

Article

What are Important Technologies for Sustainable Development in the Trucking Industries of Emerging Markets? Differences between Organizational and Individual Buyers

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Abstract: This article examines perceived importance of sustainable technologies and how organizational buyers and individual buyers differ in their willingness to pay for sustainable technological innovations in an emerging market. Extensive field research was conducted to develop the study measures. Using Weber's step-by-step method of coding, we selected 24 sustainable technologies that are representative of the technological preferences and demands of truck drivers in China. We also conducted pretests with trucking company executives to improve the final survey instrument. We collected data from 510 organizational buyers and 2680 individual buyers. Results show that organizational buyers and individual buyers have similar preferences for 15 of the 24 sustainable technologies. The individual buyers have a significantly higher preference than organizational buyers for sustainable technologies, such as comfort, image, and service attributes. However, the study findings suggest that organizational buyers have a greater preference in the total cost of ownership dimension. Through content analysis of survey responses in China, we identified the most influential and popular sustainable technology in the business-to-business trucking industry in emerging markets, such as China. Our research expands the application of sustainable buying behavior theory to the trucking industry in an emerging market. We suggest management and marketing strategies to sustainable development of trucking industry.

Keywords: sustainable technologies; emerging market; individual buyers; sustainable buying behavior; organizational buying behavior; individual buying behavior

1. Introduction

The sustainable development of trucking industry is an indispensable part of the sustainable development of the modern logistics industry and supply chain management [1]. Scholars have begun to pay more attention to the sustainable development of the trucking industry in emerging markets, such as truck scheduling, truck delivery, truck routing model, and transport routes [2]. Yet few scholars have studied technological attributes for sustainable development and how the willingness to pay for sustainable technological innovations differs between organizational buyers (carriers) and individual buyers (owner-operators).

In today's market, a considerable proportion of trucks are sold by manufacturers from emerging markets, such as Dongfeng Motor, FAW, CNHTC, and Tata Motors [3]. Over the last decade, China

has become the largest heavy truck market in the world, accounting for over half of total sales and an average contribution rate to global heavy truck sales of 40% to 50% [3]. With its huge domestic market and the introduction of advanced technologies from foreign partners, China is now the largest manufacturer of medium and heavy trucks in the world. Today, almost all global companies within the automotive industry have set up production in China [3]. Sustainable development in the global market is not entirely dependent on sales but also on whether companies can outperform their competitors in terms of quality, reliability, and sustainable technological attributes. Research in sustainability literature has emphasized that China's trucking industry is one of the industries that need to be improved in the sustainability goals. The Chinese government also attaches great importance to the sustainable consumption and sustainable development of trucking industry [3]. Therefore, studying sustainable technologies in the trucking industry will enhance the sustainable development goals in China.

Global trucking's sustainable development is confronted with many challenges, such as pressure on total cost of ownership (TCO), demand shift to growth regions, continuous market cyclicity, suitable business models, and brand strategies. To remain competitive and cater to customer needs, businesses have to be continually attuned to the emergence and application of cutting-edge technologies. They need to respond to the demands of a highly diversified market and monitor growth trends in emerging markets, such as China and India. There is no universal business model that can adequately address all the issues in the global market. Instead, the demands of regional and local submarkets need to be considered, with innovations and technologies being tailored to address the sustainable technological challenges in each specific area. Therefore, the first research question was proposed:

RQ1: To achieve the sustainable development goals in China, what emerging sustainable technologies are important in trucking industry?

With increasing diversification and specialization of the motor carrier industry, many researchers have analyzed the development of specific technologies in this area. For example, Rishel et al. [4] studied one of the most popular innovations in the U.S. trucking industry, satellite communication systems. Giaglis et al. [5] focused specifically on vehicle routing technologies and their applications in distribution management. Cantor et al. [6] examined trucking firms' adoption of new safety technologies. Another cohort of researchers has examined the industry from a more macro perspective. For example, Manrodt and Parker [7] highlighted six major drivers of technology change and offered suggestions to the carrier industry on how to respond to emerging trends and meet the needs of customers. Other studies have assessed the most important features of the carrier industry from the shippers' perspective [8,9]. Still others have reported from the owner-operators' perspective, finding that, given the lifestyle of drivers, tractor comfort and reliability are critical truck components [10,11], and that economic benefits and industry pressures influence truck drivers' use of bypass systems [12]. Due to the importance of safety [13–15] and costs, the technologies of the trucking industry have begun to develop toward sustainable logistics, electrification alternative drives, autonomous optimization using artificial intelligence, and so on [3]. Nevertheless, there has been no comprehensive study of the application and importance of sustainable technologies and innovations in the trucking industry in general and the specific customer/user segments in particular.

