

Qu, Lu; Li, Yanwei

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Article

Research on Industrial Policy from the Perspective of Demand-Side Open Innovation—A Case Study of Shenzhen New Energy Vehicle Industry

Lu Qu ^{1,*} and Yanwei Li ²

¹ Publishing House of Electronics Industry, Beijing 100036, China

² National Computer Network Emergency Response Technical Team/Coordination Center of China, Beijing 100029, China; liyw@cert.org.cn

* Correspondence: qqmilu7@126.com

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Abstract: Nowadays, new energy vehicles play an important role in the transformation and upgrade of China's energy security, energy conservation and other industries. At present, there are 26 pilot cities for the demonstration of new energy vehicles in China; however, the operation effect and experience of the pilot cities have been summarized less. This paper takes Shenzhen's new energy vehicle industry policy as the object of research, in order to explore the impact of demand innovation on the development of new energy vehicles. This paper summarizes the three stages of Shenzhen's new energy vehicle industry promotion, and further analyzes the policy and market environments of each stage by using the demand-side innovation policy theory. By reflecting on the concept of policy design, this paper proposes that decision makers need to cultivate open innovative thinking, and transform their production-oriented policy design into a demand-oriented policy design. This conclusion is helpful for pilot cities in order to adjust their policies over time according to the different stages of industrial development, and further improve the innovation and competitiveness of China's new energy vehicle industry.

Keywords: innovation; new energy vehicles; demand-side innovation policy

1. Introduction

New energy vehicles shoulder the task of upgrading the industry and improving the overall level of the national vehicle manufacturing industry. Such products of science and technology innovation are also expected to alleviate the energy crisis and reduce urban pollution. In the process of promoting new energy vehicles in China, demonstration projects in pilot cities have played an active role in guiding the promotion of new energy vehicles throughout the country, which is inseparable from the introduction and application of relevant policies. This is a realistic example of the interaction between policy guidance and technological innovation. However, in the face of the new characteristics and requirements of scientific and technological innovation in the present era, has the existing policy system effectively promoted an innovative process?

Although China has given great support to new energy vehicles in the form of policy formulation and capital investment, the promotion effect has not been satisfactory, which can be seen in the production and sales of new energy vehicles. Figure 1 shows the production and marketing situation of new energy vehicles in China from 2009 to 2018 [1].

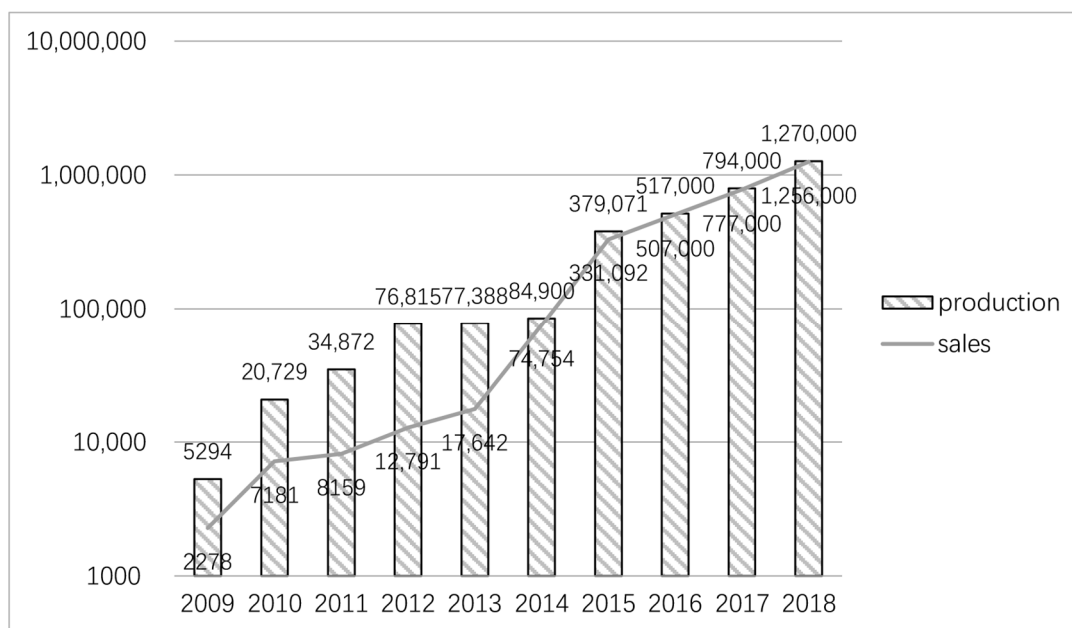


Figure 1. Production and marketing of new energy vehicles in China from 2009 to 2018.

There are two main problems in the implementation of current new energy vehicle policy. First, the market demand is small, and the new energy vehicles are mostly financed by the government or enterprises in the form of official purchases. Secondly, the technology has been poor, and in the context of mileage, safety and other aspects, remains at a relatively low level of priority.

The current industry policy cannot solve the imbalance of supply and demand with respect to new energy vehicles in China. Thus, a question arises as to what are the shortcomings of policy design? What adjustments need to be made? These problems require us to reflect on the concept behind industrial policy, based on the level of social needs, in order to propose practical policy recommendations.

Demand-side innovation policy provides a good theoretical basis to solve these problems. The theory of demand-side innovation began to have an impact in 1999 when Charles Edquist published “Systems of innovation: theory and policy for the demand side” [2]. Through the efforts of scholars, the demand-side innovation policy theory has matured, and has brought a lot of important results for research into innovation.

By combing the existing literature, it was found that although there are few summaries of demand-side innovation policies, the use of case studies and other methods of supporting the work remain scarce. More specifically, in the new energy vehicle industry, there are few relevant case studies. Few people reflect on the policy of the new energy vehicle industry from the perspective of social demand. As a policy close to the stage of industrialization and marketization, the demand-side innovation policy provides a new scheme for the management and evaluation of industrial policy. This paper attempts to apply demand-side innovation policy to solve the problems encountered in the promotion of new energy vehicles in Shenzhen. This paper analyzes the current situation of the development of Shenzhen new energy vehicle industry, user demand and the effect of policy implementation, focusing on the Shenzhen new energy vehicle industry using demand-side policy empirical research.

In the process of demonstration, this paper summarizes and analyzes the three stages of Shenzhen’s new energy vehicle industry promotion, which constitutes the bulk of the experience summary the demand-side policy of the pilot city. Through empirical research, this paper demonstrates the importance of demand and demand-side policy to the development of new industries and open innovation, thus enriching both the open innovation and demand-side theories.

Combined with the demand-side innovation policy analysis framework, the following conclusions are drawn: decision makers need to cultivate open innovative thinking. That is to adopt the innovative

elements such as social demand, adjust the policy over time according to the different stages of industrial development, coordinate the policies of the supply side and the demand side, and transform production-oriented policy design into a demand-oriented policy design.

This paper is organized as follows. Section 2 introduces the theory of demand-side innovation policy in detail through literature review. Section 3 introduces the experimental design and the method of data collection. Sections 4 and 5 analyze and reflect upon the case in detail. Finally, Section 6 presents the conclusion, analyzes the limitations, and summarizes the innovation.

2. Theoretical Introduction

In 1912, Schumpeter proposed in his book “Theory of Economic Development” that innovation was the introduction of a “new combination” of factors of production and conditions of production into the production system [3]. This involves five situations: the introduction of a new product, the introduction of a new method of production, the opening up of a new market, the acquisition of a new source of supply, and organizational innovation. Even though Schumpeter did not concretely mention technology and the market, he is the first scholar who clearly suggested economic evolution and dynamics [4].

