecosystem:



- Tires, in order to capture information on their behaviour - pressure, temperature or level of wear - as well as external conditions - the quality of car infrastructure or weather conditions;
- Specific equipment, located in the maintenance centres or at fixed points located on the route travelled by the car and dedicated to the collection of data on the condition of the tires or the vehicle;
- Specific equipment, integrated in the on-board diagnostic devices, in order to collect information on the performance of the vehicle;

The collected data is stored in the Cloud and processed with the help of Artificial Intelligence, in order to extract the relevant value for the different target audience segments.

Depending on the possibilities identified for data monetization, tire manufacturers can enter into strategic or technological partnerships with different actors in the automotive ecosystem, opting for one of the following options:

- *Partnerships with car manufacturers*, for connected or autonomous vehicles:
  - Connected vehicles: tires can collect, via connected sensors, a series of data on tire performance (pressure, temperature, wear, weight) or external conditions (road condition, weather conditions), to formulate, via computer board, a series of recommendations designed to increase safety, fuel economy or driving experience. Information on the quality of road infrastructure can be delivered to users of other vehicles in similar mobility scenarios. Predictive maintenance or connection to the car centre specializing in tire maintenance are other types of applications that capitalize on the data and vertical integration of tire manufacturers,
  - In the case of autonomous vehicles, tires are all the more important as they are the only point of contact between the road and the vehicle. The sensors connected to the on-board computer can adapt the behaviour of the vehicle in the same way that a driver adapts his driving to external conditions.
  - Shared mobility creates opportunities for partnerships with public or private institutions. The foreseeable consequences of this trend are a decrease in the number of individual vehicles owned in major urban centres and an increase in the number of kilometres travelled annually, from an annual average of 5,000 kilometres to 15,000 kilometres. In this context, applications dedicated to real-time monitoring of tire condition or predictive maintenance can be a key solution in vehicle maintenance (Intelligenttransport.com, 2018). Synergies with partner car centres located in urban areas can be imagined. Their density and level of digitization can be a competitive advantage for tire manufacturers, and the maintenance of shared vehicles, an additional source of income for car maintenance centres.
- Tire manufacturers can opt for the integrated exploitation of digital solutions, either by developing the necessary capabilities within the organization, or by acquiring organizations that have the necessary skills. In this regard, some tire manufacturers are developing independent applications aimed mainly at the B2B segment (truck fleets used in national or international transport as well as professionals whose activity is dependent on a fleet of vehicles). B2C offerings are also present, either in the form of real-time monitoring of tire performance

(intended for extreme use of tires such as recreational driving) or applications such as predictive maintenance.

The value extracted from data collection and processing can be monetized for the benefit of several types of target audience. Identifying these segments and how best to add value to them is a key step in building future business models. In the following, we aim to identify a number of options:

- B2B customers (e.g. fleet managers for freight transport, organizations interested in supervising and optimizing the fleet and driving of employees, shared fleet managers, etc.) may be interested in the possibility of supervision in real and constant time of the car fleet, to save on fuel consumption, maintenance or insurance costs of vehicles, people and goods;

- B2C customers (e.g. individuals interested in optimizing tire performance). This segment remains marginal for the time being as final consumers are reluctant to integrate digital solutions in cars (Deloitte, 2020), or are far from financially materializing the interest in new technologies (Le Figaro, 2018);

- Manufacturers of connected or autonomous vehicles;

- Car insurance operators, who can use the data in order to personalize the tariff offers according to the vehicle use scenario and driving style or propose new business models, based on tariffs depending on the actual use of the vehicle;

- Public entities, interested in the development of applications dedicated to traffic management or security (security, monitoring, charging).

Tires are, by their very nature, a consumer product with relatively limited digitization options in a short time horizon. The full potential of an innovative digital offer depends on the digitalization of the ecosystem of which they are part of, depending on the development directions of the automotive industry, the regulatory policies that influence mobility and the digitalization of distribution networks (Burlea-Schiopoiu, 2009). For these reasons, the supply of classic products remains the core business of tire manufacturers. However, the future of mobility brings with it a series of changes in the direction of which the tire industry must evolve, by digitizing the offer of products and services, in order to capture value and eliminate digital competitors, able to infiltrate to along the value chain.

## 5. CONCLUSIONS

This research allowed us to understand, in an initial phase, the world market for tires and the trends that dominate it: dependence on the automotive industry, which dictates the strategy of tire manufacturers and the evolution towards technological products, with increased added value, under the pressure of the price competitiveness of the new actors. In the second chapter, we described the directions of future mobility and how they influence the range of products and services of tire manufacturers. Finally, we highlighted the implications of digitalizing the automotive ecosystem on the supply of tires and identified various options for integrating digital solutions by tire manufacturers.

The tire industry may seem at first glance impervious to the changes produced by digital. However, our analysis highlighted the fact that digitalization affects this industry, under different aspects:

- Synergy with car manufacturers: the close link between the tire and automotive industries has repercussions on the transformations brought about by the mobility of the future on the sector we are interested in. Vehicles become digital ecosystems in which tires are an integral part of innovative transport solutions;
- The opportunity to capture new sources of value: the Internet of Things, which allows connecting not only vehicles but also creating an urban digital ecosystem involving different actors, causes an explosion of data, a new source of value that invites the revival of the business model by tire manufacturers;
- Consumer behaviour, which requires new modes of consumption and the digitization of products and services is an impetus for the digitalization of the offer of tire manufacturers;
- The future of mobility brings with it the transformation of motor vehicles (electric, connected, autonomous), of the ecosystem (smart city) and of the mode of consumption (digitalization of the consumers' journey, rent vs. possession). The tire industry, an integral part of future of the, is inevitably faced with the need to adapt its vision, offer and operations to accompany these changes. This imperative is reflected in the digital transformation projects initiated by the world's leading tire manufacturers.

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