A Digital Transforming Plan for Vehicle Industry: Evidence from Audi

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Abstract. With the development of the Internet and the impact of COVID-19, many vehicle companies have started digital transformation in order to unlock the potential of the sinking market and promote profits by developing online service. The direct-sales model and customization are highly compatible with the online service and provides a better development environment for new energy vehicles. Based on the strong economic foundation of FAW Audi, this study investigates the building of a digital system to contact customers online of it. To start the direct-sales model, website, mini-programs, and applications will connect customers with the company rather than 4S stores. Collecting and analyzing customers’ needs from basic automobile elements (e.g., color and shape) to each component through these online methods to start customized businesses, so as to achieve basic digital transformation and change the relatively backward digital level in the Chinese vehicle market. In addition, through the digital system, the company, driverless vehicles and customers are connected together which is the basic of starting online car hailing business, by which FAW Audi will further enhance its influence. These results shed light on guiding further exploration of digital transforming in vehicle industry.

Keywords: FAW Audi; digital transformation; direct-sale; driverless.

1. Introduction

In the traditional automobile product market, most of automobile enterprises brands just exist independently. They may have common suppliers, middlemen, or even common customer groups with other automobile enterprises, but these few common factors will not change their competitors relationship. However, with the development of new energy vehicle and driverless technology, digitalization has entered the automotive industry. More and more manufacturers start to realize the importance of technical cooperation and data sharing, and begin to form alliances with each other to seize the future market through cooperation [1]. Now, new energy vehicles are no longer new things. After several years of development, some trends have already emerged in the new energy vehicle industry, such as automobile system integration, platform automobile design, scale effect, by which the enterprises can simplify vehicle systems, accelerate model development, and reduce costs. As for the government, not only the amount of the subsidies for new energy vehicles have been greatly reduced, but also the eligibilities for subsidies have become more strict. Manufacturers that meet the indicators are more competitive and more likely to get the subsidies [2, 3]. The broad prospect of automatic driving technology has also attracted many big brand car companies to cooperate. Through data sharing, R & D groups cooperation, they can discuss and help promote regulations. These alliances are promoting the development of automatic driving. Under their influence, the government and relevant industries will also participate in and give support. This has also further consolidated the dominant position of these alliances [4].

At present, many Internet companies have also participated in the development of new energy and intelligent vehicles. By combining with the Internet, many technical and safety problems in driving can be solved by the artificial intelligence vehicle control system. Among them, Tesla is very eye-catching. Although the company's revenue and scale cannot be compared with traditional big brand automobile enterprises, its self-driving technology, intelligent operating system, independent experience and service stores, unified pricing and so on provide strong competitiveness [5, 6]. Under the influence of Internet plus, online car Hailing also takes its place in our life. Its rapid development
has a great impact on traditional taxi and other ways of transportation. Many governments had to legislate and restrict its development to a certain extent to protect the traditional taxi industry [7]. Uber has big advantages in online car hailing and automatic driving technology. It really holds important data and knows people's needs. No matter how much conflict it has with the current taxi industry, driverless ride hailing is an inevitable part of future transportation [8].

In China, FAW Audi, as an old brand automobile enterprise, has been declining in competitiveness compared with Mercedes Benz and BMW in recent years. Although Tesla's digital transformation can provide valuable experience for Audi and many scholars have discussed the importance of involving goods in digitalization, there is no digital transformation plan for FAW Audi. Therefore, this research will take the experience of Tesla, Uber and some other companies as reference, to design a digital transformation plan for FAW Audi. In this case, it can contact with customers better, upgrade products, expand business and improve competitiveness through digitalization. This plan may also be helpful to other automobile enterprises such as FAW Audi, which have a relatively late digital transformation start. It can even provide reference for other industries in the area of digital platform construction and data collection.

The rest part of the paper is organized as follows. The Sec. 2 will analyze the main problems and causes of FAW Audi at present, and propose a general digital solution. The Sec. 3 will give a detailed introduction to the new digital system provided by this scheme. The Sec. 4 will specifically describe the three digital transformation recommendations proposed in this scheme. The Sec. 5 will discuss the limitations and outlooks of this digital transformation scheme. The Sec. 6 will summarize the implementation, limitations, further value etc.