In the 1970s, von Hippel and other scholars put forward the multi-source nature of innovation. They suggested that the innovation ability of enterprises depends on the ability of manufacturers to integrate with users and suppliers, as well as the ability to make use of the new national standards and regulations for innovation [5]. From the 1980s many scholars began to pay attention to the social factors of technological innovation and diffusion. In 1985, Peter F. Drucker published “Innovation and Entrepreneurship”, an expanded innovation extension [6]. Drucker proposed that innovation includes not only technological innovation but also social innovation. Social innovation emerges to meet a previously unmet demand due to the failure of markets, state and even civil society or to augment, transform and restructure the existing ways of meeting such needs [7]. From the content, social innovation includes political innovation, system innovation, organization innovation, life style innovation and so on. From the perspective of the subject, there are government-led innovations, innovations in business practices, innovations implemented by non-profit organizations, and innovations driven by citizens.

With an increase in the knowledge economy, the management and sustainable development of enterprises no longer depend on the traditional resources such as capital, natural resources and labor force, but rely more on the intellectual assets such as technological innovation and professional knowledge. In 2003, Professor Henry Chesbrough of the Harvard Business School proposed the concept of open innovation in his book “Open Innovation: The New Imperative for Creating and Profiting from Technology” [8]. Chesbrough believes that enterprises should change the original mechanical way of thinking in the innovation process and combine the external and internal technology into a system organically. Open innovation grows with technology openness the strategies of firms, complex adaptive systems, and market responses stimulated by technology innovations. The firms are main entities that make such evolution in the market as important autonomous agents in the whole innovation system. Open innovation can evolve and arrive at a dominant design, and often be locked-in according to a positive feedback loop. This might be provided by supply-side economies of scale and scope, demand-side economies of network, or by an open business model that affects both the supply and demand sides [9].

As opposed to closed innovation, in the open innovation model, innovation is no longer carried out in the traditional way, but developed into a global activity. It will absorb more innovative elements, through the sharing and reallocation of resources, to achieve the maximization of economic benefits and the ultimate goal of promoting technological re-innovation. According to the results of scholars, there are three main types of innovation with respect to dynamic models, which are technology-push, market-pull and policy incentive. The theoretical framework for the innovation process and policies

over the past century has been influenced by technology-push and market-pull innovation theories. This article will focus on the incentive effect of policy on innovation.

2.1. Matching Supply and Demand Forces

The question of demand is now receiving increasing attention. This is not to say that demand was not important in the past as the feedback linkages between supply and demand in the innovation process have always been critical. Rather, advances in new energy vehicle and increased user participation in the innovation process in some industries has accelerated the interaction between the two. Moreover, there is a growing understanding of the crucial role of demand. This section reviews the role of demand in the innovation process, describing the dynamics between demand and innovation.

Governments have long fostered innovation in firms by focusing on supply-side factors such as the formation of human capital and public investment in R&D (Research and Development), while the role of demand and markets in inducing innovation was taken as a given. Alfred Marshall pointed out that the ultimate regulator of all demands is consumers' demand, demand is crucial to innovation [10]. On the basis of the theory of production, factors and production cost, Marshall explains the law of supply and the relationship between changes in supply and price. Innovation policy can also be considered from two perspectives, namely: the supply-side and demand-side.

Supply-push theories stipulate that innovation is the essential force behind social and economic change [3] and that economic growth and productivity are driven by the knowledge output of a society. Accordingly, public policy should have as its main objective the increase of knowledge production and supply in order to accelerate knowledge spillovers and externalities [11]. An increased supply of funds, laboratories, researchers, discoveries and patents would thus translate into more innovations, sales, growth and jobs. Examples of technology or supply-push public policies are government-sponsored R&D, tax credits for companies to invest in R&D, enhanced capacities for knowledge exchange and support for education and training.

Demand-pull theories instead suggest that the ability to produce innovation is widespread and flexible, but often requires market opportunity. These theories focus not on the beginning of the innovation chain but on its end: the market place. Demand is thus the force that directs resources and capabilities for innovation in a certain direction to meet societal or market needs [12,13]. As a consequence, a demand-side policy approach focuses on boosting demand and on encouraging suppliers to meet expressed user needs. It also aims to reduce barriers to innovation and stimulate the emergence or the redesign of markets. Examples of demand-side innovation policies include: tax credits and rebates for consumers of new technologies, technology-oriented government procurement, technology mandates, and innovation-specific regulations and standards.

While both frameworks provide insight into how innovations occur, both have shortcomings; supply-push theories fail to account for the importance of markets for innovation, while demand-pull theories ignore the importance of supply conditions [14]. In fact, both supply-push and demand-pull forces help to achieve the successful introduction and diffusion of innovations. The recognition of the essential interaction between the two is reflected in the broader academic literature. For example, Mowery and Rosenberg [15] conclude that neither supply nor demand factors are sufficient for innovation. Both must exist simultaneously. Freeman surveyed a set of 40 innovations and showed success involved linking technical and market opportunities [16].

This implies that demand-side innovation policies need to complement supply-side measures (and not replace them) as innovation is the product of the creative interaction between supply and demand (Figure 2). A range of studies have argued that a major task for a systemic innovation policy is the organisation of information flow between users, consumers and others affected by innovations in order to articulate and communicate preferences and demand to the market [15,17].

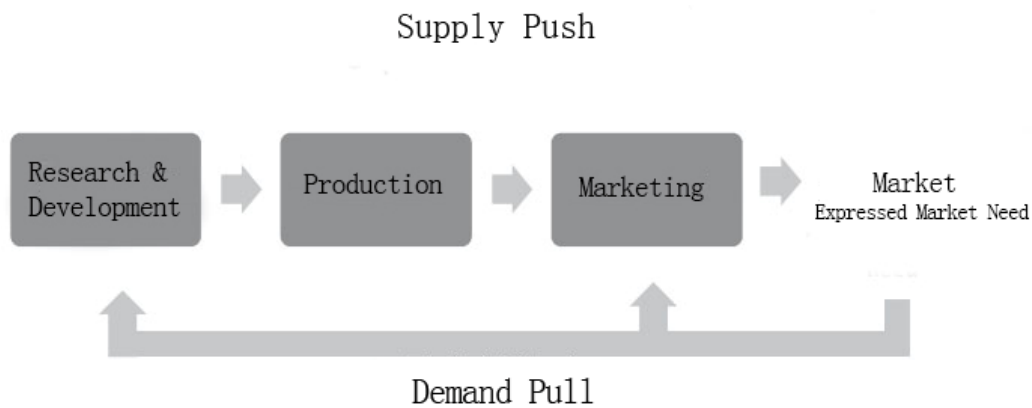


Figure 2. Matching supply-push with demand-pull forces.

Unlike general framework policies, demand-side innovation policies may be more suitable for sectors in which public and private demand-driven sectors are visible. According to the definition of Organization for Economic Cooperation and Development (OECD) [18], demand-side innovation policy is to stimulate the emergence of market or reconstruct new market by increasing the demand for innovation, improving the conditions for promoting innovation absorption, and improving the understanding of market demand. Its purpose is to accelerate the diffusion of innovation by creating a market environment conducive to innovation. In the fields of transportation, environment and energy supply, which have strong social demand, demand-side policies can effectively “pull” innovation.

Demand-side innovation policies take a variety of forms. In addition to general framework policies, targeted demand-side policies to foster innovation focus on a range of instruments that can help develop markets for innovative products and services. These include public procurement, regulations, standards, lead-market initiatives and consumer-oriented schemes (often based on tax measures).

