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The Evolution of China's New Energy Vehicle Industry from the Perspective of a Technology–Market–Policy Framework

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Abstract: Since air pollution and energy safety have become two worldwide concerns, New Energy Vehicles (NEVs) are one of the solutions to solve these problems. China has been taking action toward the NEV industry and has been successful. This paper aims to explore the evolution of the Chinese NEV industry. By using a three-dimensional model of technology, market and policy, we collected the national level policies from three NEV developmental stages based on the market sales. We found three reasons for its rising up in China: first, the NEV technical road has been directed by both the government and the market; second, the market has periodicity, so the prospective policies have been set ahead; and third, the government has transformed its role on time. Based on the resource endowment the industry has now, we can draw some inferences on its further development in the longitudinal direction.

Keywords: new energy vehicle; technology–market–policy; development path

1. Introduction

From the United Nations (UN) Climate Change Conference held in November 2017, we could see that air pollution emissions have become a concern shared by major countries due to their serious effect on citizens' life quality [1]. According to data from the UN Framework Convention on Climate Change [2], the transport sector accounts for approximately 23% of the global total of man-made CO_2 emissions. Therefore, there is widespread agreement on the need to reduce CO_2 emissions due to transportation with the help of New Energy Vehicles (NEVs) [3,4]. Compared to traditional vehicles, NEVs have an advantage in energy conservation and environmental protection [5]. NEVs offer green and clean transportation, addressing social and environmental concerns by reducing air pollution to improve the environment [6,7]. Developing NEVs is generally proposed as one of the most effective ways to solve the problem of energy and the environment [8,9]. China produces the most CO_2 emissions in the world, and China also has the largest market room for Energy Vehicles (EVs) [10]. Since this paper uses a large number of acronyms, a list of acronyms is defined as shown in Table A1.

Large cities in China, such as Beijing, Shanghai and Guangzhou, have experienced frequent hazy weather because of the air pollution from vehicle emissions [11]. Data from the China National Environmental Monitoring Centre [12] show that Beijing experienced twelve days of heavy pollution and four days of severe pollution during the first half of 2017. Energy safety is another major factor responsible for the popularity of NEVs in China and one of the top priorities for China's national security [13–15]. Since China's dependence on oil imports in 2016 reached 65%, which is much higher than the 50% international security threshold [16], it is necessary for China to develop new energy

vehicles. As a result, China strongly encouraged its NEV industry and obtained rapid growth from both the technology and market aspects. According to Wei Miao [17], the minister of the Ministry of Industry and Information Technology (MITT) of the People's Republic of China, the level of the battery technology in the Battery Electric Vehicle (BEV) field of China has caught up to the international level. Also, China has now become the largest market for NEVs. The NEV industry will continue to grow rapidly in the coming decades and NEVs will dominate the Chinese vehicle market by around 2050 [18]. As shown in Figure 1, 50.40% of the global NEV volume was sold in China in 2017. In 2017, new energy vehicle sales reached 1.621 million units globally, a year-on-year increase of 77.2%, accounting for 1.7% of total global vehicle sales. From the perspective of global sales of new energy vehicles, the largest proportion is China and the United States, accounting for 50.4% and 17.3% respectively, as shown in Figure 1.

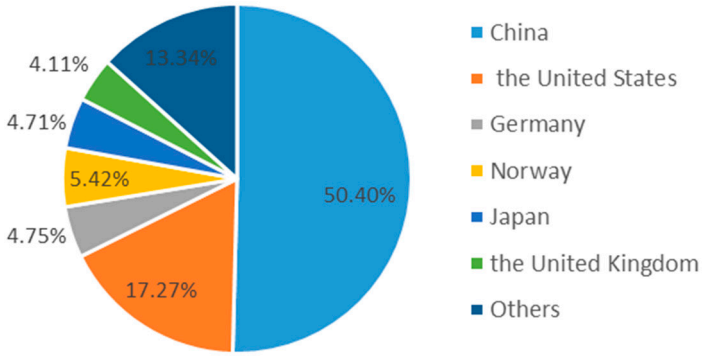


Figure 1. The global new energy vehicle sales share in 2017. Sources: Internal Energy Agency and Huajin Securities Research Institute.