With the advancement and sustainable innovation of technology, the environment in which organizations make purchases is constantly developing [16]. Buying behavior is a complex and dynamic issue that is subject to many complex environmental factors, such as sustainable economic development goals, raw material with low carbon and environmental protection supply, competition, and technological changes in sustainability [17]. The demand for technologies for sustainability may also vary with ownership structure: Common carriers (organizational buyers), who use employee drivers, may be more concerned with after-sale service packages and driver training, which may dramatically reduce their operation costs, while owner-operators (i.e., individual buyers) may be primarily concerned with the quality, durability, and resale value of trucks because of their liability exposure and limited access to capital. A systematic study is, therefore, necessary to provide the trucking industry's sustainable development with deeper insight into the technological needs of

customers and provide guidance on how to respond to such demands in an emerging market like China. A second research question was developed:

RQ2: How do organizational buyers differ from individual buyers in selecting sustainable technologies for development?

We focused this research on China's trucking industry for several reasons. First, as an emerging market, China is the most important part of emerging markets and attracting more attention from scholars [14,18], and, even in the context of the U.S.–China trade war, the performance of the Chinese trucking industry has remained strong. Second, there are more accidents in China's trucking industry than in developed countries, such as the United States and Japan [14]; thus, the sustainable technologies of trucks may be more important to Chinese customers at the time of truck purchase. Third, research has shown that truck customers in China find it difficult to obtain value from after-sale services [19]; thus, it is very important for sustainable development of China's trucking industry to consider organizations' and individual buyers' preferences when designing and producing trucks.

This study is among the first to focus on truck customer sustainable technology preferences (see [14,19] for exceptions). We conducted 495 face-to-face interviews with company salespeople, external distributors and service providers, and owner-operators to determine which emerging technology attributes are most important to truck customers. Using organizational buying behavior theory as the theoretical lens, we hypothesized the different preferences for sustainable technologies between carriers (organizational buyers) and owner-operators (individual buyers). We also adopted transaction cost economics (TCE) to further analyze the reasons behind the cross-group differences. To test the hypotheses, we collected empirical data from 510 carriers (organizational buyers) and 2680 owner-operators (individual buyers) in China. We calculated standardized values of all respondents and applied statistics (*t*-tests on means and mean differences) to make cross-group comparisons of the sustainable technological features between organizational buyers and individual buyers.

The theoretical contributions of this study include: (1) This study expands and enriches the application of organizational buying behavior theory into high environmental uncertainty [20,21] and into an emerging market setting [17,22–24]. (2) This study enriches the empirical application of the transaction cost economics in the trucking industry [25–28]. (3) This study adds to existing literature with the applicability of the organizational buying behavior theory in the trucking industry of sustainable development [1,2].

This study provides some important managerial implications for manufacturers: (1) The study findings provide valuable insights for truck manufacturers by identifying the needs of organizational and individual customers for truck sustainable technologies; thus, suggesting how to better design key sustainable technologies to cater to their target customers for achieving sustainability development goals. (2) The study findings offer some specific recommendations on how marketing strategies can be tailored to the preferences of different customer segments. (3) The study proposes directions for future sustainable technological innovation for truck manufacturers to achieve sustainable development goals and the sustainability of organizational performance.

2. Theoretical Background

2.1. Carriers (Organizational Buyers) versus Owner-Operators (Individual Buyers)

According to Bess [29], the trucking industry can be divided into two major components: private trucking and for-hire trucking. Private trucking refers to companies that maintain a fleet of trucks and trailers and employ drivers to haul and distribute their freight, but whose principal business is not trucking. For-hire trucking companies (organizational buyers) carry freight for a fee to domestic and/or international markets. There are two common driver employment modes in for-hire trucking: company (or carrier) drivers and owner-operators. Carrier drivers are hired under open-ended employment contracts to drive vehicles provided and maintained by the carrier, using fuel for which the carrier pays. A carrier usually assigns a driver to the same truck for an extended period of time.

Owner-operators (individual buyers) are self-employed truck drivers who work under contract for either for-hire trucking companies or companies engaged in private trucking. They typically own the road tractors and trailers they drive. Contractual relationships with owner-operators range from single-haul transactions to long-term contracts, with the typical arrangement resembling repeated short-term contracts. Owner-operators are paid on either a per-mile basis or a per-haul basis where the driver receives a fixed percentage of haul revenue. These drivers may find it necessary to work long weeks to cover fuel, maintenance, insurance, and rental or leasing expenses [29].

Owner-operators receive greater market opportunities from taking on greater economic risks than other drivers, and they should, thus, receive a higher return than employees in similar positions. However, they also face the risk of earning less. In fact, there is no evidence that owner-operators earn significantly different total incomes compared to employed drivers [29,30]. Because of their personal stake in their trucking activity, owner-operators have strong incentives to properly care for their vehicles. In contrast, carrier drivers have fewer incentives to care for the equipment they operate. Further, because carrier drivers do not fully internalize the cost of idle equipment, they have less of an incentive to expend effort than do owner-operators [31]. Because owner-operators directly bear all the costs associated with the operation of their vehicles, they have a stronger incentive than carrier drivers to minimize such costs [27].