2.2. Demand-Side Innovation Policy Instruments

2.2.1. Innovation-Friendly Public Procurement

Two levels of public procurement can be distinguished. First, there is regular public procurement, which occurs when public sector organisations buy ready-made products for which no R&D is required. In this case, public procurement can be made “innovation-friendly”. That is, it can be made more conducive to innovation. Innovation-related criteria can, for instance, be incorporated in the tender specifications and in the assessment of tender documents. Public procurement can be made more supportive of innovation for a vast number of products and services purchased by public authorities, from energy, transport, construction and catering services, to health products and equipment.

Secondly, public procurement can also be strategic, for instance when governments request specific technologies or services for the delivery of public services. This technology procurement is typically associated with sectoral policies and therefore is generally neither initiated nor coordinated by the ministries responsible for innovation. Ideally, the government predefines functional requirements of the products demanded.

Finally, there are cases in which the state buys not only to fulfill its own mission, but also to support private purchasers’ decision to buy. This catalytic procurement occurs for instance when the state is involved in the procurement, or even initiates it, but the purchased innovations are ultimately used by private end users. In order to ensure the wider social benefit of a specific procurement, the supplier firms must subsequently find buyers in the wider public or private market.

The rationale for using public procurement to support innovation is that, because of their purchasing power, governments shape innovation directly and indirectly. They can foster innovative activities within firms. Firms benefit because procurement can help them recover the sunk costs of large and sometimes risky investments over a pre-determined period of time. And by creating a

signalling effect as lead user they can influence the diffusion of innovation (the expectation of course is that an advance in innovation caused by procurement policies will translate into benefits for the domestic economy, rather than for overseas suppliers of innovative goods or services).

2.2.2. Technology-Oriented Regulations and Standards

Standards are documents based on various degrees of consensus which lay out rules, practices, metrics or conventions used in technology, trade and society at large. Standards can affect innovation and other economic outcomes through many routes.

Standardisation helps to create critical mass in the formative stages of a market. Standards can focus demand for innovations that might otherwise be spread over many technical solutions. Standards are especially important in network industries, in that they can facilitate the formation of a critical mass of users. In this connection, standards ease the emergence of technological platforms, independently supplied yet inter-operable components with shared technical standards. Many successful platforms, such as the Internet and the cellular telephone, are based on open standards. Swann provides a comprehensive review of the literature on standards [19,20], which includes evidence that successful standardisation enables innovation, acting as a barrier to undesirable outcomes. Blind summarises the catalytic effects of standards on innovation [21]:

Standardisation reduces the time to market of inventions, research results and innovative technologies.

Standards promote the diffusion of innovative products (important for the economic impact of innovations).

Standards level the playing field and therefore promote competition, and consequently innovation.

Standards are the basis for network industries: they facilitate the substitution of old technologies by new ones and allow the co-existence of old and new standards. Platform standards are the basis for innovation in upstream or downstream markets.

Standards reflect user needs and therefore promote the diffusion of new products by early adopters.

Standards set minimum requirements for environmental, health and safety aspects and promote trust in innovative products.

Taking into account standards and regulations is thus part of any successful firm's behaviour. Thus, well-designed objective-focused standards can offer businesses the scope they need to innovate and find new ways to reach the standard efficiently and effectively.

Unlike regulation, the setting of standards is mainly the responsibility of industry bodies with the government acting as a facilitator or coordinator. The public sector's role largely involves measures to include under-represented groups in the process of developing standards, as the likelihood of negative effects of standards, and the misuse of standards by specific stakeholders, can be reduced if the standardisation process follows the principles of openness, transparency and consensus. The public sector also supports the process of preparing standards, notably international standards. Finally, standards can also be used by the public sector in the context of public procurement, notably in tender specifications. The adoption of standards in procurement schemes can for instance be used by governments to diffuse innovations into the private sector.

Standards are a core element of the government's approach to supporting innovation. As noted in the Swann report [19], standardisation can "help to create a strong, open and well-organized technological infrastructure" in order to enable innovation-led growth. Standards can improve competitiveness by reducing costs in both manufacturing and service provision. They reduce uncertainty, i.e., providers of goods or services do not need to reinvent the specifications or performance criteria incorporated in the standard and can concentrate their resources on improving product and service quality, performance and safety in order to differentiate their products.

Both buyers and sellers benefit from the shared information conveyed by a standard. This transfer of knowledge can be useful to innovators who can then make improvements which can help them to enter and create markets. Indeed standardisation, together with collaborative research, licensing and the exchange of personnel can be an effective and efficient channel of knowledge transfer.

However, this channel has been neglected by many research institutions, companies and policy makers, especially research funding organisations.

The standard laws and regulations have the basic, comprehensive and strategic characteristics. New energy vehicle standards and regulations play an important role in supporting and regulating industrial development and promoting technological improvement and level upgrading of new energy vehicles. It also plays an important role in promoting scientific and technological innovation and industrial development in the field of new energy vehicles. It is of great significance to speed up the cultivation and development of new energy vehicles as a strategic emerging industry.

According to the Energy-saving and New Energy Automobile Industry Development Plan for 2012–2020 [22], in order to ensure the implementation of the plan, the first of the planned safeguard measures points out the need to “improve the standard system and access management system,” and requires that “the research and formulation of safety standards for new energy vehicles should be strengthened according to the needs of application, demonstration, and large-scale development”. Therefore, the improvement of new energy vehicle standards and regulations is an important condition to ensure the development of new energy vehicle industry.

2.2.3. A Leading Market with a Combination of Supply and Demand

Lead markets have received increased attention in recent years. Lead markets are those that take up innovations that eventually spread and are adopted in other markets, thereby changing the dynamics in lagging markets and fostering further competition and innovation. Once an innovation or technology has taken hold of a market, it can be characterised as operating in a “lead market”. A lead market can be thought of as a “new” market with the potential to expand geographically and to create above-average rents for firms. Lead users play an important role in “pulling” innovation: a lead market often originates in areas with demanding customers who are willing to pay for the innovation. Under certain circumstances public-sector actors are well placed to play the role of lead users by mobilizing common needs to create common demand [23] (as shown in Figure 3). The development of lead markets follows an S-pattern as users in other markets adopt the innovation.

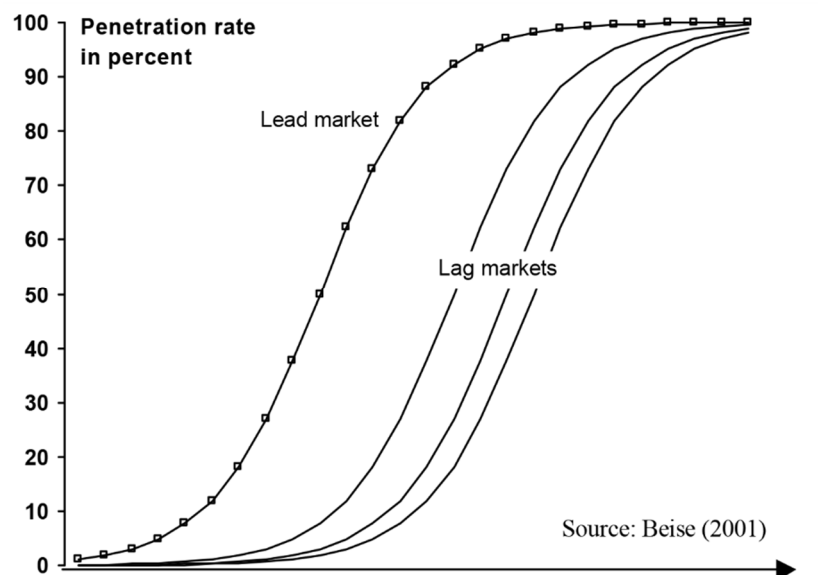


Figure 3. The international diffusion of an innovation design.