The increase of China's NEVs over 2016 was 250,000 units, or 72%, which is over 30 times faster than the market as a whole [19]. The boom is even more impressive when considering that central NEV subsidies were reduced by 20% and local subsidies were cut in half compared to 2016. So, why does the NEV industry in China stand out from the rest of the world? What kinds of elements have led to the success of Chinese NEV technical roads?

Traditionally, the market has always dominated the direction of a technical road, however, the technology and market trends in China are similar to those of other countries who are also active in the NEV industry. In the technology aspect, although there are some multistage differences in the time for Hybrid Electric Vehicles (HEVs) and plug-in HEVs (PHEVs) between China and other countries, such as the U.S. and Brazil, they have all experienced a process from vehicles with an Internal Combustion Engine (ICE) to HEVs to PHEVs, and then from PHEVs to BEVs [20]. As described in their future plan [21,22], the technical route will continue to change from BEVs to fuel cells vehicles (FCVs). In the market aspect, China started to develop NEVs in 2001, while, in contrast, Europe and the U.S. started in the last century [23]. At the end of 2015, China's NEV sales total was 497,000, more than anywhere else in the world [24]. In just six years' time, China ascended from almost zero NEVs to being the first country with NEVs on the road.

Nevertheless, it is obvious that the policy in China has its specificity; a large number of government incentives has played an important role in this process [25,26]. China has taken government procurement and demonstration from within 25 cities [27], while Brazil has not done this [28]. This policy led NEVs to spread broadly in China, creating an advantage towards their sale [29]. Less-established automobile manufacturing countries, such as Norway, tend to use direct subsidies in sales and diffusion. Meanwhile, countries with an established automotive industry, such as Germany, are subsidizing R&D and structuring a niche market to improve the technical performance of NEVs [30]. The Japanese government introduced an eco-car promotion policy that included tax reductions and monetary subsidies as a part of its financial year (FY) 2009 tax reform legislation. Comparing the sales situation before and after 2009, it is apparent that both oil and vehicle prices play important roles

in the choice-making processes of consumers [31]. Besides this, the policy in China is more varied than it is in the U.S. For instance, in the technical support aspect, China built a technical platform for three technologies [32]. However, in the U.S., the industry depended more on the customers' demand [33]. China's policies are much more diverse than those of other countries. This is due to China's government, who takes charge of the NEV technology [34]. This kind of political mobilization model has created huge revenues for the industry. In conclusion, we decided to analyze the NEV industry from mainly the political perspective in this article.

The formal studies on NEV policy mainly focus on the two-way interaction between two of the three aspects (technology, market, and policy), similar to how the customer demand determines the policy [15] and the decision role of technical efficiency to the market [35]. Little research concentrates on the whole of NEV development in China [36], which contains all three aspects. Relying on the three-dimensional model of technology, market and policy, this article will separate the development of Chinese NEVs into three different periods. Through observing the impetus for each period, we can easily figure out the reason why there was a boom in the Chinese NEV industry.

The remaining parts of the paper are organized as follows. First, we describe the analytical framework of "technology–market–policy" that we use to reveal why China's NEV industry has had a quick development, and collect the national-level policies. Next, we divide the development of China's NEV industry into three stages based on the market sales by using the "technology–market–policy" analysis framework. Finally, we discuss the implications of our study and conclude the paper.

2. Research Framework and Data Collection

2.1. Research Framework of "Technology–Market–Policy"

This article uses the research framework of "technology–market–policy" to analyze the evolution of China's NEV industry [37]. That is to say, the study will explore the factors affecting the growth of China's NEV industry from the three dimensions of "technology–market–policy" and identify the subdivision factors that will be used in each dimension, such as technological standards, investment in technology research and development, industrial investment, market demand, financial subsidies, demonstration projects, and industrial alliances. This model appeared first as a tool for analyzing China's LED (Light Emitting Diode) Standard Lighting Unit [37]. In its definition, the technology aspect is a critical element in the development of an industry because the speed of technology development determines the speed of the whole industry's development, and this aspect includes the technical choice and the road. The market demand usually works with the technology. The market aspect mainly focuses on the consumer demand and consumption structure. The policy aspect is an indirect intervention because it influences just the behavior of the market subjects by affecting the technology or the capital. Thus, it can offset the insufficiency of the market and guide the industry to a brighter future. Depending on the coordination between technology, market, and policy, we can figure out the ideal cross-point for the industry to implement its expanding strategy and then realize its elevation.