2. Description of FAW Audi

Contemporarily, FAW Audi is facing a declining in revenue. There are 3 main problems right now. First, as key technologies are controlled by the joint venture company, its technological innovation capability is weak. Joint ventures such as the German Volkswagen Group have the absolute right to speak in research and development. With the arrival of the millennium, young people have become the mainstream consumption power, and the ideas of young people are far from the ideas of technicians who study product lines. Secondly, its huge and complex corporate structure and interest relations are hindering innovative decision-making, and there are too many unrelated departments need to participate in an approval unnecessarily. Finally, the investment in fixed assets is relatively large, and its operating costs are correspondingly high. However, its degree of digitalization is not high enough to adapt to the rapidly changing market. In terms of e-commerce marketing strategy, finance and insurance business, its network system and supply services are still relatively backward compared with other companies which have more successful digital transformation.

Most of the problems can be attributed to Audi's lack of digitization, which makes it unable to adapt to the rapidly changing market. Here are some recommendations. First, it needs to cut out the middleman and sell directly so that Audi can profit more and provide service more directly. Secondly, it ought to develop personal customized car services so that Audi will know what customers really want and upgrade its product line. Finally, transforming into a company that owns both taxi service and sales business so that Audi can profit in more ways. With the new digital system in this transforming plan, all these three recommendations will be realized. In addition, in order to be responsible for the environment and adapt to digitization, driverless technology and new energy vehicles are also very important.

To ensure that these measures can be realized, data will be collected legally through applications, mini-programs and vehicles equipped with digital systems. Subsequently, a reliable digital platform will process the data. Finally, the information will be used to guide future production and other system improvement, and then enter a new round of data collection. With the implementation of this plan, Audi will first step in the initial stage of transformation with its old customers and solve the technical errors that may be encountered in various digital links. In the mid-term, the data volume will show
an increasing trend because of the arrival of new customers. Finally, Audi will realize the digital transformation of its products and services, stabilize its profits, and make good use of data to be ready for all possibilities in the future.

3. The new digital system for FAW Audi

One of the important parts of digital transformation is designing a new sales model. It will be a new model that includes enterprise resource planning (ERP) plus an e-commerce platform and customer relationship management (CRM) system. In the past, the information system of a traditional automobile factory mainly consists of a dealership management system (DMS) at the dealership end, an ERP core system, a vehicle development product lifecycle management (PLM) system, manufacturing execution system (MES) at the depot end, and an supply chain management (SCM) system connected to the suppliers. The new digital system for Audi is inspired by Tesla which has a completely different business model from traditional car factories in the entire automotive industry. It has 3 main features:
- Direct online sales.
- Direct service to the customer.
- Continuous updating of the firmware version of the vehicle.

The system used by Tesla called Warp is a combination of an e-commerce system and back-end management software, fully customized and developed to support Tesla's unique car sales and servicing processes. Based on Tesla's model, the new FAW Audi digital model is shown in Fig. 1. Seen from the results, there are no agents in this model. Right now, the direct sales model is still the basis because the company is unable to collect comprehensive data without its support. This model focuses on data flows in different parts and it is made up of five essential components, which are:
- Production lines.
- Background system
- Database & processing algorithm
- Website & application and mini-programs
- Cars

![Fig. 1 New digital model for FAW Audi.](image-url)
also a very vital part of digital transformation since they are no longer traditional industry machines. A lot of digital technology is represented in the car like vehicle system and autopilot functions.

The arrows in Fig. 1 are all bi-directional which means data can exchange in any part of this model. At first, cars provide driving data. The website and application provide user data and customized model data. As all the data reaches the database, it will be processed and analyzed by processing algorithms, which include data analysis and deep learning. It is the most essential part of this model because there is no value in examining the data if it is not processed. Companies need to choose the right data analysis model for their own situation. For driving data, it is also important to use algorithms such as convolutional neutral networks (CNN), recurrent neuron network (RNN), and long short term memory network (LSTM) to improve the capability of autonomous driving. The processed data is then sent to the back office where decisions are made by the company's decision-makers. Finally, the commands are sent back to the vehicle in the form of software updates that enhance the vehicle's autonomous driving and other functions, and the decisions resulting from the processed data can upgrade the production lines to meet the user's vehicle requirements better. It is important to note that even with the new digital model, Audi does not need to redevelop all the specific models. For example, Audi can continue to use the existing PLM and MES systems.