A key characteristic of a lead market is that uptake is not due solely to the technological superiority of an innovation, but also to the ability of market players—competitors, consumers and government regulations—to influence its adoption (e.g., via the price mechanism) and adoption in other markets, including in other countries. Initially, countries will present different innovation designs for a given

problem based on national conditions and the regulatory context. Depending on its lead or leverage imposed via a standard, for example, a country may be able to impose its technology or innovation on the global market. The transfer from one market to another however implies generic market requirements. The development of lead markets can help innovating firms achieve the critical mass and competitiveness needed to bring prices down and encourage further diffusion and adoption of the innovation.

The promotion of lead markets has received increased attention from OECD countries in recent years. If a country or region is able to impose its technology or innovation on the global market (for instance via a standard), its firms may capture above-average rents for a period of time.

There are well-known examples of lead markets, some of which have involved some degree of government intervention such as the development of the GSM (Global System for Mobile communications) mobile telephony standard in Europe which then was taken up in North America [24]. For the creation of a lead market, demand-side and supply-side measures are usually combined.

2.2.4. Consumer-Oriented Plan

Consumer Policies

Understanding the cultural, economic and social intricacies of different consumer markets and how certain products and service are constructed, particularly their mode of provision, manner of access and delivery, and the social context of their consumption, helps policymakers to understand how consumer preferences are shaped and how their needs are both expressed and met.

Regulation and standards are frequently used to channel social and cultural expectations into the process of introducing new goods and services. Information and awareness campaigns are also used to influence consumer preferences and behaviour. This can also translate into public pressure to introduce new regulations or to set certain standards and provide an opportunity for businesses to innovate.

Awareness-Raising Initiatives

Initiatives to promote education and awareness can help to improve transparency and assist consumers to develop the skills, knowledge and confidence needed to improve market outcomes, thereby increasing consumer welfare. In developing consumer awareness, information can be used not only to inform but also to influence consumer behaviour. This is an important policy instrument that can be used to counter inertia and skepticism with respect to new goods and services, and it helps to improve the flow of information between users and developers. To be effective, education and awareness strategies must go beyond addressing information asymmetries in individual transactions: they should help to promote critical and active engagement by consumers generally [25].

The key differences between an awareness campaign and an education initiative are the time frames in which each operates and the depth of knowledge each imparts. Awareness campaigns are generally short-term, media-oriented actions that focus on a particular consumer issue. Education initiatives, on the other hand, take a long-term approach, as the focus is on developing lasting skills and on bringing about changes in consumer behaviour [26]. Many education initiatives also make use of awareness campaigns as part of their strategies to improve decision-making capacity and promote more responsible behaviour, such as buying products that are more environmentally friendly.

3. Research Design and Data Collection

3.1. Research Method

This paper adopted the case study method. Case study is an important research method in management and organizational studies. The case study method is adopted in this research for the following reasons. First, the generalization method is a suitable way to study questions involving

“how”. One key point of this paper is to discuss how Shenzhen’s policies cultivate its new energy vehicle industry. Second, the analytic generalization principle from case to theory is suitable for exploring and explaining the research phenomena above. The phenomena of cultivation and the generalization of the new energy vehicle industry in Shenzhen are complex and multifaceted so it is hard to answer the above research questions using quantitative methods. Thirdly, the case study method is suitable for research aiming at an overall process. The popularization of new energy vehicles in this paper is featured with characteristics of the overall process.

3.2. Research Case Selection

This research selects new energy vehicle industry in Shenzhen as the case for the reason that it reflects the following three principles of case selection:

First of all, the case selection takes into account both importance and representativeness. In terms of lithium batteries and automotive electronics, Shenzhen’s technological advantages are outstanding. Shenzhen is the first pilot city in China for the demonstration and promotion of energy-saving and new-energy vehicles, and a pilot city for privately-purchased new energy vehicles. Since 2009, Shenzhen has taken the lead in the introduction of new energy vehicle industry-related promotion policies. Its new energy vehicle industry started earlier and developed rapidly in the pilot cities, and the measures and experiences are representative.

Secondly, the selection of research sample follows the principle of theoretical sampling. The choice of case is based on the need to fill existing theoretical gaps or develop new theories rather than statistical sampling. Demand-side innovation policy is an important topic of academic concern in recent years. Existing theoretical research focuses on the concept, characteristics, mechanisms and other aspects. However, the theoretical background is insufficient in the feedback relationship between supply and demand of innovation process from an evolutionary perspective. The research on the new energy vehicle industry in Shenzhen tries to discover how the communities of government, enterprises, consumers and so on participate in the innovation process to accelerate the interaction between demand and innovation. It helps to improve the demand-side innovation theory.

Thirdly, the case selection takes into account the consistency principle of theory and research object. The author participated in the field surveys and was impressed by the rapid development of the new energy vehicle industry in Shenzhen. Since 2004, Shenzhen has been promoting the development of the new energy vehicle industry. The data is abundant and relatively integrated.

3.3. Research Tactics and Data Collection

From the aspect of study tactics, this research followed a standard case study process: literature review, draft design and data collection, and data analysis. First, we collected and reviewed the literature of innovation theory and confirmed the research questions and targets. Second, in terms of draft design and data collection, this study is led by interview and observation, and is supplemented by documents and archives. In order to get the whole picture of practical activities of the Shenzhen new energy vehicle industry, interview outlines were designed. The study team conducted more than 30 formal and informal in-depth interviews with relevant departments and personnel from the production, service and consumption links. Interviewees included Development and Reform Commission of Shenzhen Municipality (DRC), Transport Commission of Shenzhen Municipality, BYD, Wuzhoulong Motors, Pengcheng EV Taxi Co., Ltd., Potevio New Energy (Shenzhen) Co., Ltd., taxi drivers and users. Thirdly, we use the demand-side innovation policy toolbox for analysis; the data was collected through government units, the Internet, published papers and books.

4. Case Research

Based on the above, we can summarize the demand-side innovation policy in Figure 4 and take the development of new energy vehicles in Shenzhen as an example for in-depth study.

