



Exploring the factors influencing public support willingness for banning gasoline vehicle sales policy: A grounded theory approach

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ABSTRACT

Banning gasoline vehicle sales policy (BGVSP) is considered a potentially important drivers for achieving carbon peak. This study, therefore, analyzed public support for such policies from the perspective of consumers. Using a grounded-theory approach, we developed a public-support model for BGVSP, on that basis, revealed the effects of the key elements and the theoretical logic. The results revealed: 1) Individual and psychological factors are important internal motivations, while the external driving factors include contextual factors and product factors. 2) The depth of individual perception is key to filling gaps in attitudes and behavior, and it plays an important role in improving public support. 3) The external contextual factors that affect consumer support mainly include external incentives, social influences, and urban contextual variables, which also play a moderating role in the integration model. The results show that the prohibition policy is easy to bring negative emotions, thereby causing public resistance, so the design of BGVSP should be based on the understanding of individual cognition, attitude and emotions. This paper constructs a model of the motivation of public support for China's localized BGVSP, and clarifies the core influencing factors and mechanisms, which provides fresh ideas for the realization of carbon peaking and carbon neutrality goals.

1. Introduction

Considering the threats excessive CO₂ emissions pose to the environment and human health, there is an urgent need for effective governance approaches [1–4]. Accordingly, the governments of various countries formulated the United Nations Framework Convention on Climate Change in 1992 and the Kyoto Protocol and the Paris Agreement were later adopted in 1997 and 2015, respectively, to limit carbon emissions and mitigate the harm caused by climate change [5–7]. China's carbon emissions have grown substantially from 2000, reaching 92.58×10^8 t in 2017, contributing for 27.3% of the global total carbon emissions [8–10]. Global warming is the result of long-term cumulative emissions. Historically, the level of cumulative carbon emissions per capita in the US has been eight times that of China. China, however, as the world's largest developing country, has become the largest emitter of carbon dioxide and has taken appropriate steps in response [11,12]. Since September 2020, President Xi Jinping has articulated China's

vision for achieving carbon peak and carbon neutrality, showing a strong commitment to tackling climate change [13].

As a cornerstone of economic development, the transportation sector is one of the main sources of carbon emissions [12]. In 2016, the transportation sector ranked among the world's highest carbon emitters, behind only manufacturing and electricity [14]. As of 2018, transportation was the world's second-largest emitter, accounting for 25% of total emissions [15]. It is urgent, therefore, to control transportation-related emissions, and without effective measures, global emissions from transportation are expected to double by 2100 [16]. For China, transportation is also a major contributor to emissions, accounting for nearly 10% of the national total, and with continuous growth in transportation demand, that sector faces increasing pressure to reduce emissions. Specifically, the compound growth rate of transportation-related emissions from 1990 to 2018 reached 8.3%, which is significantly higher than the global average [15].

Against the background of China's carbon peak and neutrality

Abbreviations: BGVSP, banning gasoline vehicle sales policy; GVs, gasoline vehicles; NEVs, new-energy vehicles.

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targets, the transportation industry, as a key contributor, faces great pressure to reduce emissions [17]. The electrification of transportation is an important measure for decarbonization. China has actively explored this field, proposing various ideas for the electrification of public transportation and for banning gasoline vehicle sales policy (BGVSP). The ban was first proposed by the Netherlands and is scheduled to be fully implemented in 2025, and since then there have been statements from countries that they will implement BGVSP [18]. The policy was developed to achieve long-term climate change mitigation goals while being effective in reducing CO₂ emissions. June 29, 2022, the EU-27 Environment Ministers' meeting adopted a resolution to ban the sale of gasoline vehicle, which means that gasoline vehicle will be banned throughout the EU in 2035.

Incremental vehicle electrification can significantly reduce the rate of carbon emissions in transportation while the electrification of stock gasoline vehicles (GVs) can directly reduce emissions. BGVSP could be a key driver for incremental vehicle electrification and the conversion of stock GV, which are important for helping the transportation industry to meet carbon peak and neutrality targets. The BGVSP directly affects the supply of GV, forcing consumers to buy new-energy vehicles (NEVs). This has a more significant effect on achieving the electrification of transportation in China and reducing emissions. Studies have found, however, that the negative public sentiment generated by such prohibitive policies can create resistance [19–21]. Therefore, when designing policies, policy makers should pay attention to not only the immediate effects of policy tools but also individual-level emotional responses to policy interventions.

The majority of BGVSP research has been on policy comparison, implementation resistance, and implementation plan design [22–24]. For Japan, banning the sale of fuel vehicles in 2035, including fossil-fueled ICE gasoline, diesel and natural gas vehicles, hybrid electric vehicles and plug-in hybrid electric vehicles, will significantly reduce CO₂ emissions [25]. In addition, for non-provincial provinces in China, the carbon emission reduction and health co-benefits of BGVSP vary greatly [26]. Although BGVSP will make an outstanding contribution to alleviating global carbon emissions, its impact on the economy and society should not be underestimated, taking the United States as an example, the implementation of this policy will bring an annual loss of 1.5 billion US dollars [27].