2.2. Organizational Buying versus Individual Buying in Achieving Sustainable Development Goals

Since the 1960s, organizational buying behavior has been widely discussed by scholars as an important factor affecting the sustainability of organizational marketing and growth. Organizational buying decisions usually involve many individuals from different functions within an organization. Robinson et al. [32] proposed the BUYGRID model, which considers organizational buying behavior as a series of activities that includes new task buying, modified rebuying, and straight rebuying. Subsequently, Webster and Wind [33] identified five buying roles within the context of these buying centers: users, influencers, buyers, deciders, and gatekeepers. Organizational buying behavior is, thus, regarded as a process [17,22,34–37] consisting of a series of complex and interdependent activities [17], such as requirements, technical specifications, supplier evaluations, and final purchase decisions [36]. The specific decision stages and roles in organizational buying may vary across buying situations. The same individual could occupy a number of roles (e.g., buyer and user) and a number of individuals could occupy the same role (e.g., there may be a number of users). Webster and Wind [33] conducted in-depth research and found four types of factors that affect organizational buying behavior: environment, organization, interpersonal, and personal.

Many scholars since have expanded on this research [16,17,22,24,38]. Sheth [34] considered the influence of information factors and psychological factors on organizational buying behavior. Research has posited that organizational buying behavior in the manufacturing industry in particular, is influenced by six main factors: supplier flexibility, supplier reliability, cross-departmental communication, top management support, daily procurement, and buyers' price sensitivity [17]. In addition, advances in information technology have affected the structure and processes of the purchasing center, significantly increasing the efficiency and effectiveness of organizational buying activities [36].

Cultural differences across countries are also important factors influencing organizational buying activities [24]. In the process of organizational buying, the purchaser should consider the operation and development of the whole company, choose the most advantageous purchasing mode for the company, and be able to prove to the other members of the organization that the purchasing decision is correct. Therefore, the organization's buying behavior may be more rational than that of individual consumers. But, because organizational buying decisions are ultimately made by individuals, organizational buying behavior is often guided by both rational economic motivation and the emotional motivation of the purchasing decision makers [39]. Compared with individual customers, organizational customers have wide geographical coverage, larger single purchases, more

complex purchase decision-making processes, customized services or products, and more stable and continuous customer relationships [40–42].

Individual buying in general is characterized by a relatively leisurely and casual overtone, which means that consumers, unlike purchasing professionals, shop also for social, recreational, and even therapeutic reasons. Consumer buying behavior involves a large number of decisions, ranging from the identification of a need through various stages of generation and evaluation of alternatives to the selection of a product, specific features of a given brand, and time and place of purchase.

Specific differences between organizational and individual buying behavior include: (1) Individual buying behavior usually involves only the individual, perhaps with a few friends or family members. But organizational buying behavior involves a large number of people representing different departments and holding different roles; thus, involving a variety of appeals and interests [17]. (2) Organizations make purchases for the purpose of production or resale to earn differential profits and for other business-related consumption, whereas consumers make purchases to meet the personal needs of themselves and their families [43]. (3) Organizational buying behavior is affected by many factors and constitutes the rational buying behavior of collective decision-making, whereas consumer buying behaviors is affected by the individual's own interests and preferences. Nevertheless, several scholars have noted some similarities and differences between organizational and consumer buying behavior [34,38,44–46]. For example, Kemp et al. [39] suggested that both organizational buyers and individual consumers are affected by emotions when making buying decisions. Sheth [34] implicitly recognized the similarities between organizational and household buying behavior in his theory of family buying decisions. At the individual level, Zaltman and Wallendorf [47] specified the similarities between organizational buyer behavior and consumer behavior as the cultural effects on purchasing behavior, norms governing purchasing behavior, and the role of others' expectations on purchasing behavior. Additionally, in the process of making a purchase, both organizations and individuals gather information about alternatives [48], process this information, learn about available products, determine which alternative matches the perceived needs most closely, and carry through by making a purchase.

Most prior research on organizational buying behavior has focused on the construction of theoretical frameworks, defining influencing factors, and developing the theoretical knowledge of organizational buying models [17,36] based on studies of mature markets in developed countries. It is uncertain whether these theories and conclusions are applicable to emerging markets [23], and thus, more in-depth study of buying behavior in emerging market countries is needed [24]. There is also a lack of research comparing organizational buying behavior and individual consumer buying behavior within specific industries.

Past studies also suggest that because the increasing easiness of information access, the differences between organizational buying behavior and individual buying behavior are becoming less obvious [20,21]. We believe that the theory of transaction cost economics (TCE) is also useful for explaining some of the differences between organizational buying and individual buying in achieving sustainable development goals. Therefore, we briefly review TCE and discuss how TCE can be useful as an additional theoretical perspective for this study below.