The policy in this model can be spilt into two fields: the administrational policy and the economic policy. This classification standard is drawn from the article written by Ma et al. in 2017 [38]. The administrational policy is for the manufacturers, with regulation and guidance on the supply aspect, which includes four specific rules, such as technical support, science and technology input, financing support, and information service. Inside it, the science and technology input is a direct fund to the automakers, while technique support means that the government builds a technical platform or system to support the development of NEV technology improved by the automakers. The economic policy makes NEVs more cost-effective through incentives towards the market. It also contains four aspects: government procurement, subsidization, preferential tax and demonstration.

Applying this model is related to the characteristics of the NEV industry. The NEV industry is an emerging industry with plenty of novel technologies and a nearly blank market, which means opportunities. However, it also has huge risks in the preliminary stage because its exploration of

technology requires a large amount of investment, possibly requiring direct and long-term government assistance. Also, the destination of those NEVs is being put into the market, satisfying the demand of the people. However, if these NEVs are going to replace ICE vehicles, which are more familiar to consumers, it will be harder for NEVs to be accepted. Therefore, the early development of NEVs still needs political support. Additionally, we need to consider technology, market, and policy by using a three-dimensional model when dealing with such a complex problem. This paper builds the framework of "technology–market–policy". This model has its adaptability towards the NEV industry because it takes into consideration both the supply and the demand side.

Besides this, we applied content analysis [28] as the study method to analyze the important central government documents selected at each stage in the following section. Content analysis is a specialized method for quantitative analysis of the content of the literature. Its purpose is to clarify or test the essential facts and trends in the literature and reveal the hidden information contained in the literature. It is actually a semi-quantitative research method. The basic method is to convert the text on the media, non-quantitative and exchange-valued information into quantitative data, and establish a meaningful category to break down the communication content and analyze it. Based on the policy classification standard we just set, we can divide those policies into two groups: the administrational policy and the economic policy, and compare them by counting the numbers. Therefore, we can give the results logically.

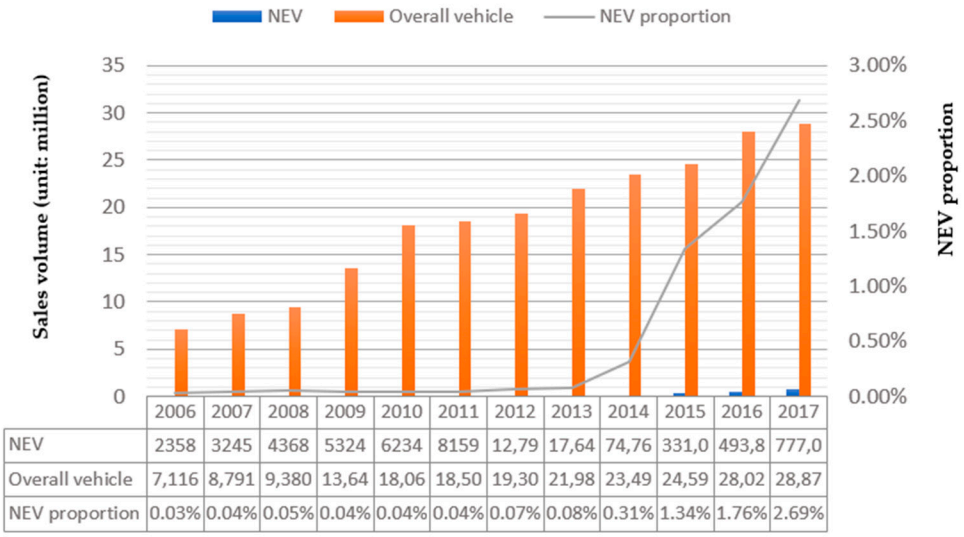
2.2. Data Collection

In this paper, there are patent numbers that come from the Patent Search and Analysis database, and energy vehicles sales volume data that come from the China Passenger Car Association. During our research, we found that many ministries and commissions had released policies to support the Chinese NEV industry. In this section, we used the information from different government agencies to find the impetus for each development stage and draw a conclusion on the developmental pattern of the NEV industry in China. Our selection of the policies depended on the following rules. First, the policy should be closely related to the NEV industry. Second, the chosen policy should be a national policy that was given by the central government directly. Third, the types of policies should contain only laws, plans, strategies and notations, and others should not be included. Fourth, we counted the time when the policy was established, not the time when it was still efficient. Thus, we could consider two aspects of the policy: influential and comprehensive. As a result, our collection was reasonable.