It is important to help traditional vehicle companies and the public smoothly through this transition stage. Bennett and Vijaygopal [28] used a questionnaire to study GV drivers' attitudes toward BGVSP in the UK; they suggested that before policy implementation, marketing activities focused on the health benefits of the policy should be conducted. In addition, Liu and Dong [24] and Li and Dong [29] study the decision-making behavior of the central government, local governments, car companies and consumers after the implementation of BGVSP in China. The timing of BGVSP implementation—which is a command-and-control means—needs to take public willingness and support into consideration [30]; however, research in this area remains immature. This study, therefore, used a grounded-theory approach employing open coding, axial coding, and selective coding to identify the factors affecting consumer attitudes toward BGVSP and build a motivation model for public support.

The marginal contribution is mainly to construct a model of the motivation of public support for China's localized BGVSP, and to clarify the core influencing factors and mechanisms. Specifically, 1) Based on interview data, an individual–psychological–contextual–product factors integration model was constructed for willingness to support BGVSP. We also revealed the logical relationships among the elements, providing a sound theoretical framework. 2) This study refined the mechanism of the important components related to consumer support, emphasizing the guiding function of psychological, contextual, and product factors, which provide a theoretical reference for research on the timing of BGVSP implementation. 3) The moderating effects of external situational factors (i.e., external motivation, social influence, and urban

contextual variables) in the motivation model were found to be conducive to revealing the process mechanism of individual support intention. The research architecture is shown in Fig. 1.

2. Methods, material, and analysis

2.1. Research methods

The lack of research on BGVSP has led to a lack of theory to explain both public support and timing. In this regard, case studies can provide rich, empirical descriptions to clarify the “how” and “why” questions, delineate the interconnectedness of ideas, and uncover logical relationships [31]. Meanwhile, grounded theory is a method based on empirical data that supports both flexible qualitative research and rigorous theoretical exploration, thus ensuring reliability and validity [32]. This study, therefore, used a multi-case approach based on grounded theory to investigate the drivers of public support for BGVSP and sort out the paths for improving such support.

Developed by Anselm Strauss and Barney Glaser, grounded theory is a qualitative research method for systematically investigating phenomena that has been characterized as “the most widely used explanatory framework for qualitative research at the end of the 20th century” [33]. The basic idea is to obtain information from natural contexts; develop a theoretical structure through data analysis, induction, and refinement; and form a deeper understanding of the subject. As a methodological trend originating in sociology, grounded theory has been used in a wide range of research fields, including education, management, political science, economics, psychology, communication science, library science, sports science, and medicine [34].

Therefore, this study mainly adopts the grounded theory technology, and constructs the theory of influencing factors of consumers' willingness to support BGVSP through three steps: open coding, axial coding and selective coding of text materials. In the process of data analysis, the analytical idea of constant comparison is adopted, and the theory is constantly refined and revised until theoretical saturation is reached (that is, the newly acquired data no longer contributes to the construction of the theory).

2.2. Material

The text materials were mainly obtained from semi-structured interviews designed to elicit information regarding respondents' motivations to support BGVSP. The majority of the interview materials came from clients of an automobile sales service shop. Firstly, developed a semi-structured interview framework by drawing on available literatures and referring to recommendations from relevant re-known experts. We arrived at the final formal interview framework by revising it based on the pre-survey results of three interviewers chosen at random.

To guarantee the venerability, we selected the customers of eight automobile brands as the interviewees, namely Mercedes-Benz, BMW, Toyota, BYD, Hyundai, Volkswagen, Ford and Chery, and interviewed a total of 54 customers who supported the BGVSP. Interviews are conducted in the form of face-to-face or video interviews for each interviewee. Each interview lasts for 20–30 min, and the interview period is from July to August 2021. The interview process is recorded, and the recording is converted into text after the interview. Meanwhile, Zhao and Han [34] showed that a sample size of around 50 is appropriate when using the grounded theory for research. The sample size researched in our paper fits into this category, and the basic profile of interviews is shown in Table 1.

2.3. Data analysis

2.3.1. Open coding

The open-coding stage involves labeling the collected information to define concepts and areas of discovery. The data were preliminarily