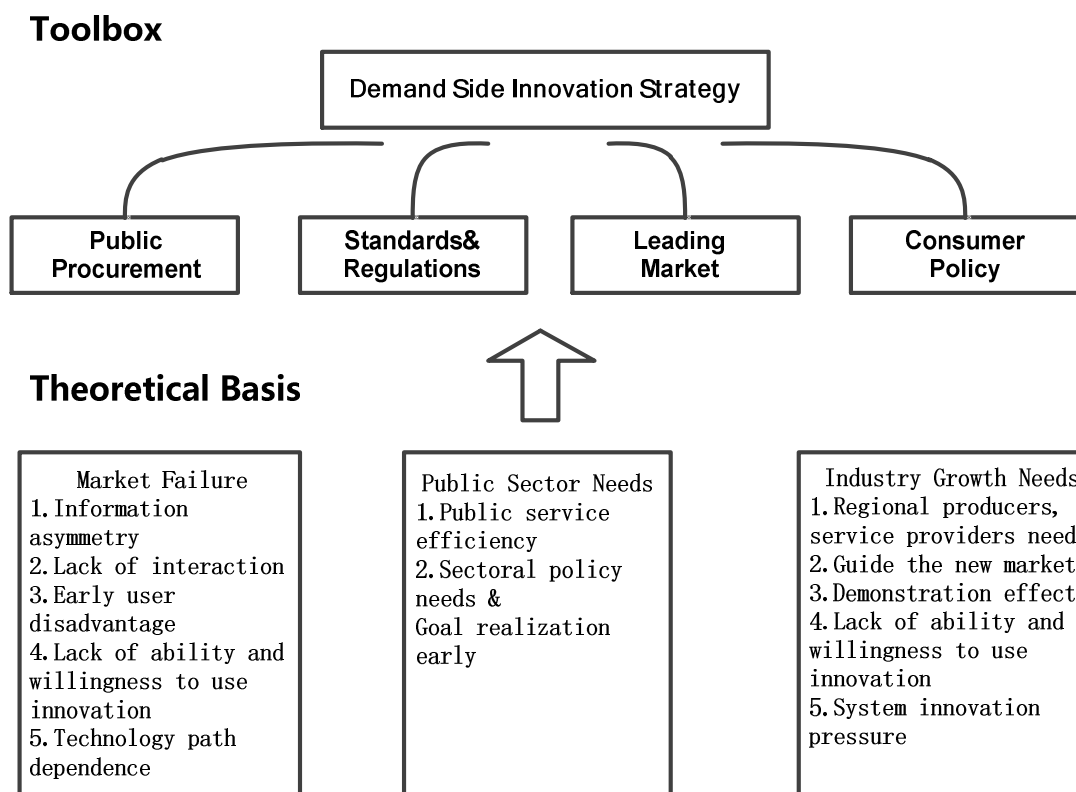


Figure 4. Demand-side innovation policy schematic map.

4.1. Development Process of New Energy Automobile Industry in Shenzhen

4.1.1. Supporting the Initial Stages of Supply-Side Policies (2004–2010)

In 2004, with the advantage of lithium battery and automotive electronics, Shenzhen began to develop the vehicle industry. In 2005, Shenzhen took on the new energy vehicle test subject of the national 863 plan and began to explore the development of new energy vehicles. Soon, Shenzhen opened its first hybrid bus demonstration line and put in the first batch of seven hybrid bus buses, with a total mileage of 2.84 million kilometers in three years. In 2009, Shenzhen became the first pilot city for demonstration and promotion of energy-saving and new energy vehicles, which began to be demonstrated and popularized in three major fields: public transport, public service and household vehicles. In the same year, Shenzhen’s Plan for the Revitalization and Development of the New Energy Vehicle Industry (2009–2015) was promulgated and implemented.

Just a few years, with the development of differentiation ideas, Shenzhen has formed BYD, Wuzhoulong Motors, Changan PSA Automobiles Co., Ltd. new energy vehicle base. Shenzhen has gradually become the leader of the domestic new energy automobile industry and has created a “Shenzhen model” for the development of automobile industry by means of government leading, industry leading and marketization.

4.1.2. Demonstration and Extension Stage of Supply and Demand Matching (2011–2013)

In March 2010, Shenzhen innovated the operation mode of electric taxi, established the first pure electric taxi company in China-Shenzhen Pengcheng EV Taxi Co., Ltd. In July 2010, Shenzhen 26th World University Games new energy vehicle demonstration operation project was approved by the Ministry of Science and Technology. On the eve of the Universiade held in June 2011, Shenzhen issued Demonstration Plan for New Energy Vehicles in the 26th World University Games, proposing to put in 2011 new energy vehicles during the Universiade. The demonstration made Shenzhen the largest city to use new energy vehicles in the country, and even the world. New energy vehicles put into the

Universiade accounted for more than half of the total demand for traffic vehicles. In total, 77 new energy public transport lines of the Universiade, covering all 44 competition venues, initially formed the urban new energy public transport network [27]. Shenzhen took advantage of the Universiade to set up the Potevio New Energy (Shenzhen) Co., Ltd. and Potevio-CNOOC New Energy Power Corp in order to strengthen infrastructure construction and improve the operating environment. During the Universiade, the promotion and application of new energy vehicles produced a cumulative carbon emission reduction of about 69,232 tons, saving about 22,493 tons of fuel (19,027 tons of diesel oil, 3466 tons of gasoline) [28]. This has effectively promoted the green low-carbon development, has brought the obvious energy saving and emission reduction effect, the urban environment obtains the good improvement.

In October 2011, The “Shenzhen City to build an international standard public transport city five-year implementation plan” [29] was issued, which clearly proposed the future of new and updated public transport vehicles are in principle using new energy buses. The new energy bus accounted for more than 50% of the total number of public transport vehicles in the city by 2015, and the construction of bus charging stations was promoted simultaneously.

In 2012, in order to play a role in promoting and applying new energy vehicles in the public transport industry, Shenzhen added 1000 pure electric buses and 500 pure electric taxis, bringing the total number of new energy vehicles to 3850. On 4 May 2013, 50 pure electric taxis were put into operation in Shenzhen, and opened a prologue of the demonstration of pure electric taxis.

By the end of December 2013, there were 6363 new energy vehicles in Shenzhen, including 3900 new energy vehicles, 73 charging stations and 3328 charging piles in the public transport industry [30]. Judging from the effect of demonstration application, new energy vehicles have achieved safe mileage of about 500 million kilometers, a carbon emission reduction of about 90,000 tons and fuel savings of about 30,000 tons. The safety mileage of hybrid bikes is about 350,000 km, while that of pure electric taxis is close to 500,000 km.

4.1.3. Large-Scale Demand-Driven Marketing Phase (2014 to Date)

Since 2014, the national policy has been introduced frequently, which clearly reflects the strong support attitude of our country to the new energy vehicle industry. In 2015, the “Working Plan for the Development of New Energy vehicles in Shenzhen and Some Policy Measures for the Promotion and Application of New Energy vehicles in Shenzhen” [31] were issued, as the Shenzhen Municipal Government proposed to purchase and use new energy vehicles and to offer a number of preferences. According to this policy, the proportion of subsidies for the local purchase of new energy vehicles is 1:1.

In the use of new energy vehicles, Shenzhen has also introduced innovative subsidies. In order to replace fuel taxi with pure electric taxi users, in addition to the purchase and use of pure electric passenger car subsidies, this policy will be extended to the application of subsidies of 55,800 yuan. According to regulations, subsidies for individuals and enterprises to purchase and use new energy passenger cars are mainly used in areas such as compulsory insurance premiums for motor vehicle traffic accidents, road and bridge fees, charging fees, self-use charging facilities and installation charges, etc.

In 2017, the “Operation Subsidy Measure for the Demonstration and Promotion Period of New Energy Buses” [32] was promulgated. The subsidy standard for new energy buses required to be put into operation in that year shall be appropriately lowered according to the actual purchase price paid by the enterprise. Compared with other cities, Shenzhen has shifted the development strategy of new energy vehicles from subsidies to the market. Shenzhen has also adjusted the charge service fee for electric vehicles and introduced preferential policies for pure electric logistics vehicles with new energy sources.

The above policies and measures, like a combination of punches, open the way for the promotion and application of new energy vehicles and the development of industry, making the development of new energy vehicles industry into the fast lane. By the end of 2018, Shenzhen had added 20,114 pure

electric taxis, with the pure electric rate reaching 93.85 percent. A total of 178 centralized charging stations were built, with about 40,000 charging piles. Shenzhen has since become one of the largest cities with respect to the application of new energy vehicles in China, with more than 220,000 new energy vehicles and the highest market acceptance, providing convenient green public transportation services for citizens to travel [33].