3. Results

3.1. The First Stage (2001–2007): Preliminary Stage

The first stage was from 2001 to 2007. The period we analyzed started in 2001, when the policy on the NEV industry began, and the first five years of NEV development focused on the researching and manufacturing stage, without actually being put into the market. Also, the economic policy being put into the private section started in 2006, and that gave motivation for customers to purchase NEVs. At this time, China put most of its energy into the Internal Combustion Engine Vehicles (ICEVs) field, and very little energy towards NEVs. Also, the NEV industry was experiencing its initial R&D stage, with the technological researching team mainly concentrated on improving PHEVs, and regarding BEVs and FCVs as supplemental [39]. As the market gradually opened under the guidance of the policy, the sales volume of NEVs was almost 3245 at the end of the period, as shown in Figure 2. However, the data on NEV sales were released in 2006, and that is why we used market data for 2006 to 2017.



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
NEV	2358	3245	4368	5324	6234	8159	12,79	17,64	74,76	331,0	493,8	777,0
Overall vehicle	7,116	8,791	9,380	13,64	18,06	18,50	19,30	21,98	23,49	24,59	28,02	28,87
NEV proportion	0.03%	0.04%	0.05%	0.04%	0.04%	0.04%	0.07%	0.08%	0.31%	1.34%	1.76%	2.69%

Figure 2. The new energy vehicle (NEV) sales trend from 2006 to 2017. Sources: electric vehicle (EV) sales and the China Passenger Car Association (CPCA) [40].

The technology in this paper could be separated into three segments: PHEVs, BEVs, and FCVs, based on the standard of the State Council [41]. On one hand, due to the severe situation of energy and the environment, the consumption of ICE technology is dropping. On the other hand, the rapid development of technologies is providing broadened sources for BEVs and FCVs. At present, the powertrain transformation process from fossil energy to electric energy is continuously being deepened [20]. From Figure 3, we can see the patent numbers of the three technologies increasing from 2001 to 2017, and there is also a technical trend that changes from PHEVs to BEVs and then on to FCVs. In addition, initially, patents were mainly for PHEVs; however, later, the focus was on BEVs, and their proportion increased and surpassed that of PHEVs.

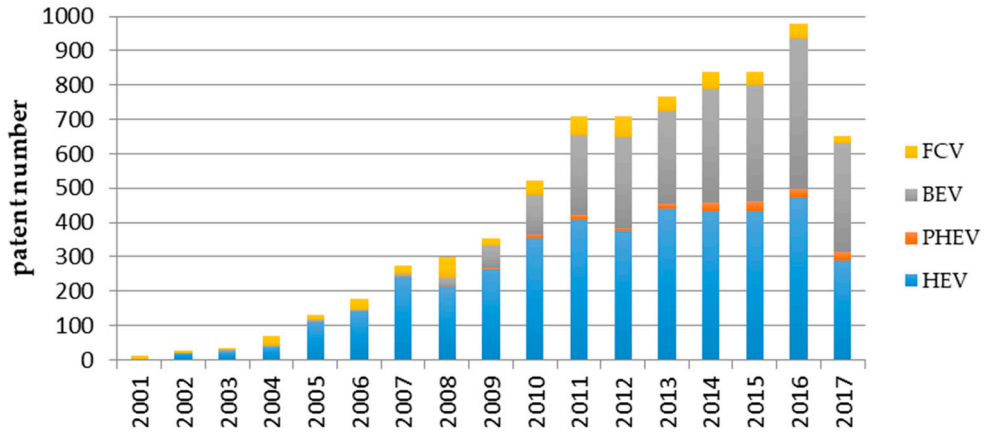


Figure 3. Patent numbers of the three technologies from 2001 to 2017. Source: Patent Search and Analysis of SIPO (State Intellectual Property Office (China)) [42].