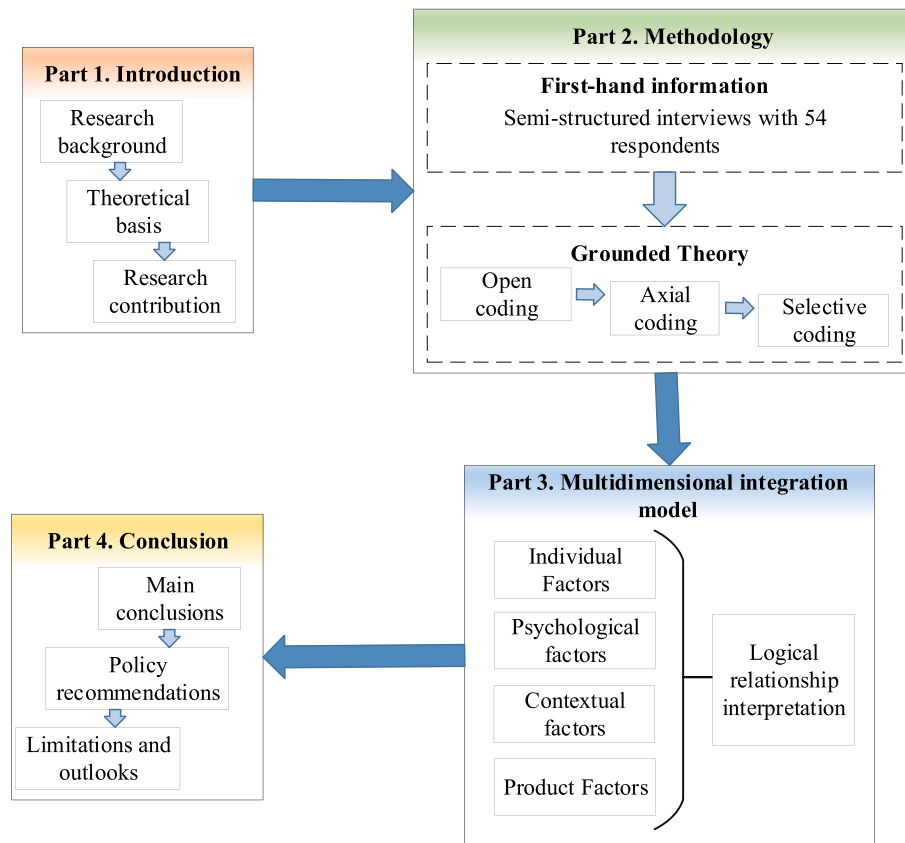


Fig. 1. The technical road-map for this study.

Table 1
Basic information on interview sample targets.

Indicate	Options	Frequency	Percentage
Gender	Male	23	43%
	Female	31	57%
Age	25–29 years old	17	31%
	30–35 years old	22	41%
	Over 35 years old	15	28%
Education	Bachelor degree or below	44	81%
	Master degree or above	10	19%
Family monthly earning	4001 to 8000 RMB	6	11%
	8001 to 12,000 RMB	17	31%
	12,001 to 16,000 RMB	20	37%
	1600 RMB or above	11	20%
Family size	2	3	6%
	3	20	37%
	4	23	43%
	5	8	15%
	Number of owned GVs	0	4
	1	41	76%
	2	7	13%
	3 or above	2	4%

sorted word by word, statements related to consumers’ motivation to support BGVSP were extracted and numbered, and there were 586 primitive statements received.

Three independent group-members labeled the primitive statements after they were transformed into brief phrases that expressed the reason for consumer support. Then, the labeling results were centrally compared and discussed, and similar statements are merged. This study uses NVivo 12 software reorganization to repeatedly summarize and refine the initial concept. In the categorization, the research team eliminated the initial concepts with a repetition frequency of less than 2 times, forming a total of 57 initial concepts.

Twenty subcategories were obtained through open coding, such as individual characteristics, family endowment, values, environmental perceptions, emotional motivation, social motivation, and so on.

2.3.2. Axial coding

Axial coding requires further clustering of the initial categories to establish logical connections between the categories and form a more systematic category. Thus, through the axial coding process, the 57 initial categories are classified according to the interrelationship and logical order of different categories at the conceptual level, and eight main categories were formed: “consumer attributes”, “subjective norms”, “behavioral motivations”, “consumer perceptions”, “external incentives”, “social influences”, “urban contexts” and “substitute attributes” 8 main categories. The corresponding sub-categories included in each main category are shown in Table 2.

2.3.3. Selective coding

In selective coding, the separate categories identified by the main axial coding are further analyzed and generalized to identify a core category and develop a story line that encompasses the entire category. And in the form of story line to depict behavioral phenomena and contextual conditions, after completing the story line, a new substantive theoretical framework is actually developed. Based on the steps taken to code in the prior phase, we defined 8 core categories that were collectively related to the motivation to support BGVSP.

Social psychology considers individual-psychological-contextual interaction as the cause of behavior [35]. However, the specificity of BGVSP makes the attributes of GV alternatives crucial to public support; therefore, product factors ought to be considered as a major dimension as well. Accordingly, the 8 core categories were further subdivided into multiple elements: individual factors, psychological factors, contextual factors, and product factors. We summarized the materials from

Table 2
The categorization process of influencing factors of public support for BGVSP.

Child node	Father node	Main category
Statistical characteristics Consumer demand Consumer preference Lifestyle	Individual Characteristics	Consumer Attributes
Family structure Parents' education Family earning	Family Endowment	
Green values Self-interested values Social-interested values	Values	Subjective Norms
Environmental self-identification Environmental awareness Environmental behaviors	Environmental Cognition	
Social responsibility Mission	Emotional Motivation	Behavioral Motivation
Social recognition Self-expression	Social Motivation	
Policy backgrounds Policy goals Policy results	Policy Cognition	Consumer Perception
Technology cognition Safety cognition Brand cognition	Substitute Cognition	
NEVs preferential NEVs driving Experience NEVs propaganda	Market Incentives	External Motivation
NEVs subsidy policy License plate lottery policy	Policy Incentives	
Descriptive norms Mandatory norms.	Social Norms	Social Influence
Peer Pressure Social relationships Social networks	Peer Pressure Social Capital	
Economic level Innovation degree Environmental protection input	Development Level	Urban Contextual
Air pollution Automobile exhaust pollution	Environmental Quality	
Geographical Climatic conditions	Geographic Conditions	
Charging time Infrastructure construction Free parking After-sales service Driving perception Autopilot	Use Perception	Substitute Attributes
Safety performance Battery life Acceleration performance Life of battery	Technical Level	
Acquisition cost Conversion cost Use cost Maintenance cost	Economy	
NEV appearance NEV interior NEV size	Appearance Characteristics	

semi-structured interview based on grounded theory. And a motivation model was constructed to investigate the factors that influence the public willingness to support BGVSP (See Fig. 2). Table 3 shows a typical relationship structure in this study.