2.3. Transaction Cost Economics (TCE)

TCE is one of the major theories of organization. The TCE perspective has its roots in the work of Ronald Coase [49]. Williamson [50–52] further developed TCE as a governance mechanism. After comparing differences between TCE and agency theory, Williamson [52] suggested that TCE offer important insights into understanding of sustainable organization development and resource optimization for the sustainability of organizational development.

The TCE perspective has its roots in the work of Ronald Coase [49]. Compared to the neoclassical economic approach (where emphasis is on the firm as a production function), Coase [49] argued that the market and the firm are two modes of governance, and what ultimately determines the choice of governance mode can be linked to differences in transaction cost. However, it was Williamson [50–52]

who further developed this governance perspective into a strategic approach we today commonly refer to as TCE. At first glance, TCE appears to be presenting a fairly simple and straightforward idea: “the properties of the transaction determine what constitute the most efficient governance structure” [53], which is either the market or hierarchy (i.e., managing the transactions within a firm). According to Williamson [50–52], both types of exchange agreements are associated with costs, and the two governance forms also differ in their ability to support the exchanges between economic actors due to features and elements in the transactional context.

Given its emphasis on efficiency, TCE favors picking the type of governance mode that minimizes transaction costs, which in turn, has resulted in a rich literature discussing and analyzing the importance of direct and/or opportunity costs associated with monitoring and governing transactions [52]. Hence, from a strategy viewpoint, deciding what governance form to go with is the way by which managers, etc., impact the costs of, for example, negotiating, monitoring, and enforcing contracts [53,54].

Literature on TCE suggests that there are four major assumptions which lead to the differences and difficulties in the transactional exchange. First, TCE comes with two core behavioral assumptions: (1) “opportunism” and (2) “bounded rationality.” Opportunism refers to a decision maker’s action that is based on self-interests (i.e., the decision maker makes a conscious decision to take selfish advantage of circumstances) [53,55,56]. Bounded rationality is the assumption that the human mind has cognitive limitations which make it difficult for decision-makers (in spite of their best efforts) to fully handle the complexities of all possible aspects of any particular decision [53,54,56]. Consequently, it is costly for decision-makers to acquire and evaluate information [53,54]. In addition to these two core behavioral assumptions, TCE also acknowledges the role of “imperfect information” as a third assumption [53,55]. It is suggested that transactions often take place in the presence of information asymmetries between a buyer and a supplier, which means that either party may enter the transaction having more knowledge than the other [53,54]. A fourth, but less discussed and researched behavioral assumption in the TCE framework is “risk neutrality” [55,57]. In combination, these four assumptions of TCE provide theoretical reasons for explaining why a firm is likely to design and implement costly mechanisms to monitor and enforce contractual performance [53,54].

In addition to the four theoretical assumptions of TCE, prior studies suggest that transaction costs are affected by uncertainty, small numbers bargaining, and asset specificity [50,53,54,56–58]. First, the presence of uncertainty makes it difficult to predict and set up effective measures of future performance, which means that the more uncertainty, the higher the need for monitoring and control. Transactions in highly uncertain environments are more prone to run into unanticipated contingencies that require renegotiation and monitoring than the transactions conducted in more stable environments [53,54]. Therefore, market governance is more difficult in highly uncertain environments than in low-uncertainty environments. Second, small numbers bargaining captures the degree to which a decision maker has alternative sources of getting what he or she wants [53,54]. Thus, fewer possible suppliers or collaborators will constrain the decision maker’s possible strategic options. Finally, empirical evidence suggests that asset specificity is one of the most essential variables affecting the choice of governance mode [53,54]. Asset specificity refers to the level of customization and transferability associated with the transaction [53,55–57]. It comes in different forms; for example, human asset specificity, site specificity, or physical asset specificity. It can also differ in terms of degree from highly customized and idiosyncratic assets to elements that are highly standardized, and therefore, non-specific in nature. Consequently, low asset specificity indicates that transactions are relatively frequent, and therefore, transactions are most likely to be efficiently governed by markets. Empirical evidence suggests that high asset specificity leads to hierarchical governance [57]. When asset specificity is high, specific assets are costly to re-deploy in alternative uses, and it is, therefore, likely that the hierarchical form of governance will be selected [53].

With few exceptions, most of the TCE related research primarily has concentrated on examining vertical integration issues, interorganizational relations, and the validity of TCE’s assumptions. However, the TCE has been applied to examine different economic theories of organizational boundaries

in the truck industries [25,27,59] and agency theory [28,59,60]. To our knowledge, no empirical studies have used TCE to explain the differences between the organizational buying versus individual buying decisions when facing the varied sustainable technology attributes in the Chinese context. In addition to the organizational buying behavior theory, this study adopts the TCE perspective to provide additional reasons and assumptions behind the differences between carriers and owner-operators in choosing sustainable technology attributes.