During the first stage, several significant policies were published by the Ministry of Science and Technology of the People's Republic of China (MOST) and the Ministry of Finance of the People's Republic of China (MOF). The technology and science input towards NEVs started in 2001, and the signal was the 863 program. The 863 program or State High-Tech Development Plan [43] is a program funded and administered by the MOST, who intended to stimulate the development of advanced technologies in a wide range of fields. It set up a special fund of 0.88 billion yuan towards 12 fields, including electric vehicles. Then, under the guidance of the Tenth Five-Year Plan (2001) [44] by the State Council, China's "three verticals and three horizontals" plan came into being, representing

technical support. The plan was to build a technical platform used for gathering the emerging technologies. "Three verticals" refers to PHEVs, BEVs, and FCVs, while the "three horizontals" refers to the powertrain control system, the motor control system, and the battery management system. Also, the National Department of Reform Commission (NRDC) settled the production admittance of the NEV industry in 2007 [45] to help enterprises know about the information on market access and protect market subjects from information asymmetry. In conclusion, the technical support, science and technology input, and information service policies mentioned above can be summarized as the administrational policy.

At the same time, the Ministry of Finance of the People's Republic of China (MOF) reduced the consumer tax for NEVs in 2006 [46], and guaranteed Beijing as the first demonstration city of NEV operation in 2001 [47]. These policies could also be regarded as a preferential tax and demonstration, respectively, which could be classified as the economic policy.

3.2. The Second Stage (2008–2013): Rearing Stage

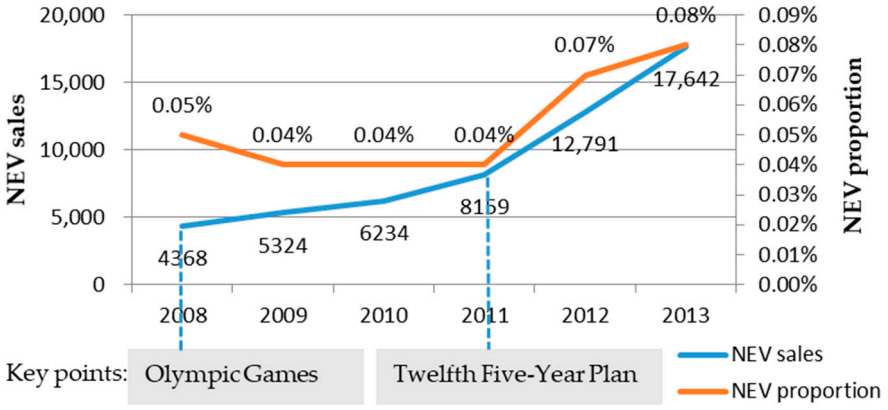
The second stage was from 2008 to 2013. During this stage, PHEVs flourished and BEVs were gradually elevated. Also, as shown in Figure 3, the market witnessed the Olympic Games as a turning point with the cooperation of the government, which intended to industrialize NEVs gradually. From Figure 2, we can see that there were turning points in 2008 and 2014. In 2008, the NEV proportion reached 0.05%; this is a 20% increase compared to the previous year. In 2008, the financial crisis occurred, which caused the oil prices to go up and severely affected the energy safety of many countries, including China, making NEVs an emerging trend [48]. Also, the Olympic Games held in China used 595 NEVs to serve different venues, which made NEVs a hot point of that year, and thus motivated an increase in sales. Besides, the Ministry of Industry and Information Technology of the People's Republic of China put BYD (BYD Auto Co., Ltd.) company's double mode NEV into the NO.179 set on the vehicle manufacturers list in that same year [49]; this signified that the first Chinese domestic NEV had received the authority to mass produce and come onto the market [50].

In order to industrialize NEVs, the government in 2009 arranged 10 billion yuan to support NEV techniques and several significant components [51]. Also, in the same year, the government provided financing support to the whole industry, putting 20 billion yuan as a national discount loan to be an incentive for the improvement of technology [52]. In commerce for the Twelfth Five-Year Plan (2011) [53] led by the NRDC, NEV techniques were separated into three major technologies (the powertrain control system, the motor control system, and the battery management system), vehicle integration technology (hybrid power, electric power, next-generation electric power), and public platform technology (technical regulations, basic infrastructure, and testing and evaluation technology). As we saw, the technical support and science and technology input remained during this period, adding financing support to the administrational policy.