2.3.4. New categories' testing

We used the five-interview data, reserved in advance, to conduct a new category test. The results indicated that the present categories were



Fig. 2. Theoretical model for the influencing factors of public support willingness.

already quite comprehensive and condensed, with no significant impact elements missing. Thus, the grounded theory-based analysis results of the previous section met the requirements for new-category testing.

3. Explanation of motivation model for public support for BGVSP

Through the previous analysis, it was found that the individual–psychological–contextual–product factors integration model can effectively explain the formation mechanism of consumers' willingness to support BGVSP. Specifically, the influencing factors that affect consumers' willingness to support can be summarized as individual factors, psychological factors, contextual factors, and product factors. However, the mechanism of action of each factor on this willingness is not consistent. The following will be analyzed in detail.

3.1. Individual factors

We found that personal characteristics and family endowment were the consumer attributes that influenced support for policy. These are key internal factors that were found to enhance support intention, and there was an internal causal relationship between consumer attributes and support intention.

Differences in individual characteristics—such as gender, age, and other statistical characteristics—are the main reasons for differences in responses under the same stimulus [36]. Consumers focused on green consumption tend to be more willing to support BGVSP. Thus, an inherent incentive to increase support for BGVSP is to enhance customer consciousness of energy conservation and environmental protection. Differences in consumer behavior characteristics also explain different attitudes toward BGVSP. Habitual consumption behaviors may cause consumers to prefer GVs to NEVs, making them resistant to BGVSP. For impulsive consumers, however, the cutting-edge technology aspect of NEVs makes them more attractive, and these consumers are therefore

Table 3
The typical relational structure of the main category.

Typical Relationship Structure	Connotation
individual factors → public support willingness	Individual factors are the internal factors that affect consumers' willingness to support BGVSP, which directly affects the public's willingness to support.
psychological factors → public support willingness	Psychological factors are the internal factors that affect consumers' willingness to support BGVSP, which directly affects the public's willingness to support.
contextual factors ↓ → psychological factors → public support willingness	Contextual factors are external conditions that affect consumers' willingness to support BGVSP, which affect the strength and direction of the relationship between psychological factors and public support willingness.
product factors ↓ → psychological factors → public support willingness	Product factors are external conditions that affect consumers' willingness to support BGVSP, which affect the strength and direction of the relationship between psychological factors and public support willingness.

more willing to support BGVSP than other types of consumers.

Family endowment is an important dimension of consumer characteristics. The influence of family structure and parents' education on support for BGVSP cannot be ignored. Family life-cycle theory proposes that there are five stages from the formation of family until death: single stage, newly married stage, full-nest stage, empty-nest stage, and widowed stage. People in different stages have different consumption needs, thus showing differences in behavioral intentions [37]. For example, *"My parents are both college students. They taught me to be grateful for the motherland and to compromise our individual rights and interests to policies that are beneficial to the country's development. Since the BGVSP is a policy to ease our country's development dilemma, I will definitely support it. " " I have a daughter who is young now, and my wife and I dare not take her on a long journey, so we can buy a NEV with enough space ... "*

3.2. Psychological factors

Consumers' psychological variables have been shown to play a significant role in the promotion of NEVs. Likewise, public support for BGVSP is also closely related to psychological factors. We found that subjective norms, behavioral motivation, and consumer cognition were the main psychological factors affecting consumer willingness to support BGVSP.

3.2.1. Subjective norms

The theory of planned behavior proposes that behavioral intentions are affected by attitudes, personal norms, and perceived behavior [38]. Similarly, norm activation theory suggests that personal norms are stimulated by factors such as the attribution of responsibility and awareness of consequences, thereby inspiring altruistic consumer behavior [39,40]. From the interview results, we found that consumers' subjective norms were closely related to their willingness to support BGVSP. By summarizing the initial categories extracted from open coding, the subjective norm factors were classified as values and environmental norms.

Respondents with different values showed different attitudes when faced with BGVSP. In particular, individuals with green concepts demonstrated a significant willingness to support BGVSP. Meanwhile, for those with pragmatic values, their support was more vulnerable to external factors. Therefore, willingness to adopt a green development

philosophy has a substantial impact on the moment at which the BGVSP is implemented. It is vital for achieving China's carbon peak and neutrality targets as well.

Since purchasing NEVs reflects a consumer behavior with a green development concept, it is essential to accurately estimate the effect of environmental cognition on BGVSP support [41,42]. Firstly, environmental consciousness is a consumer quality to promote more purchase of green goods [43]. Second, environmental self-identification is an outgrowth of environmental protection concept [44]. When consumers adopt the position of environmentalist, they will exhibit a variety of corresponding intents and actions [45]. Finally, for consumers who exhibit environmental behaviors, appealing to their pro-environmental attitude can increase their willingness to support BGVSP [46].