4. Recommendations

4.1 Cutting Out the Middleman and Selling Directly

Whether the direct sales can be carried out depends on whether the customer can get enough information of the car and experience driving the car offline without contacting the middleman. It also depends on whether the customer's interest and demand information can be conveyed to the production line in a timely and appropriate manner, so as to ensure that there will be no overproduction, insufficient supply and other problems.

![Fig. 2 Traditional sales model & new sales model based on direct-sales model.](image_url)

Seen from Fig. 2, in the new sales model, 4S stores will be replaced by website, applications and mini-programs. FAW Audi's website will be comprehensive. It not only contain information directly related to the purchase of a car including the function introduction, the purchase website, etc., but also include all other information related to the car, i.e., current and upcoming car policies, car maintenance services, owners' forums, etc. The function of this page should be so comprehensive that new customers can find all possible questions before buying a car. While customers looking for information, the database will record these problems, process data, and upgrade the web page, so that similar problems will not bother customers in the future. In addition to web pages, targeted small programs are also an important way for customers to obtain information. At present, companies such as BMW and Mercedes Benz have begun to develop small programs, providing rich after-sales services, new cars' information, testing driving appointment, etc. These small programs have clear
functions, which can meet the needs of customers, FAW Audi will make it better and ensure that the customer has a full understanding of the car he wants.

As for the production line, due to the continuous collection of demand information in the database, the accurate analysis of the data processing system, and the prediction of the future demand for possible models and parts, the manufacturer will obtain the most direct demand data, and the discrepancy between production and actual demand will be gradually reduced. At present, not only FAW Audi, but also many automobile manufacturers delegate the task of conveying demand to 4S stores. After receiving the goods from the manufacturers, 4S stores are also responsible for sales. If the actual sales revenue is not as good as expected, they even need to pay the difference to the manufacturer. This kind of price opacity also causes dissatisfaction from consumers. With the help of the new digital system, manufacturers will no longer need 4S stores to make sacrifices to ensure that they do not lose money.

By implementing this digital direct sales mode, FAW Audi can reduce the publicity expenses and intermediate links, save human, material, and financial resources in the traditional circulation process [9], and thus reduce the money and time costs. By building a digital direct sales network, the production line can release the potential of the sinking market [10]. Directly facing the consumer group can also enable FAW Audi to master the market changes and the latest demand, which is conducive to the enterprise to improve production and research and develop marketable products to meet the changing needs of consumers. Moreover, under the direct selling mode, the company basically only needs to worry about the problem of supply exceeding demand. Many traditional debt problems will be avoided, which is conducive to the company's cash flow. In addition, under the direct-sale mode, it's necessary to pay attention to the collection and analysis of data to adjust the deployment of direct-sale stores in real time. Otherwise, too many direct stores will become a burden [11].

4.2 Developing Personal Customized Car Services

SAIC Maxus has practiced customization through the customer to manufacturer (C2M) model. According to its published data, there are 10616 customizable items in customer customization service. In the first half of 2019, SAIC Maxus produced 60641 vehicles and sold 62732 [12]. In 2017, the CLEVER SPIDER platform for customer was launched to realize direct connection with users. The user can freely select cars’ color, shape, configuration, etc. of the vehicle through the mobile application or website. Taking SAIC Maxus G50 as an example, this model provides consumers with up to 40 categories and 100 high perception configurations. Since CLEVER SPIDER was launched, there have been more than 1.21 million browsing users, with a total of 11.68 million visits. 30% of the users have chosen to freely match their cars through C2B mode [13]. Although customization has not yet become the mainstream, it has proved its potential.