At the same time, the government procurement policy from both the central and local government increased the motivation towards purchasing NEVs. For instance, Chongqing first procured 10 PHEVs as government cars at the end of 2008 from CHANA (Chang' an Automobile (Group) Co., Ltd.), who is a famous vehicle manufacturer in China [54]. Later, the Ministry of Industry and Information Technology of the People's Republic of China (MIIT) assumed that it would encourage applications for NEVs as government cars at a national level [55]. In 2009, the strategy called "ten cities and thousand vehicles" was demonstrated by the NRDC, MOST, MOF, and MIIT, indicating that, in the next three years, 10 project cities with 1000 NEVs would be developed per year. The program would spread in public fields, such as in public transportation, taxi, government car, and post fields [56]. In the same year, the MOF and the MOST decided to take the project to 13 cities, including Beijing, Shanghai, Chongqing, Changchun, Dalian, Hangzhou, Jinan, Wuhan, Shenzhen, Hefei, Changsha, Kunming, and Nanchang. The subsidization of NEVs began in 2009. Depending on the rate of economizing petrol and the maximum electric power ratio, the MOF settled different standards for PHEVs, BEVs, and FCVs. In the light passenger car section, since BEVs and FCVs are both pure electric vehicles, they can

reach 100% for economizing petrol. Therefore, the subsidies to them are 60,000 and 250,000 yuan per car, respectively, which is the top two compared to others [57]. In 2011, because of the exemption of the vehicle and vessel tax, BEVs, FCVs, and PHEVs could obtain benefits [58,59]. As a result, as shown in Figure 4, we can conclude that the economic policy had a boom in the demonstration, subsidization, preferential tax, and government procurement aspects.

From the collected data and the article written by Li and Zhan in 2017 [50], we concluded that, in the second phase, the economic policy dominated the industrial trend.



(**a**)

Economic policy:	Administrational policy:
(1) 2008, 2009 government procurement	(1) 2009 technology and science input; financial support
(2) 2009 thousands of vehicles in ten cities	(2) 2011 technical support
(3) 2009, 2010 subsidization	
(4) 2011 vehicle and vessel tax exemption	

(**b**)

Figure 4. The NEV proportion trend from 2008 to 2013 with some major events (unit: vehicle); (**a**) the NEV proportion trend; (**b**), the economic policy and administrational policy in NEVs (Sources: National Department of Reform Commission (NRDC), Ministry of Industry and Information Technology of the People's Republic of China (MIIT), Ministry of Science and Technology of the People's Republic of China (MOST), and Ministry of Finance of the People's Republic of China (MOF).

3.3. The Third Stage (2014–2017): Growth Stage

The third stage began in 2014 and ended in 2017. During that time, the dominance of technology forms switched from PHEVs to BEVs due to the increase in status of BEVs. On one hand, the BEV technology increased and even surpassed that of PHEV, but on the other hand, some cities, such as Beijing and Shanghai, made PHEVs an exception from the subsidy list, which sped up the switch from PHEVs to BEVs.