3.2.2. Behavioral motivation

Motivation is an internal state that drives people to achieve goals [47]. Consumer behavior is determined by the interaction of different motivations and decision-making processes, which relate different motivations to behavioral outcomes [48,49]. Supporting BGVSP is a pro-social altruistic behavior, and the main internal driving forces for adopting it include emotional and social motivation.

Understanding a consumer's tendency to accept a policy is a complicated matter, and emotional motivation is also a factor in the complex influence model. Driven by emotional motives, people will engage in prosocial behaviors in fulfillment of a sense of social responsibility and mission. Social responsibility plays a vital role in improving public pro-environmental behaviors [50]. Giving people a sense of responsibility encourages them to adopt altruistic behaviors, thus showing their willingness to support BGVSP. We found that, similar to Graham-Rowe et al. [51] in the US, a more socially responsible public is more inclined to purchase green products and support corresponding policies.

After physiological needs are met, people have further social needs for social recognition and self-expression. Social motivation encourages consumers to buy products and adopt behaviors that others consider desirable, thus gaining respect from others. Although consumers may be motivated by environmental awareness or by the attractive design to purchase a Tesla, for example, the behavior is still guided by the pursuit of identity [52]. Similarly, some consumers in this study who expressed support for BGVSP were motivated by social motivation. When people

are more socially motivated (e.g., people who buy NEVs to keep up with the times; people who like to share their ideas with others), they are more receptive to new ideas and technologies and thus more willing to support BGVSP [53].

3.2.3. Consumer perception

Consumer support for banning the sale of GVs derives from attitude theory; that is, attitude toward the policy determines whether consumers support it. That said, perceptions and emotions are the main components of consumer attitudes. The interview data in this study indicated that consumers' perceptions of BGVSP and NEVs were the main cognitive factors affecting support.

Policy cognition refers to the public's understanding of the specific content of a policy, which is an important factor affecting policy attitudes. The degree of policy awareness among potential consumers determines the efficacy of BGVSP implementation [54]. Rational behavior theory emphasizes the importance of individual attitudes in influencing their behavioral preferences. Therefore, consumers' cognitive depth regarding policy can be considered intimately associated with if they support BGVSP. Consumers tend to have short-sighted cognitive biases, which similarly applies to BGVSP [55,56]. When consumers' attention to and awareness of policy increase, their coordination with its implementation should increase accordingly. This study's interview results showed that consumers deconstructed the policy in the dimensions of policy background, goals, and results.

Consumers' perceptions of NEVs also affected their support for BGVSP. When consumers have only a vague concept of NEVs, which are a relatively recent technological innovation, lacking an in-depth understanding of NEVs' performance and advantages, consumers will have difficulty making decisions about buying them. Consumers' cognitive depth regarding NEVs is not only an important factor stimulating purchase intention but also the key to filling the "attitude-behavior gap." Consumers with a strong desire to buy NEVs are more inclined to purchase them, so their resistance to BGVSP is more easily reduced. Through qualitative analysis, we found that perceptions of NEVs mainly include technology cognition, product safety cognition, and brand cognition.

3.3. Contextual factors

Support for BGVSP is easily stimulated or influenced by external circumstances. Based on qualitative analysis, we found that the contextual factors affecting consumer support included three dimensions: external motivation, social influences, and urban contextual factors.

3.3.1. External motivation

Market and policy incentives are among the key contextual factors affecting consumer attitudes toward BGVSP, both of which belong to external incentives. In addition to relying on government support and guidance, NEV manufacturers have also pursued various marketing activities to attract consumers and compete for market share.

Our qualitative analysis showed that consumers' NEV awareness can be increased through subtle advertising or publicity—whether received actively or passively—thereby strengthening their support for BGVSP. Similar to Jense et al. [57] and Graham-Rowe et al. [51], our analysis results further showed that purchase behaviors can be reshaped by experiencing NEVs directly or indirectly ahead of time (e.g., by way of test drives or social communication), minimizing the "psychological distance" among the public and BGVSP [58].

Although there is currently no BGVSP in place, policies that promote consumers' willingness to purchase NEVs are directly linked to support for such a policy. Such policies can enhance consumers' policy awareness and their willingness to purchase NEVs [59]. External policy incentives can include government subsidies and lotteries for vehicle purchases [54,60]. In short, our analysis found that policies that

improve consumers' NEV purchase intention also had an incentivizing effect on support for BGVSP.

3.3.2. Social influence

Individual attitudes have proven to be significantly impacted by social influence, an essential component affecting the decisions of Chinese consumers. As social trends in support of BGVSP are formed, consumers will increasingly change their attitudes toward the policy under the force of public opinion. Our findings indicated that the social factors affecting Chinese consumers' support for BGVSP mainly included social norms, peer pressure, and social capital.

Social norms are behavior standards gradually formed through social practice and interaction that maintain social order by regulating individual behavior [61]. The focus theory of normative conduct divides social norms into descriptive norms and mandatory norms [62]. Our interview results revealed a similar division. Descriptive norms influence consumers' behavior intentions by informing them about which behaviors are effective and suitable under certain situations. Mandatory norms show the public which actions will be affirmed and which will be denied in a given situation. Social norms become internalized, and both types of norms have an important influence on support for BGVSP.