4.2. Policy Measures of Shenzhen New Energy Vehicle Industry

4.2.1. Choosing the Right Time for Policy Intervention

Generally speaking, the government plays the role of the driving force of new industries. The government chooses the right time to intervene, through the formulation of policies and mechanisms to promote the sustainable development of the industry and to enhance the competitiveness of the country. Therefore, in the industrial economy of the whole country, the development of new energy vehicles is naturally the inevitable choice of many governments.

In Shenzhen, the Development and Reform Commission of Shenzhen Municipality (DRC) has become the chief planner of, and advocate for the promotion of new energy vehicles. The DRC formulates corresponding policies according to the different emphases of stages of industrial development.

First, in the initial stage and demonstration stage, improve industrial policy. According to the “Planning for the Adjustment and Revitalization of the Automobile Industry” [34] and “Energy Saving and New Energy Automobile Industry Development Plan (2012–2020)” [22], the DRC compiled and implemented the “Demonstration and extension Scheme of Energy-saving and New Energy Automobile in Shenzhen (2009–2012)” [35], the “Construction Plan of New Energy bus Station in Shenzhen, and New Energy vehicle Public charging Facility Programme in Shenzhen (2009–2012)”, and the “Shenzhen New Energy vehicle Promotion and Application Plan for 2016–2020” which all strive to provide a good policy environment for the development of new energy vehicles in Shenzhen.

Second, formulate technical standards. In June 2010, the “Technical specification for charging system of electric vehicles in Shenzhen” [36] was implemented. This is the first vehicle charging technology standard in China, which will effectively break through the “bottleneck” of electric vehicle application and promote the rapid development of electric vehicle industry. The DRC has taken the lead in promulgating and implementing local technical specifications for charging facilities in China, which provides a universal and safe standard for the commercialization of charging facilities.

Thirdly, in the stage of large-scale market promotion, strengthen economic incentives. From 2009 to 2015, Shenzhen allocated 500 million yuan each year to support the development of new energy industry. In 2010, Shenzhen introduced the “Subsidy Policy for Private Purchase of New Energy Vehicles”, becoming the first of four ministries and commissions of the local new energy policy. According to the policy, on the basis of state government subsidies, Shenzhen added 30,000 yuan to dual-mode electric vehicles and 60,000 yuan to pure electric vehicles. This means that Shenzhen residents can enjoy a maximum subsidy of 80,000 yuan for a dual-model electric vehicle and a maximum of 120,000 yuan for a pure electric vehicle, which will be returned to consumers by enterprises at the point of sale in the form of a reduced price, and 5000 yuan in electric power subsidies to consumers. The introduction of Shenzhen’s new energy subsidy policy shows that Shenzhen’s policy has consciously shifted from the production side to the demand side.

4.2.2. Market Environment and the Behavior of Local Enterprises

Consummating the Supporting Services of Infrastructure

The industrialization of new energy vehicles cannot be separated from the matching and improvement of infrastructure. Infrastructure is an indispensable part of the new energy vehicle industry chain, and related supporting services (such as supplementary energy, vehicle maintenance, etc.) play an important role in the market promotion of the new energy vehicles. Whether the energy

can be replenished, whether it is convenient to replenish energy or not, and whether the supplementary energy is quick or not, will affect the choice of consumers.

The electric power supply of electric vehicles cannot be separated from charging stations, therefore, scientific and reasonable charging station construction is very important for the development of electric vehicles. The State Grid Corporation of China (SGCC) has vigorously promoted the construction of charging stations and charging piles in three stages. The first stage is the construction of 75 charging stations and 6209 charging piles in 27 provincial companies in 2009–2010, and the initial construction of a network of electric vehicle charging facilities. The second stage is 2011–2015, when the scale of electric vehicle charging stations has reached 4000. The third stage is 2016–2020, the electric vehicle charging station reaches 10,000, simultaneously carries out the charge pile complete set construction, completes the complete electric vehicle charging network, simultaneously promotes the construction of charging pile, forms the electric vehicle charging network preliminarily; the third stage is 2016–2020, the electric vehicle charging station reaches 10,000 [37]. In 2018, the “Notice on Speeding up the Construction of Rapid Charging Piles and Supporting Facilities for Taxis in Shenzhen” [38] was issued, which better meets the growing consumer demand of the citizens.

In addition, in order to meet the development needs of new energy vehicles, the Putian Offshore Oil New Energy Power Co., Ltd. was established in August 2009, dedicated to new energy vehicle batteries, vehicle systems, charging station construction and operation and other business areas. The company is committed to the new energy vehicle battery, vehicle system, charging station construction and operation and other business areas. Shenzhen Linengjia Power Station Co., Ltd. is focusing on consulting, design, investment, construction, operation and other services of the new energy vehicle charging network.

Innovative Operation Mode

With the cooperation and support of the Shenzhen Development and Reform Commission, Shenzhen has adopted the way of franchising, explores the mode of “combination of car and electricity separation, financing leasing, combination of charge and maintenance”. Through the introduction of professional operators to invest in, build and operate charging facilities, the new energy vehicles will be leased to public transport enterprises, which will pay rent to the operators. Bus companies are also required to pay energy service fees to professional operators to encourage time-sharing of electric cars and speed up the introduction of new energy vehicles.

The Shenzhen municipal government innovates the construction mode of charging stations and actively introduces social capital in order to participate in the construction of charging facilities. It signed a strategic cooperation framework agreement with Southern Power Grid and China Potevio on the construction of new energy bus charging facilities, introducing two major state-owned key enterprises to participate in the investment, construction and operation of new energy bus charging facilities by way of franchise. In order to meet the demand of new energy bus charging, according to the principles of “foundation first, station pile combination, reasonable layout, unified standard and convenient service”, Shenzhen has compiled and implemented the “Shenzhen New Energy bus Station Construction Plan for the near term”, speeding up the construction of charging stations through the installation of charging facilities and the provision of temporary land at existing bus stops. Now, Shenzhen has basically formed a combination of a fast charging and slow charging network, in order to meet the needs of the demonstration and promotion of new energy bus.

5. Reflection on Demand-Side Innovation Policy of New Energy Vehicle Industry

At present, the policy of new energy vehicle industry in China is focused on the supply side, and the policy design is production-oriented. Through the investigation, we find that the policy of new energy vehicle industry has the phenomenon of insufficient service side and lack of demand side. Therefore, it is very important to change the policy design from a production-oriented to demand-oriented nature. Only in this way can we make up for the market failure, optimize the

allocation of resources, give full play to the incentive effect of subsidy policy, and promote the development of the new energy vehicle industry in China.

5.1. Actively Develop Public Demand

As the biggest buyer of products and services in the market, the new market demand created by the government through procurement will affect the process of innovation to some extent. A well-designed public procurement scheme can effectively embed public procurement budgets into the high-risk research and development contracts and will generate long-term social benefits. In the "Implementation Plan for the Purchase of New Energy Vehicles by Government Agencies and Public Institutions" [39], four ministries and commissions clearly defined the timetable and road map for the "new energy" of government agencies and public institutions' official vehicles. No less than 30% of new energy vehicles required to be purchased are buses. In practice, however, this is difficult. In the actual investigation, some staff proposed the suggestion that "the local government has not completed the part of the total amount of the promotion of new energy vehicles, the central government will make up for it". Enterprises have the power to promote new energy vehicles only if they have profits, otherwise it will be difficult to work on a sustainable basis. Since the previous year's demand for the promotion of 20,000 cars did not reach the equilibrium point of economies of scale, if replaced with "the central authorities make up the unfinished parts of the localities," they could also fully mobilize the enthusiasm of all localities. There is a need to increase the general acceptance of procurement of innovations, notably by giving the findings of innovative solutions strategic priority. This can only be achieved by a political impetus and a strategic reorientation of relevant public institutions, since there are no market forces that would drive the ongoing transfer of innovative ideas into marketable products.