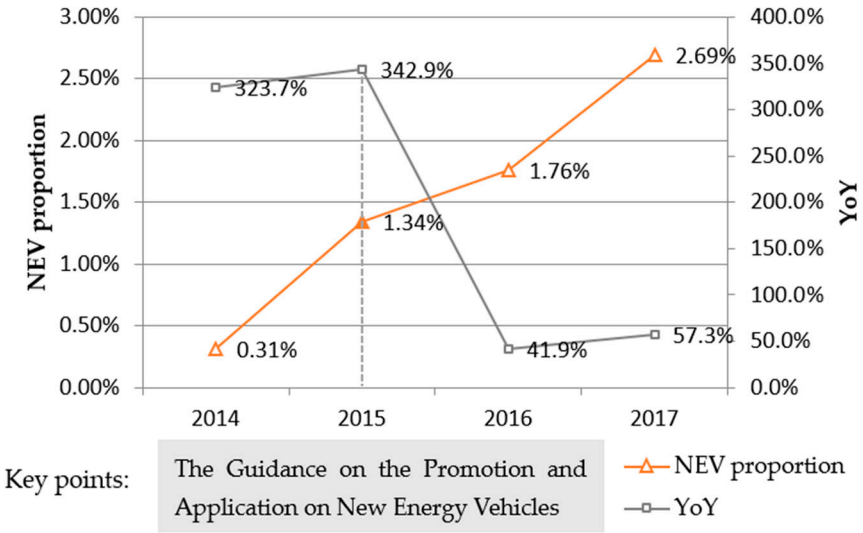
The market also tended to build a support system for NEVs with the help of policy. The main concern for accepting NEVs for customers is charging stations. After solving this problem with the help of the government, the market will come into its golden age. As shown in Figure 2, in 2014, the NEV sales growth rate reached 323%, and the proportion of NEV sales had grown to 0.31% from a negligible level. This is because the government set 16 policies in the NEV industry, which was booming at that time. After that, the market share of this industry has experienced a gradual increase. In conclusion, the time nodes were confirmed to be 2008 and 2014, and thus the period could be divided into the abovementioned three parts.

According to The Guidance on the Promotion and Application of New Energy Vehicles [60], six aspects of the future development of NEVs have been settled: building the charging infrastructure, guiding the innovation of the commercial mode, extending in the public service field first, improving the policy system, breaking local protectionism, and speeding up technology updates.

In 2014, the four commissions (including the NRDC, MOST, MOF, and MIIT) approved the statement that they were going to build a comprehensive technical system and industrial chain. By means of the 2015 national technical plan, the government needed to strengthen technical innovation as well as the supervision of the products' quality, and spend funds on several key technologies, such as energy storage in NEVs, the driving system, the information system, and the vehicle control system [61]. Then, in the following year, it set 15 core programs for hydrogen energy and fuel cell batteries [62]. In 2017, the double integration policy appeared [63], which improved from two policies in the U.S. and the Europe. Except for these, the government carded the whole industry, and provided more supporting infrastructures by rewarding the building of charging infrastructures, giving each hydrogen energy charging station 4 million yuan [64]. The NRDC also established a supporting price for the electricity used in charging stations in the same year [65]. It was not a unique instance, but had its counterpart in the construction of and investment in a distribution network in 2015 [66].

For the sake of the requirement of speeding up the after-sale service system to build and broaden market access, in 2014 the government encouraged the bringing of social capital into the NEV industry. Using such methods as a Public–Private Partnership (PPP), which leads the market to mix with the fiscal expenditure of the government, the financial support towards the NEV industry could be strengthened. Besides this, in 2015, the government also implemented some financing innovations. In the public section, they discovered the mode to operate a finance lease for NEVs; in the private section, they looked for new modes, such as timeshare rental, car sharing, and mortgage loans, to purchase NEVs. In 2016, the government paid attention to the green-credit policy [67].

Also, in 2015, information technology played an important role in the process according to Made in China 2025 [68]. In order to bring more convenience to customers, the MIIT gradually upgraded the application level for modern information technology in the NEV operation mode. By speeding up the application of smart power grids, mobile internet, the internet of things, and big data, the policy encouraged some Internet enterprises to join in the R&D of NEVs. Therefore, we can figure out that the administrational policy at this stage was composed of three branches: technical support, financing support, and an information service, as shown in Figure 5.



(**a**)

Figure 5. *Cont.*

Administrational policy:	Economic policy:
(1) 2014 2015 technical support	(1) 2014 tax exemption of purchasing
(2) 2014 financial support	(2) 2014 decline of subsidization
(3) 2015 information service	

(**b**)

Figure 5. The NEV proportion and Year-On-Year percentage (YoY) trend from 2014 to 2017 with some major events; (**a**) the NEV proportion and YoY trend; (**b**) the administrational policy and economic policy in NEVs (Sources: NRDC, MIIT, MOST, MOF).

However, the general decline in the subsidy began in 2014 [69], when the document from the MOF stated that the subsidy would be decreased by 5% from the 2013 level. During this time, the government applied a tax exemption in purchasing NEVs [70]. Thus, the economic policy was divided into two parts: declining subsidization and preferential tax, as shown in Figure 5.