3. Theoretical Model and Research Hypotheses

Drawing on organizational buying behavior theory and TCE, we propose a theoretical model (shown in Figure 1) to illustrate the differences in perception of technological attributes between carriers (organizational buyers) and owner-operators (individual buyers) in the Chinese trucking industry. From the TCE perspective, we argue that carriers and owner-operators differ in “opportunism” and “bounded rationality” [28,53,55,56]. Relative to owner-operators, carriers have higher incentives for pursuing opportunism (i.e., the decision is based on carriers’ self-interests and not the drivers’). Because it is costly for carriers to acquire and evaluate information regarding the value of the emerging technologies for drivers due to “imperfect information” [53,58], carriers have more limitations on bounded rationality than the owner-operators have [27]. Furthermore, carriers have higher level of “risk neutrality” than that of owner-operators. Therefore, we proposed two research hypotheses regarding differences in technology preferences between carriers and owner-operators.

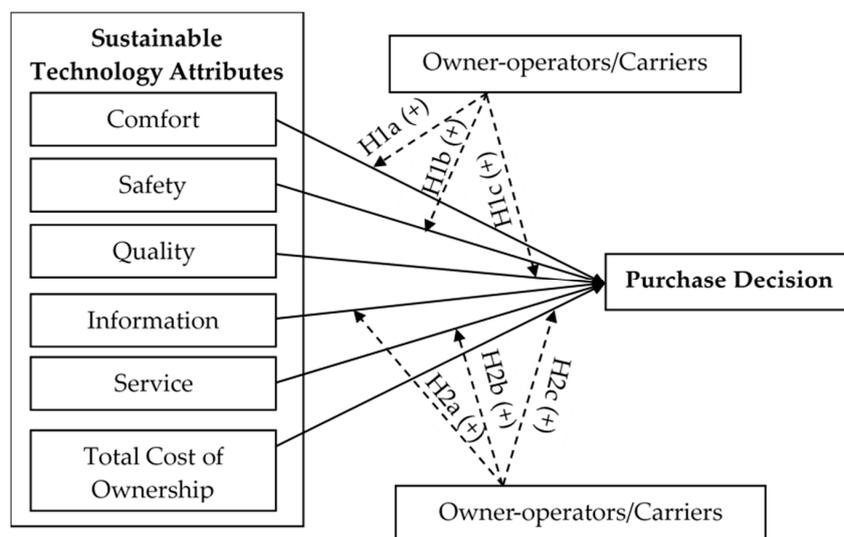


Figure 1. Theoretical model.

The highly competitive nature of the trucking industry often demands nearly around-the-clock operation of vehicles and equipment [1,61]. Because of the long and often boring working time [13–15], comfort has become an important factor that truck drivers consider [62]. While all carriers must provide a basic level of equipment to their employee drivers, those who choose to exceed this level are likely to be viewed as being more supportive than those who do not. Offering drivers a comfortable working environment is a discretionary decision on the part of management [62]. Because voluntary actions are viewed as particularly strong signals of an organization’s support, it is not surprising that, all else being equal, good equipment has been found to be associated with lower driver turnover rates [63]. Most routine purchasing occasions likely reflect a typical pattern of purchasing managers acting with delegated discretion, virtually as individuals, within organizationally prescribed limits and cultures. At the same time, organizational buying is a rational and logical activity of professionals, ignoring the habitual, intuitive, and experiential behavior of purchasing managers and subordinates as uniquely idiosyncratic individuals [20].

From TCE perspective, there are several reasons (e.g., bounded rationality, imperfect information, and uncertainty) for the difficulties associated with calculating the real costs and value of comfort for carriers. When a carrier rents out its trucks to drivers, the costs are calculated according to each haul with a quota. However, it is difficult to accurately assess the value and charge a price for the comfort technologies (e.g., bounded rationality, imperfect information, and uncertainty). Similarly, it is difficult for carriers to determine whether the trucks are comfortable to the individual driver because of imperfect information for the driver's uncertainty. This argument is consistent with the analysis of price determination mechanisms in the TCE literature [26,64] and analysis of managerial compensations [65].