Peer pressure, as an important dimension of social influence, is particularly important for the formation of individual support for BGVSP. Meanwhile, innovation diffusion theory proposes that the internal influence coefficient in the contagion model is more effective in populations of the same social status. Specifically, prosocial behavior will tend to be spread among peers. When consumers observe that their peers support BGVSP or purchase NEVs, they will be encouraged to adopt similar behaviors [63,64]. Crucially, consumers' preferences and desires are influenced by the aims of their peers [65,66]. When a consumer knows the goals of a peer who has purchased an NEV, his or her willingness to support BGVSP will be subconsciously promoted. In addition to innate resources, the social capital owned by consumers is also an important factor affecting consumers' intentions.

Our qualitative analysis results showed that social relationships and networks were the main social capital factors influencing consumers' support for BGVSP. Studies of social networks have shown that the effect of social relationships on consumers can be categorized into short-term and long-term effects. In short order, social relationships can directly influence consumers' decisions, which is also evident in the supporting intention motivation model [67]. Over time, individual tastes can also be influenced by friends, which can be seen as a long-term effect of social relationships [68]. Therefore, the social capital of consumers is crucial to whether they support BGVSP. When people they interact with are resistant to BGVSP and NEVs, their support will be greatly weakened.

3.3.3. Urban contextual

China's unique national conditions, especially the economic and cultural differences resulting from its vast territory, also contribute to differences in consumers' intentions to support BGVSP. Many studies have verified that the characteristics of the city where a consumer lives affect their behavioral intentions. Based on our interview data, urban contextual factors such as urban development level, environmental quality, and geographic conditions were found to affect attitudes toward BGVSP.

Since China's "reform and opening up" more than 40 years ago, regional imbalances in urban development have intensified, and imbalances in economic development are the most salient [69]. Such gaps have developed into differences in the ability to cultivate innovation and in financial expenditure. At the macro level, such gaps will inevitably be "contagious" for consumer behavior at the micro level. Our results also showed that the level of urban development affected consumers' willingness to support BGVSP. Namely, consumers living in cities with different levels of development showed significant differences in attitudes toward BGVSP.

The deterioration of the living environment harms not only a city's

reputation but also residents' health. Thus, the deterioration of urban environmental quality will aggravate residents' perceptions of the seriousness of environmental problems [70]. This perception can also positively affect consumers' environmentally aware behavior, thus showing a stronger willingness to support BGVSP. In particular, we found that air pollution and automobile exhaust pollution were the main urban environmental quality factors affecting consumers' willingness to support BGVSP.

Hainan is the first province in China to propose a ban timetable for GVs, mainly because of its superior geographical location. Hainan is surrounded by the sea, and its annual average temperature is 23 °C–29 °C. The excellent climatic conditions in Hainan provide a suitable working environment for the stable operation of NEV batteries. The tropical climate also provides an excellent validation environment and application ecology for the product development, technology evaluation, and practical application of NEVs. Our interview data revealed that respondents living in areas with distinct seasons and high terrain were more skeptical of BGVSP. We therefore included cities' geographical and climatic conditions in the model of consumers' support for BGVSP.

3.4. Product factors

Banning the sale of GVs can encourage consumers to pursue NEVs to gradually achieve carbon neutrality in the transportation sector. The characteristics of NEVs are significantly linked to whether the consumer supports BGVSP. Our qualitative analysis results indicated that the use perception, technical level, economy, and appearance characteristics of GV substitutes will affect public support.

Unlike GVs, infrastructure construction has a greater influence on NEVs. In developing regions, the lack of infrastructure might reduce consumer support [71]. The wait time for a vehicle to charge is normally considered as "dead time", which can adversely affect the emotional benefits of owning an NEV. However, new technologies have greatly shorten NEV charging time, increasing consumers' willingness to support BGVSP. Such as, " ... at the beginning, it took 8 or 9 h for NEVs to be fully charged, but now it only takes 20 min in a professional charging station. The charging time has been greatly reduced, and the problem that most bothers me has been solved ... ". Our analysis showed that the special treatment some cities have given to NEVs—such as unlimited driving and even free parking—significantly improved consumers' willingness to support BGVSP [72]. This finding is consistent with Langbroek et al. [73].

Distrust of new technology has caused some people to have a negative attitude toward NEVs and to oppose BGVSP [74]. This situation is seen not only in China but also in Norway, for example, where consumers have shown skepticism about the technological level of NEVs [75]. Research and development on energy storage equipment is not only a challenge facing the development of China's NEV industry but also a major factor affecting consumer attitudes [71,76,77]. The short battery life and limited lifespan of NEVs are the main reasons why domestic respondents were suspicious. A similar dilemma has been seen in Spain [78]. Our interview data indicated that battery life, safety performance, acceleration performance, and life of battery were the technical factors affecting consumers' willingness to accept NEVs and BGVSP [79,80].