4. Discussion and Conclusions

Based on the analysis above, we discuss implications for the future development of NEVs in the longitudinal direction.

Based on the resource endowment the industry now has, we can roughly infer some developments for NEVs in the future. According to The Technology Roadmap of Energy Efficient and New Energy Vehicles, it is estimated that the number of demonstration fuel cell vehicles in 2020, 2025, and 2030 will reach 5000, 50,000, and 1 million vehicles, respectively, which requires cooperation between personnel and foreign researchers. Under the background that the subsidy for NEVs is declining [71], many powerful NEV enterprises need to go abroad to find more commercial opportunities. Also, the medium and long-term plan for NEV companies is to elevate their market share as well as status in the world [72].

One of the leading enterprises is BYD. Based on its international strategy, the company's CEO (Chief Executive Officer) has said that it will build more factories overseas [73]. To date, BYD has achieved its international layout in Singapore, Japan, Australia, the United States, and the United Kingdom. Among them, the most famous achievement was the construction of the biggest electric bus factory in Lancaster, U.S. [74–78], because it quickly occupied the American electric bus market by relying on its advanced technology. Also, the complete basic infrastructure in the U.S. contributed to the success of BYD. In September 2016, the number of public charging stations in the U.S. reached 44,000 [79], and the number of private charging stations has been increasing as well (Tesla) [80]. Therefore, it is believed that BYD will make an international strategy based on its status in the domestic market, opening the overseas market and leading other NEV companies to go global.

We can summarize from the perspective of policy that the boom of the NEV industry in China has its own underlying reasons, which have something to do with technology, market and policy. No matter if it is the administrational policy or the economic policy, it could affect the technology road, the market sales, and the government's role. In addition, we can make suggestions for the next step of this industry.

This paper concludes with three reasons for why the NEV industry in China has grown quickly.

First, the selection of NEV technical roads is determined by both the government and the market. As we said before, the NEV industry has experienced a trend from PHEVs to BEVs. At first, the government implemented many administrational policies, such as the science and technology input and technical support, which aimed to encourage research in and the production of NEVs. The purpose for improving NEVs is to apply them in the market to deal with air pollution, and it was the right time for the economic policies to come into effect. For example, with the subsidization of NEVs in Beijing [81], the government said it would subsidize BEVs and FCVs, but not PHEVs. We cannot say that this local policy represented the view of the whole country. However, Beijing is an effective city

and this policy had an influence on other cities, so that it may have helped the technical road switch from PHEVs to BEVs.

Second, due to the periodicity of the market, the supporting policies should go along with the trend. The dominance of the industry changed between the market and the government. Also, the policy needs a period of time to come into play. Thus, what the government needs to do is set up several prospective policies that rely on market-oriented research. As a result, the policy set in the previous stage could better promote the development in the next stage.

Third, the role of the government has been well-transformed during the development process. Generally, the government establishes the policies. In the third phase, although the government reduced its subsidization of NEVs, the car ownership and market sales did not drop. As the NEV industry has now moved into a stable stage, the government could change its position from a partner to an environmentally friendly builder by supporting the building of charging infrastructures.

Author Contributions: The manuscript was approved by all authors for publication. P.Y., J.Z., and D.Y. conceived and designed the study; D.Y., X.L., and T.X. collected data; P.Y., J.Z., and D.Y. analyzed the data; P.Y. and J.Z. wrote the paper. J.Z., D.Y., and X.L. reviewed and edited the manuscript.

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Appendix A

Table A1. A list of acronyms defined in this paper.

Acronyms	Full Words
NEVs	New Energy Vehicles
EVs	Energy Vehicles
BEV	Battery Electric Vehicle
PHE	Plug in Hybrid Electric
PHEV	Plug in Hybrid Electric Vehicle
FCV	Fuel Cell Vehicle
ICE	Internal Combustion Engine
ICEV	Internal Combustion Engine Vehicle
MIIT	Ministry of Industry and Information Technology
MOST	Ministry of Science and Technology
MOF	Ministry of Finance of the People's Republic of China
NRDC	National Department of Reform Commission
BYD	BYD Auto Co., Ltd.

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