In contrast, the imperfect information presents a lesser problem for owner-operators (individual buyers) because they have voluntarily chosen their lifestyle and work environment [27,29]. Even though they are not more economically successful than other truck drivers, owner-operators may have chosen their jobs for other personal reasons. Owner-operators, naturally, are more concerned about their personal needs in their purchasing decisions. Comfortable driving and rest environments, effective noise prevention systems, and the decor of truck interiors are important factors affecting truck-purchasing decisions. Recent research finds that with increasing popularity of the concept of automated driving in the trucking industry, owner-operators are becoming more interested in sustainable technologies related to comfort [1,62]. We, therefore, hypothesized:

Hypothesis 1a (H1a). *When making truck-purchasing decisions, owner-operators (individual buyers) have a higher preference than carriers (organizational buyers) for sustainable technologies related to comfort.*

Given the importance of safety, both carriers and owner-operators are very interested in improving their safety management [5,6,15,62]. The carrier believes that the risk of renting out the truck to a driver depends on two aspects: (1) technical safety attributes of the truck and (2) the skills and driving habits of the truck driver [62]. According to the TCE, carriers should be more risk neutral than the owner-operators [27]. They usually neither avoid risks nor actively pursue risks. Therefore, when carriers make a decision on what technology to include in purchasing a truck, their major criterion for choosing specific technology (asset specificity) is the expected return on investment. Therefore, carriers are less willing to incur unnecessary costs associated with choosing high-tech safety features beyond industry standards with unknown future risks. Instead, they are more willing to pay for technology features that involve risk management. For example, carriers' risk management departments can apply comprehensive measures, such as purchasing insurance, safety training, adopting safety technologies, and installing safety accessories, to prevent or reduce damage and loss caused by incidents such as accidents, theft, or fires.

However, due to their lack of management resources and financial limitations, owner-operators usually cannot compete with carriers in risk management even though they are well aware of the importance of safety measures [27]. In China, truck drivers often face poor driving conditions, especially in remote areas, which leads to frequent truck accidents [14,15]. Owner-operators are in the trucking business to make a profit but they personally drive the truck, so safety is of paramount concern when purchasing new equipment [27]. They may prefer to choose a truck with sustainable technology features that can help them deal with all these concerns rather than to commit further investment of time and money in a comprehensive and professional way, as carriers do. Recent studies suggest that even in the trend of the highly automated driving technology in the trucking industry, one of the biggest focuses of owner-operators is still safety [5,6,15,62]. As a result, trucks with superior safety technology features may cater very well to the safety requirements of owner-operators. We therefore hypothesized:

Hypothesis 1b (H1b). *When making truck-purchasing decisions, owner-operators (individual buyers) have a higher preference than carriers (organizational buyers) for sustainable technologies related to safety.*

From TCE perspective, we argue that relative to owner-operators, carriers have higher level of imperfect information and uncertainty [27,53,54,57,58]. When purchasing products, customers or users generally perceive indications of quality from the product [3,5,15,53,58]. Due to a lack of professional knowledge to judge the intrinsic attributes of the product, owner-operators may view product image as an indication of quality and reliability. Thus, they care more about vehicle characteristics, such as design, fashion, and color. In contrast, trucks are also symbolic of the owner-operator's personal wealth. Therefore, owner-operators may prefer sleek, modern designs, neat wiring arrangements, and so on. Owner-operators are also owners of the residual value of their trucks. Therefore, they risk most of the costs associated with how they drive the truck [59]. The owner-operators will also bear all risks caused by information asymmetry regarding the residual value of the truck used [27,59].

When the carrier acts as the center of truck purchase, the risk is transferred accordingly. For carriers, to maximize the return on investment and establish competitive advantage, greater emphasis is placed on intrinsic attributes, such as reliability and service, whereas extrinsic attributes such as product image, may carry little weight [27]. Trucks purchased by organizational buyers are merely the functional property of the company, which is focused on maximizing profit rather than the quality and image of trucks [27]. We, therefore, hypothesized:

Hypothesis 1c (H1c). *When making truck-purchasing decisions, owner-operators (individual buyers) have a higher preference than carriers (organizational buyers) for sustainable technologies related to quality.*

Studies have shown that technological innovation has expanded the variables under which carriers and drivers can sign contracts. The development of information technology enables carriers to better measure how drivers operate trucks. Due to the installation of the information technology, the performance improvements of carrier's drivers are greater than those of individual truck drivers [59]. Carriers manage fleets of trucks that are distributed over a wide geographical area. In such a highly dynamic industry, whether various information can be exchanged efficiently and cheaply may play a critical role for industry participants. To operate the fleet smoothly and efficiently, carriers have adopted a wealth of information technologies, such as global positioning systems, electronic data interchange [1,66], and satellite communications [4]. Technologies involved in real-time communication enable carrier managers to provide each truck driver with the most up-to-date road conditions. Professional route management systems can direct the fleet to adopt optimal routes that bypass toll stations and highway weighing stations and effectively reduce idle time and total mileage [12]. Onboard computer systems can send all-round information about the truck, such as speed, position, condition of cargo, and arrival time. Organizational buying behavior is, thus, largely influenced by information communication [17,36]. Obviously, information technology can help carriers reduce their costs, which also verifies the Coase's law [49] that carriers will choose to coordinate activities internally rather than through the external markets when the cost of transacting in the markets is higher than the cost of internal coordination. The combination of various resources become asset specificity for carriers that are difficult to be imitated by other carriers [27,57].