As for the customization of FAW Audi, as illustrated in Fig. 3, website and mini-programs are still the main ways to obtain customers’ demand data. By taking apart the car's color, shape, hardware configuration and other elements, customers can choose the combination they want online. After receiving the order, the database will record the favorite proportion of each element, and send the
integrated order data directly to the manufacturer. Manufacturers do their production job according to orders so there will be no need to worry about overproduction at all.

Customization also has two important points, one is whether the customers could get exactly the same cars they customized online. The other is whether the supply of manufacturers can be kept stable. For the former, new energy vehicles equipped with intelligent systems will send performance data of various hardware of the cars in real time. After the database receiving the data, processing algorithm will analyze the overall situation of these customized vehicles and timely feed-back whether there is any abnormal combination of auto parts. Through a large number of simulation driving in the early stage, the malfunction problems can be eliminated in time, and the reliability of customized vehicles will be guaranteed. For the latter, the key is to keep manufacturers not in a passive situation of insufficient supply. On this basis, customization service will start with a few factors that can be customized including color, shape, functions of auto drive system, etc. In the initial stage of customization, it may only meet 30%~40% of customer needs, but as more and more driving information is fed back to the database by vehicles, the combinations that can be realized will become much more than before, and will gradually transition to all hardware, systems and models. All customers can enjoy customized services. This gradual process is very important to maintain the stability of the production line and avoid supply shortage. Customization gives car owners more freedom of choice. The customization data created by car owners can help improve the assembly line products after processing. Reduce production costs, increase revenue, and improve the competitiveness of the organization in the industry.

4.3 Transforming into a Company that Owns both Taxi Service and Sales Business

Audi can transform itself by adding more business to the company, i.e., from a single car sales company to an integrated organization combining sales and autonomous driving travel services. However, FAW Audi needs a transition period before driverless cars can take on the taxi business. As exhibited in Fig. 4, in the transitional period, taxi vehicles will still be driven by real drivers. The business model in this period is based on Uber. According to the research of Cramer, Judd, and Alan B. Krueger, Uber drivers' time utilization efficiency may be much higher than that of traditional taxi business. There are 4 main reasons: (i) Uber's more efficient driver-passenger matching technology; (ii) Uber's larger scale, which supports faster matches; (iii) inefficient taxi regulations; (iv) Uber's flexible labor supply model and surge pricing, which more closely match supply with demand throughout the day [14].

![Fig. 4 Starting taxi business.](image)

On the basis of Uber, FAW Audi can make some adjustments to adapt the plan to its own business. On the one hand, the taxi driver of FAW Audi will be Audi owner. FAW Audi has a huge user base in China who are all potential Audi taxi driver. By collecting and analyzing the automobile and environmental data of these Audi taxis, FAW Audi will get a lot of information, which is the foundation of self-driving taxi business in the future. After the taxi arrives at its destination, there will be a feedback and evaluation where drivers and customers can put forward their feelings or opinions.
as well. On the other hand, Audi has closer relationship with taxi owners than Uber. Audi cars equipped with intelligent systems can send basic information like location, vehicle and road condition information to the database. In other words, FAW Audi can deal with or even avoid many factors that may affect the quality of taxi service, e.g., detours caused by traffic, dangerous driving, and many other unexpected situations.

After the database has accumulated enough road conditions and vehicle driving information, users of FAW Audi can voluntarily upgrade their Audi cars and install automatic driving technology. While enjoying self-driving, car owners can also apply for taxi qualification for their autonomous vehicle through official websites, applications and small programs. When the vehicle is idle, the owner can set taxi time through the on-board vehicle system or online application. During the taxi time, others can book these cars online.

FAW Audi's self-driving taxis will have absolute advantages over traditional taxis. Under the operation of the on-board vehicle system, the information base stations in various regions and the FAW Audi data center, the driving information and road condition information will be updated in real time, which can not only discover the vehicles that may go wrong in advance, notify the owners to repair them, but also arrange the best driving route for taxis in their regions. Accidents, traffic jams and other problems caused by drivers and untimely updating of road condition information will be avoided, which will greatly improving the efficiency and safety of taxi.