In the initial implementation stage, in addition to conservative consumer attitudes, higher prices are also a reason for the slow growth of NEV sales [81]. Preferential tax policies have been widely used around the world in the process of implementing NEVs. Sales tax exemptions reduce the cost of NEVs and can significantly increase consumers' purchase intention [82,83]. Although NEVs cost more than GVs, consumers are drawn to their cheap cost of use [82]. In addition to cost factors, consumers are generally hesitant to purchase NEVs, owing to concerns about unpredictability of maintenance fees. Whether the combined expense of NEVs entails a price advantage is essential to

whether they can be widely supported and also a prerequisite for BGVSP implementation [84]. Furthermore, the conversion cost is a significant economic element that consumers with GVs must take into consideration when deciding on whether they are willing to support BGVSP. The conversion cost variable has received considerable attention in the management field; specifically, it refers to the time, money, and energy consumers expend in the process of switching from traditional products to green products [85–87]. Our findings indicated that when consumers perceived the cost of converting from GVs to NEVs as too high, they would show aversion to BGVSP.

Different from other motivational factors, our qualitative analysis revealed that female consumers were more concerned about the appearance characteristics of NEVs. Competing for market share through innovative exterior designs is the current development strategy of many NEV enterprises. More NEVs that are small in size and have a sophisticated appearance are being launched, which are considered more attractive to female consumers.

Similar to the findings of Higgins et al. [88], our results also showed that the size of NEVs can change consumer preferences and, correspondingly, their willingness to support BGVSP.

3.5. Interpretation of logical relations

Adopting a grounded-theory approach using primary interview data, this research constructed a motivation model for the public's willingness to support BGVSP, involving four key elements: individual factors, psychological factors, contextual factors, and product factors. The model absorbs theoretical results for BGVSP from different perspectives while discovering new categories and relationships. The logical relationship between the eight elements is shown in Fig. 3.

Both individual and psychological factors have an internal causal relationship with consumer support intentions, and both can influence consumer intentions separately or in combination. Internal factors are susceptible to the influence of external factors, especially psychological factors, when developing their effects. Specifically, external motivation moderate's individual and psychological factors' effects on intention, resulting in consumers with similar psychological characteristics showing different behavioral intentions. Compared with individual factors, consumers' psychological factors are more easily affected by contextual factors and product factors. Taking urban context variables as an example, the levels of urban development and pollution where consumers were located were found to be closely related to their perceptions of NEVs. Generally speaking, when consumers perceive the severity of environmental pollution, they will have higher expectations for NEVs and BGVSP, thereby improving their cognition, which can result in a stronger willingness to support NEVs and BGVSP.

Contextual factors not only directly influence consumers' willingness but also exert an indirect effect by influencing psychological factors. Contextual variables such as external incentives and social norms have been identified as external drivers of policy implementation and as entry points for changing negative intentions among the public. Not only do external factors include contextual factors but product factors are also important for explaining differences in consumers' willingness. When the attributes of NEVs can meet consumer expectations—including use perception, technology level, economic benefit, and appearance characteristics—consumer support for BGVSP can be increased as well. Similar to previous work [89], our findings revealed that the external factors in the motivation model, in addition to showing a direct effect, also showed a moderating effect when internal factors were at play.

4. Conclusions and policy recommendations

4.1. Main conclusions

We undertook an exploratory theoretical construction of a model for consumers' willingness to support BGVSP in a realistic context where

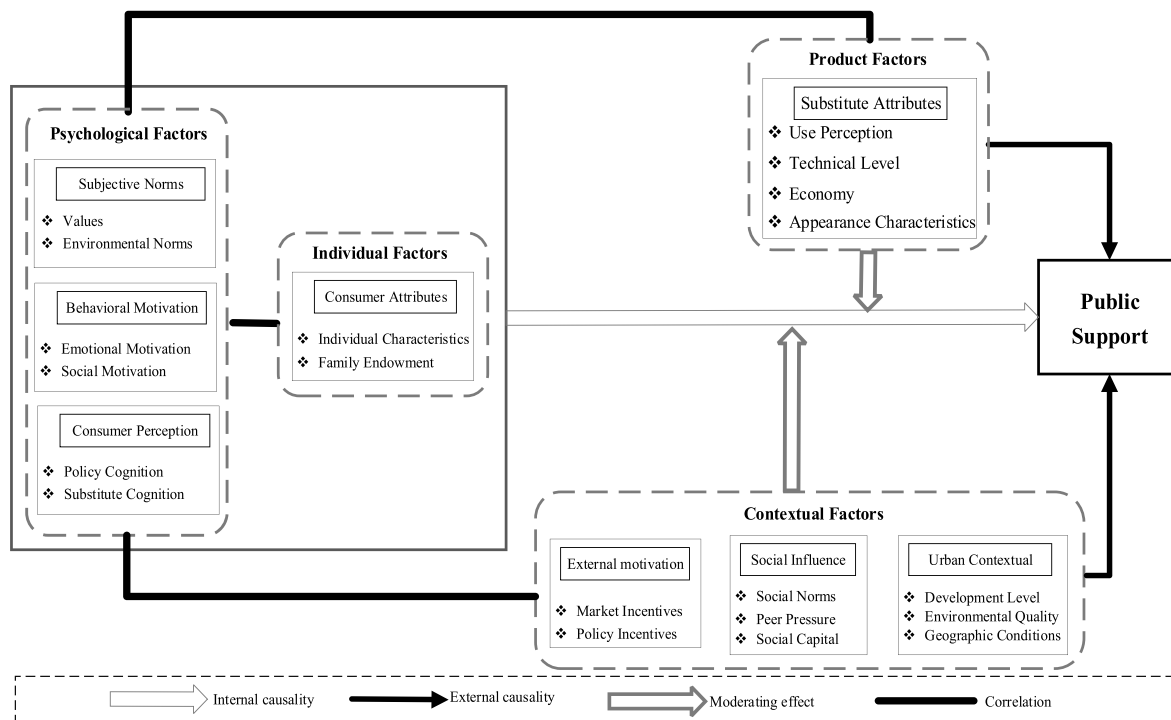


Fig. 3. The logical relationship of the model of public support for BGVSP.