When confronted with a purchase situation, owner-operators will try to collect information and acquire knowledge to help them evaluate the purchase decision. However, because of a low level of education, the information and knowledge they can access is extremely limited. Their evaluation of the product is primarily based on their personal experience, advertisements, word of mouth, and observational learning. Consequently, owner-operators have weak perception of the expected role of information as a technological attribute [59] and do not have too much preference for this attribute. We, therefore, hypothesized:

Hypothesis 2a (H2a). *When making truck-purchasing decisions, carriers (organizational buyers) have a higher preference than owner-operators (individual buyers) for sustainable technologies related to information.*

Because of the damage to reputation and high financial costs of any delay or cessation caused by mechanical problems, carriers may put a high value on the quality of services provided by truck manufactures to guarantee the continuity and reliability of the operation. Manufacturers can provide sustainable technology-based services, such as self-diagnosis and electronic fleet management to help truck drivers improve driving performance and reduce driving pressure, thereby reducing the workload of truck drivers and improving safety. Lower accident incident rates improve the brand image and reputation of carriers [14]. Reputational concerns can motivate shippers and carriers to communicate clearly and deter them from appropriating quasi-rents from trading partners [25,27]. Providing training services, such as vehicle driving and maintenance, not only reduce service costs for carriers but also provide convenience for truck drivers. Carriers that offer such supporting services can better attract and retain drivers, ultimately benefiting their bottom line [27].

This is particularly important in the Chinese market, where many truck drivers have a low level of education, making it difficult for them to gain competence with advanced technologies. It is, thus, very important that truck manufacturers make their products easy to operate and offer after-sale service options to carriers to support the optimal operation and management of their fleets [14]. Truck manufacturers often provide services to carriers with lower marginal costs due to the concentration of carrier's purchases. But this kind of good service is incomparable for owner-operators.

However, in China, due to the lack of social credit systems, it is very difficult and costly for truck manufacturers to identify whether owner-operators have the economic ability to compensate for the consequences of default. Therefore, owner-operators often have more difficulties in getting services, such as free trials, loans, and insurance. Consequently, when owner-operators buy trucks, these services have little impact on their purchase decisions. We, therefore, hypothesized:

Hypothesis 2b (H2b). *When making truck-purchasing decisions, carriers (organizational buyers) have a higher preference than owner-operators (individual buyers) for products related to services.*

TCE indicates that bounded rationality is the assumption that the human mind has cognitive limitations that make it difficult for decision-makers (in spite of best efforts) to fully handle the complexities of all possible aspects of any particular decision [53,54,57]. Consequently, it is costly, both in time and resources, for decision-makers to both acquire and interpret information. Due to the low education level, owner-operators' capability to obtain true and useful information is very limited in China. Currently, the Internet has of a large amount of false information, so it is very difficult and costly for owner-operators to identify correct and useful information. Consequently, it is difficult for owner-operators to take into account all the potential costs of operation, such as management, delivery, and service, to reach the most efficient and accurate evaluation. At the same time, owner-operators are usually subject to financial constraints due to the scale and profit margin of their businesses. Even if they are fully aware of the importance of TCO [67], their buying decisions will be greatly restricted by their purchasing power. As a result, owner-operators may take the initial price, rather than the TCO, as a top criterion in making their purchase decision.

In contrast, carriers are motivated by maximizing profit, and thus, are more attuned to minimizing the TCO than owner-operators are [27]. According to TCE, bounded rationality is one of most important assumptions for the emergence of a company. That is to say, the cost of internal coordination is lower than the market transaction costs. Carriers' decision making is, thus, much more professional and comprehensive and they have more experience and resources in the industry to draw from [27,60]. The experience and resources of carriers are their specificity assets which are difficult to be imitated and replaced in a short time. The specialists in each department can provide useful information to evaluate the efficiency of each purchase decision. Abundant resources and capital allow them to reach the optimal cost structure for their purchase [60]. We, therefore, hypothesized:

Hypothesis 2c (H2c). *When making truck-purchasing decisions, carriers (organizational buyers) have a higher preference than owner-operators (individual buyers) for sustainable technologies related to TCO.*

4. Methodology

4.1. Development of the Survey Instrument

Following prior studies that used field research to ascertain demands and needs for different product categories [68], we used field research to develop the survey measures for important sustainable technology attributes of purchase decisions [69]. The development of the important sustainable technology attributes occurred in three phases. The first and second phases were designed to seek qualitative input from both organizational and individual buyers about what they viewed as the important factors and assess buyers' perceptions of the relative importance of the factors. The third phase was a quantitative study designed to test perceptions of the relative importance of the factors.