FAW Audi will also be able to handle emergencies that may occur when customers are on the taxis, such as sudden illness. The large amount of data and experience accumulated in database can provide solutions for almost all emergencies. Passengers only need to speak their requirements to the vehicle, and the intelligent vehicle system will solve the problem. In addition, users can also contact emergency online customer service through vehicle microphone, taxi applications or small programs to clear about their needs. Staff will control the vehicle from the taxi center, select new lines, and solve the problems for passengers. In addition, FAW Audi can use its own taxi platform to cooperate with hotels, restaurants and other enterprises on online booking and other services, which can greatly enhance passengers’ dependence on Audi rental.

By starting taxi business, FAW Audi can retain old customers and attract new customers while undergoing digital transformation. Passengers' online feedback on the taxi experience can guide FAW Audi to improve its cars. Passengers taking a taxi can also be regarded as a test drive of the car, which will stimulate them to buy their own Audi vehicles. These will greatly improve the competitiveness of FAW Audi and broaden the profit ways.

5. Limitation & Outlooks

Nevertheless, it should be noted that there are some drawbacks and defects. First of all, the digital start of FAW Audi is relatively backward compared with Mercedes Benz, BMW and even SAIC Audi in China. Although FAW Audi still occupies a large market share and does not lack transformation funds, the slow decision-making caused by managers from different interest groups within the company may still bring direct resistance to Audi's digital transformation. Secondly, the current new energy vehicle market is still in the early stage of competition, many new technologies are yet to be developed, and the key technologies required for digital transformation such as intelligent vehicle systems and automatic driving are not ready as well. If FAW Audi wants to complete the digital transformation and gain market advantages, it must gain technical advantages. This is undoubtedly a big test for FAW Audi's decision on technical cooperation and FAW Audi's own R & D team. In addition, whether the management and cost problems brought by the scale-up of direct stores can be solved is also a difficult problem that many automobile enterprises which are adopting the direct-sales mode have not solved. Finally, taxis using automatic driving technology have brought a huge impact on the traditional taxi industry. Especially under the influence of COVID-19, the current economic situation is very poor, and the taxi industry cannot bear this huge industry change. In order
to ensure the stability of the economy, it is not likely for the government to vigorously support the development of self-driving taxis. However, although there are still many problems, FAW Audi still has a great chance to complete a successful digital transformation. The development of intelligent new energy vehicles has become the general direction of the entire automobile industry. At this very beginning, technical cooperation are more likely outweighs competition. FAW Audi can make use of its influence and financial advantages to widely purchase technology and cooperate with other teams, so as to obtain technical advantages. As for the development of driverless taxi business, since FAW Audi’s current business can still maintain the stability of the company, it will not be at a disadvantage or backward in this competition. In addition, although the development of FAW Audi in China is not as optimistic as before, under the management of Volkswagen Group, the overall competitiveness of Audi is still strong. Technical support from Audi in other countries will also help FAW Audi successfully complete the transition to digital transformation.

6. Conclusion

In a word, this plan will help FAW Audi achieve a more advanced digital transformation and regain its absolute competitiveness in the Chinese automobile market through three main aspects. Primarily, this scheme provides a new sales model based on the direct sales model and builds a new digital platform, which can adapt to the digital era of the automobile industry. Subsequently, this plan specifically points out how FAW Audi can achieve customization through digital systems. Finally, this plan also proposes the idea of driverless taxi business, which provides a way for FAW Audi to expand its market influence and business range. As FAW and Audi have not yet started these changes, many data and expected results are from other automobile enterprises, which may lead to some inevitable difference in FAW Audi’s case. In addition, as the traditional taxi industry is very large in China and closely related to the economy and people’s livelihood, the development of driverless taxis may obviously lag behind the other two digital transformation measures, affecting the integrity of this digital transformation plan. Overall, this digital transformation plan extensively refers to the development experience of Tesla, Uber, SAIC Maxus and other automobile enterprises and groups, conforms to the development trend of new energy vehicles and intelligent on-board technology. In addition, it makes rich assumptions about the possibility of digital transformation of traditional automobile enterprises, providing references for automobile enterprises that have not yet started or are relatively backward in digital transformation.

References