Combined purchasing by public entities not only allows for this exchange of information but is also a way to achieve positive scale effects and share risks.

A number of factors facilitate public procurement activities of new energy vehicles. Providing adequate resources, such as clear guidance, tools and support, can help clarify public agencies' scope for fostering and benefiting from public procurement of innovation. This involves providing documented examples of best practice, preparing sample documents, and providing tools for tasks such as calculation of lifecycle costs. In addition, the provision of resources should focus on priority areas with good potential for enhancing the levels of innovation. Also, efficient procurement processes (such as e-procurement) and structures facilitate the innovation orientation of public institutions; standardisation facilitates the preparation of specifications and the comparability of the required items. Focused communication between contracting entities and contractors is necessary to co-ordinate requirements with what is technically feasible. Further, reliable statistics on procurement processes and volumes are indispensable for monitoring the status of innovation orientation in public procurement. This includes estimates of contracting volumes by sector and task groups and institutionalising reporting in order to improve procurement practice and identify the potential for investment in future markets.

Finally, it is important to balance innovation goals against the need for competition, transparency and accountability in public procurement. As dominance by large players is a risk in public procurement, governments should take measures to ensure that this does not occur, by sourcing competitively from different firms and preventing discrimination against SMEs.

5.2. Fully Meet Private Needs

Compared with the good news in the field of public transport, the private buying market has been less upbeat. During the interview, automobile industry analyst Zhang pointed out that "At present, it is still difficult to promote vigorously in the private market. Compared with that, the promotion in the field of public transport is easier to achieve." A staff member of Shenzhen Wuzhoulong Motors also points out that in the context of the country's efforts to promote energy conservation and emission reduction, enterprises have launched new energy vehicles. However, compared with the private

market, the public transport sector has more advantages in reducing emissions and the extent of promotion. In this way, stimulating private sector buying demand has become a major priority in the promotion of new energy vehicles in the future.

5.2.1. Demand Subsidy

The price of the product is the first consideration for the consumer. However, because of the high cost, the price of new energy vehicles is also difficult to lower in the short term. A woman who is hesitant to buy a new energy car once said that “if you buy a new energy car with a mileage of more than 300 km, you will have to pay more than 100,000 yuan after deducting the relevant subsidies. But if you buy a conventional fuel car, there are plenty of good choices in the market at that price”. In Shenzhen, there are few customers who have money to buy like her. A 4S (Sale, Sparepart, Service, Survey) store sales manager once told us, “the new energy vehicle represented by pure electric vehicle is still a new thing compared with traditional fuel vehicles, and the price range of the main demand for passenger cars in China is between 80,000 and 180,000 yuan. If the consumer has 200,000 yuan, their first consideration is definitely not an electric car”. Influenced by traditional Chinese culture, consumers are not always willing to try new things.

At present, government subsidies are concentrated in the consumption link. Because of the heavy workload of the subsidy, the subsidy is given to the enterprise first. This is a big problem with subsidies. That is to say, the subsidy is not used on the blade, but is diluted by the whole car factory. The car factory used 60% of the money that should have been supplied to consumers. If the country wants to strengthen the subsidy of the consumption link, must consider to carry on the one-to-one subsidy to the consumer.

Today's government subsidies are the link to subsidizing consumption. The state strengthens the consumption link subsidy, such that if there is a desire to supply the consumer, costs must be considered on a one-on-one basis. At present, when subsidizing, because the workload is big, the first monetary subsidies are made to enterprises; this is a big problem of subsidies. The subsidy was not used on the blade and was diluted by the whole car factory. The subsidies originally given to consumers ended up with 60% of the subsidies taken by the automakers.

On the other hand, it is important to define the development mode and construction requirements of charging infrastructure, and to subsidize charging pile construction enterprises, to support the construction of charging facilities, and to improve the convenience of use. Whether in the field of public service or in the private sector of electric vehicles, public charging stations are essential, but the construction of charging stations in varying degrees restricts the sales of electric vehicles, because the land required to build stations is difficult.

First of all, urban planning cannot keep up with the development of the urban scale, the construction of station land is difficult to implement. In particular, new energy vehicles are new things for cities, often there is a need to build charging stations where there are no suitable sites for construction. For large and medium-sized cities, there is no need for public charging stations in the suburbs, and urban land is scarce. Some cities in the urban construction of charging stations are not as effective as the construction of parking lots. Some local governments give the charging station temporary land, valid for only two years, which is not conducive to long-term use, thus there is a great policy risk.

Secondly, the charging station construction approval process is complex, which is also a common problem. It is suggested that the construction of infrastructure be strengthened and that a scientific and reasonable layout for the construction scheme of charging facilities is formulated according to the characteristics and requirements of different types of electric vehicle.

For the electric vehicle charging facilities for private use, the convenience and economy should be fully considered, the scattered charging pile of parking space should be the main, and the centralized charging station should be taken as the auxiliary. In the area of land use and station construction subsidies, it is suggested that central and local governments should give more support to the construction of charging stations. It is suggested that charging facilities should be incorporated into the

urban and rural construction plan at the national level, and the status and role of charging facilities in urban and rural planning and construction should be clarified. Cities (including cities outside the pilot project) should be encouraged to incorporate charging facilities into the overall urban construction plan and to promote the construction of charging supporting facilities step by step. The construction of charging stations should also introduce market competition in order to solve the problems of land and profit models through the market mechanism. In addition, due to the need of planning, the demolition of charging stations built on temporary land should be properly compensated in terms of input equipment, infrastructure, and so on.

5.2.2. Training and Continuing Education

The needs, wants and preferences of users and consumers are becoming the key drivers of innovation. It is the absence of a market, or its low level of development, that leads to a lack of demand for products and innovations. In some cases, what may appear to be a lack of consumer demand for a product may be caused by a lack of understanding of a product or its functionality. Government therefore also plays a role in shaping the behaviour of consumers and thus affects private demand.

As consumers and users become catalysts for innovation, by creating demand and facilitating the diffusion of innovation, consumer policy is of growing importance. Consumer policy regimes and consumer education play a role in promoting innovation in key innovative markets and can help ensure that confident consumers make informed choices. Bottlenecks such as Internet fraud, a lack of consumer education or product safety risks can significantly slow innovation by negatively affecting demand.

Initiatives to promote education and awareness can help improve transparency and assist consumers to develop the skills, knowledge and confidence needed to improve market outcomes. Consumer policy and education can be used to counter inertia and skepticism towards new goods and services, and further help to improve the flow of information among firms and users. To be effective, education and awareness-raising strategies must go beyond addressing information asymmetries in individual transactions. They should also help promote critical and active engagement by consumers generally.

5.2.3. Add Demonstration Projects for Private Needs

It is a necessary prerequisite to promote the market of new energy vehicles to reduce the purchase threshold and use cost of new energy vehicles. To this end, local governments should be guided to issue the new energy vehicle anti-rolling number, auction, unlimited policies, and in charge prices, parking fees and other aspects of the introduction of preferential policies. On the one hand, in Beijing, Shanghai, Guangzhou, Guizhou and other cities where the purchase of vehicles, restrictions, the implementation of new energy vehicles anti-rolling number, non-shooting number, no restrictions on such policies as discrimination, in order to effectively guide consumers to buy new energy vehicles. On the other hand, it is suggested that new energy vehicles be charged at valley prices, that unified charging prices and charging methods for electric vehicles be prescribed, and that local governments be actively guided to issue preferential policies such as road tolls and parking fees in order to encourage the consumption of new energy vehicles in order to create a good environment for use.