the idea of BGVSP is proposed. Using a grounded-theory approach and invoking the theory of planned behavior, we analyzed and coded the text of semi-structured interviews with 52 people. The main findings are as follows.

- (1) The factors affecting consumers' willingness to support BGVSP could be divided into individual, psychological, contextual, and product factors. Among them, individual and psychological factors were important internal elements supporting the intention to support BGVSP while external driving factors included contextual factors and product factors.
- (2) The psychological factors affecting consumer support intention mainly included subjective norms, behavioral motivation, and consumer perceptions. In addition, the depth of individual factors of BGVSP was key to filling the "attitude-behavior gap" and played an important role in enhancing public support.
- (3) The external contextual factors that influenced consumer support intention mainly included external incentives, social influences, and urban contextual variables; these played a moderating role in the integrated model, demonstrating the effectiveness of residential variability on support intentions.
- (4) The dimensions under the four main factors influencing willingness to support BGVSP were found to be independent of each other; they not only acted individually on public support but also had a joint effect through partial superposition.

4.2. Policy recommendations

It is worth noting that the electrification of vehicles in China faces various obstacles, namely, technological bottlenecks, weak cost competitiveness, and an imperfect development environment. Given that the differences in people's individual attributes are not easily transformed in the short term, and the technological development of NEVs still lags behind in China, support for BGVSP can be feasibly promoted by taking psychological factors and contextual factors as the starting point. Based on our findings, the following policy recommendations are put forward, aiming to contribute theoretical solutions to

increase consumers' willingness to support BGVSP.

- (1) Use the situation of publicity, prompts and guidance to replace the mandatory policy, that is, BGVSP. Policy designers need to consider not only rational cost-benefit issues but also these new trends of prompting and guidance. Therefore, before BGVSP implementation, publicity and communication should be used to influence the public's subjective norms and perceptions of pro-environmental and prosocial behaviors, thereby reducing negative sentiment toward BGVSP. Promoting BGVSP in this way can reduce the psychological cost of compliance for the public, helping to deepen their support.
- (2) Focus on improving consumers' cognition of NEVs. Firstly, recommendations from online "celebrities" or test drives of NEVs could help raise consumer awareness of the economic and ecological benefits. Secondly, word-of-mouth related to NEV should be promoted. For example, financial incentives can be used to motivate NEV users to communicate their NEV perceptions and experiences, thus creating a social atmosphere that supports the purchase of NEVs and BGVSP.
- (3) Create a social atmosphere that supports the support of BGVSP. First, the superimposed effect of policy incentives on consumer support warrants attention from city administrators. NEV support policies can drive a shift in public attitudes toward BGVSP from resistance to support. It is necessary, therefore, to not only slow down the decline of supply-side NEV subsidy policies but also develop consumer-side support strategies (e.g., free parking) to bring usage convenience. Second, the government should lead by example. Namely, it should increase investment in protecting the environment, combating air pollution, and other measures to foster awareness of environmental protection and increase pro-environmental behavior among the public, thereby reducing resistance to BGVSP implementation.
- (4) Improve consumer recognition of NEVs through digitalization. NEVs are more easily digitized than traditional GVs. Therefore, with the help of digital technologies such as simulation, cloud computing, big data, and the Internet of Things, electrification

and automation can be jointly developed in the automotive sector. This could not only attract a large number of technology-oriented consumers but also promote the transformation of consumption concepts, which could significantly increase public support.

4.3. Limitations and outlooks

BGVSP is a new and therefore immature policy issue. Although this research establishes a theoretical foundation for when to implement BGVSP, it still has inadequacies related to the limitations of the research scope.

Specifically, the scale of the investigation was limited, and the external validity of the conclusions needs to be tested through larger investigations. This study only constructed a theoretical framework for a motivation model of consumer support; it has not been empirically tested. Future research should focus on the openness of the measurement scale and quantification under this theoretical framework. As an exploratory study, we only considered consumer attitudes toward BGVSP, ignoring the environmental and economic benefits after policy implementation. Therefore, we cannot provide definitive evidence for the timing of policy implementation, which still needs to be further explored.

Credit author statement

Yajie Liu: Conceptualization, Methodology, Software, Data curation, Writing – original draft, Funding acquisition. Feng Dong: Conceptualization, Formal analysis, Funding acquisition. Guoqing Li: Methodology, Writing – original draft. Yuling Pan: Visualization, Investigation. Chang Qin: Software, Supervision. Shanshan Yang: Validation, Supervision. Jingyun Li: Writing- Reviewing and Editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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