At present, methods of "car sharing" and "timesharing" are highly respected in the new energy vehicle pilot cities, and good results have been obtained. It is of great significance for the promotion of new energy vehicles to excavate demonstration projects to meet private needs and to scale them up.

5.3. Influence Demand-Side by Regulation

5.3.1. Further Support the Product Standardization Process

Governments often support the standardisation process by encouraging self-regulation (norms, standards) on the part of firms, by monitoring or by moderating the standardisation process.

As big businesses are dominant in the standardisation process, there is a role for policy to engage a wider range of stakeholders, in particular the research community (researchers and innovators). The rapid pace of technological change also means that standards have a life cycle and that unnecessary and outdated standards should be removed or replaced as they may jeopardise beneficial economic effects. Furthermore, a common, unified and inclusive policy for standardisation is needed so that standards set by different agencies do not conflict or hinder each other.

In addition, in the planning process should be inclined to the demand side, and actively listen to the views of consumers so as to achieve the matching of supply and demand.

5.3.2. Evaluate the Reasonableness of Passing Regulations to Stimulate Innovation

In some sectors the anticipation of regulatory change has induced innovation. The impacts of regulation on innovation are likely to be highly technology- and industry-specific, so that, in order to assess the appropriateness of regulatory policy targeted at a specific sector, it is important to consider whether the market would introduce the right level of technology in the absence of regulation. Regulatory impact assessment can also help determine whether regulation is likely to achieve its objectives. Additionally, the cost-effectiveness of the measure also needs to be carefully evaluated *ex ante* as market-based instruments (for instance in the environmental sector) may be a more efficient way to meet expected policy goals.

The form that regulation takes will affect its impact on innovation. This is why regulations need to be clearly targeted to policy goals, sufficiently stringent to encourage an optimal level of innovation, stable enough to give investors adequate planning horizons, flexible enough to allow genuinely novel solutions and provide incentives for continuous innovation.

Taking the new energy vehicles as an example, the demand-side innovation policy seems to bear too much risk of government intervention, and its policy design and implementation also faces many challenges. Government departments are required to assume more important functions in promoting innovation, to consider more the reasons and opportunities for policy intervention, and to avoid the situation of “picking winners”. The development and implementation of policy incentives for a set of specific levels of technology should reflect varying degrees of technological maturity. For less mature technologies, more stable, low-risk incentives should be used to compensate for the cost competitive disadvantage.

For example, long-term protective electricity prices are more effective than subsidized costs.

5.3.3. Fostering Market Mechanisms and a Shared Vision with Industry and Stakeholders

As most demand-side innovation policies (e.g., regulation, standardisation, catalytic procurement and lead market initiatives) involve many actors—including industry, consumers and public authorities—developing a shared vision and policy objectives together with stakeholders is important for the success of these policies. A shared vision can help for assessing and projecting future spending and market conditions and reducing the risk inherent in innovation. It also makes policy initiatives more visible, an essential factor of success in the case of building market standards.

Public-private partnerships (PPPs) in particular can be an effective way to mobilise private and public demand for longer-term growth by bringing together the distinct advantages of the private and public sectors. For example, in Australia, the Green Car Fund uses competitive grants to foster PPPs to encourage research and innovation to help the Australian car industry take advantage of the shift to a low carbon economy. In the process of popularizing new energy vehicles, it is advisable to take this as a reference and gradually establish a market mechanism for public-private partnerships (PPPs).

5.4. Coordinate Production-Side and Demand-Side Policies

At present, our country is in the key period of perfecting the market economy, and the demand for scientific and technological innovation is getting higher and higher. Only by combining scientific research, commercial operation and financial capital, can the industrialization of products be realized.

Therefore, in the planned economy era, the idea of supply-side policy must be changed, and any separate use of demand-side and supply-side innovation policies is difficult to achieve results. According to the characteristics of different stages of industrial development, we should focus on the specific needs and specific links in the innovation chain, comprehensively utilize various policy tools, carry out different forms of innovation policy combinations, and eliminate obstacles that affect the expression of market demand or the absorption of innovation.

The transformation of new energy automobile technology results makes the new energy automobile industry gradually from infancy to maturity. With the development of technology, new energy vehicles will show the advantages of low resource consumption, low cost and high user recognition. New energy vehicles will gradually replace the traditional fuel vehicles and become the leading industry of the country. To realize the transition from new industry to leading industry, it is necessary to achieve large-scale economic benefits and obvious impetus to other industries, and the policy design has gradually shifted from the supply-side to the demand-side. The focus of supply-side policy at this stage is on finding the next generation of technologies. While the focus of demand-side policy is to continue to support industrial cultivation with financial input, it is also necessary to fully consider improving the efficiency of financial support, reducing intervention in market behavior, gradually reducing taxes, subsidies and other tendentious policies. In addition, it is also necessary to protect technological innovation and patent applications, regulate the market and maintain appropriate competition, as well as seek possible consumption hot spots in the future.

6. Conclusions and Further Prospects

Although the new energy vehicle is not a completely new thing, its promotion and development is faced with a new market environment. New energy vehicles are not only promoting social development, but also being shaped by social formation. The shaping of electric vehicle technology in society is evident in the form of many social factors related to new energy vehicles. Therefore, electric vehicle is a systematic technical system and social engineering system, and in the process of its development, electric vehicle is a kind of systematic technology system and social engineering system. It needs to be promoted by relevant social factors in many aspects.

Taking Shenzhen as an example, this paper analyzes the development course of Shenzhen's new energy vehicle industry, summarizes three stages of development and their characteristics, and analyzes the policy environment and market environment of each stage. The paper also reflects on the new energy vehicle industry from the perspective of demand-side innovation policy. The evolution characteristics of innovation ecosystem at the level of new energy vehicle industry in Shenzhen are explored. As the representative of electric vehicle pilot cities in China, the problems in Shenzhen are more prominent and representative. The promotion of electric vehicles involves the realization of social functions such as transportation and environmental protection. The process of successful diffusion of electric vehicles is the innovation process of replacing traditional fuel vehicles with new energy vehicles. In this process, the enterprise, the government and the market consumer are the key participants in the system. Only by the coordination of the three can the new energy vehicle be successfully popularized. At present, the policy support to the new energy vehicle industry is strong in our country, the output of the new energy vehicle increases rapidly, but the sale link mainly to the government procurement, the private market demand is insufficient. Aiming to resolve this problem, based on the theory of demand-side innovation, this paper deeply analyzes the problems existing in the current electric vehicle industry policy, and draws the following conclusions:

At the current stage of further developing the new energy vehicle market, policymakers need to cultivate the thinking of open innovation, and absorb more innovation elements. The current policy of the new energy vehicle industry should be adjusted from the perspective of the social needs of consumers, service providers and other stakeholders. It is also necessary to choose the right time for policy intervention.

In practice, the government should actively develop public demand and explore the diversity of public procurement, and management departments should directly or indirectly meet private demand by means of demand subsidies, demonstration projects and consumer education. Stakeholders, such as joint ventures, governments and market users, further improve the process of product standardization and foster market leadership. Finally, according to the different stages of industrial development, we should adjust the focus of the policy in time, coordinate the policies of the supply and demand sides, and transform production-oriented policy design into a more demand-oriented policy design.

In this paper, Shenzhen is selected for a case study, although typical, but the comparison between Shenzhen and other new energy vehicle pilot cities is not enough. In the future, more comparative studies of typical cities will be carried out. In addition to case interviews, a large sample of questionnaires will be used.

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