4.1.1. Conducting 495 Semi-Structured, Open-Form, Face-To-Face Interviews

We conducted 495 semi-structured, open-form, face-to-face interviews with company salespeople, external distributors and service providers, and owner-operators, to determine which attributes truck users are most concerned about. These three groups of interviewees have different characteristics, and thus, offer unique insights into our area of interest. Internal company salespeople deal with different dealers and customers, while also being attuned to problems within their own firms; they are cognizant of customer demand factors, mainly from customer feedback about their own products. External distributors and service providers play a middleman role in the truck sales chain. Many dealers are agents for multiple brands, which gives them a broader view of customer demand in the industry. Owner-operators are the end-users of the truck products, so they draw their demand factors directly from their own driving experiences. Table 1 reports the sociodemographic characteristics of the participants in the interviews.

Table 1. Sociodemographic characteristics of the interviewees ($n = 495$).

Variable	Company Salespeople (N = 135)		External Distributors and Service Providers (N = 87)		Owner-Operators (N = 273)		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Age	29.644	6.783	27.207	2.833	33.454	7.850	
Annual Income (RMB)	54,955.240	63,201.120	36,206.200	19,189.450	86,239.380	72,453.130	
Number of Truck Purchases in the past 12 months	1.733	1.052	2.943	0.753	2.495	1.118	
Driver Experience (Years)	6.793	3.541	7.655	2.510	8.773	2.604	
Truck Industry Experience (Years)	18.793	7.828	22.080	5.755	22.564	6.539	
Business Experience (Years)	22.422	8.697	24.586	6.292	27.821	6.660	
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)	
Sex	Male	81	60.00	58	66.67	269	98.53
	Female	54	40.00	29	33.33	4	1.47
Education	High School	96	71.11	49	56.32	179	65.57
	College Degree	32	23.70	31	35.63	65	23.81
	Graduate Degree	7	5.19	7	8.05	29	10.62

We designed several interview protocols according to the characteristics of the three groups of interviewees. Because people in China speak many different dialects, to ensure the accuracy of translations, we employed graduate students familiar with the dialects to do the translations.

Each research participant was paid 100 RMB (US \$14) at the end of the interview. The interviews ranged from 60 min to 2 h in length. Each interview started with assessing the perceived relevancy and validity of the list generated from the literature in Phase 1, and then followed a structured interview guide that included six topics:

1. Overall, what do you think are the important sustainable technology and service-related factors to you when you make decisions regarding truck purchase?
2. Why are these factors particularly important to you?
3. What are the top five most important factors to you when you make a purchase?
4. Reflecting on experience of your last purchase, what can a company do to increase your satisfaction?
5. In general, how can companies increase their chances of you purchasing their products and services?
6. What do you think are the five most important factors that may influence your decision not to purchase the products from the company?

All interviews were recorded. The interviews generated approximately 1.63 million words of text (Chinese characters). We conducted content analysis to identify truck customers' demand factors and employed Weber's step-by-step method of coding an analytical framework [70]. Cohen's kappa for the final code classification was above 0.75; thus, meeting the recognized requirement for reliability. Table 2 presents some characteristics of the transcripts.

Table 2. Transcript records of the face-to-face interview data.

	Total Number of Records (Copies)	Total Duration (Minutes)	Total Text (Million Characters)
Company salespeople	158	5400	66
External distributors and service	125	5450	49
Owner-operators	212	3140	48

The validity of content analysis can be secured when the coding classification rules are objectively defined and respected by the coders. We, therefore, employed coders who were not part of the project group, possessed a clear understanding of the principles of content analysis, were familiar with the operation of the processing software, were involved in face-to-face interviews of more than 30 people, and were not familiar with the underlying purposes of this research. The content analysis resulted in a preliminary set of customer demand items. We removed overlapping items, excluded other items that could not be achieved in the short term in the heavy-duty trucking industry, merged duplicate items, and split items that covered too much content into several items.

As a result of the content analysis and incorporating the results from Phase 1, we selected a set of 24 items that were representative of all the sustainable technological preferences and demands of truck drivers in China's trucking industry. We analyzed the explanatory statement of each item to ensure the survey respondents would be able to understand them.

4.1.2. Conduct Pretests

To confirm the validity of the survey, we conducted focus group interviews with 15 organizational buyers and 15 individual buyers, and 10 people from research and development (R&D) departments, sales departments, technology centers, and management centers with extensive experience in the heavy trucking industry. Each participant was paid 250 RMB (approximately US \$35.7). The participants were divided into two focus-group interviews. Focus group interviews were moderated by experienced researchers specialized in consumer research. We asked the participants, based on their professional experience, to indicate any problems in responding to the survey items and to offer suggestions and comments for improvement. We used the feedback received from the focus group interviews to modify and improve the final survey instrument (see Appendix A at the end of this article).

4.2. Data Collection

To maximize our sample, we employed two methods of data collection. The first method involved two truck manufactures assigning the research task to their subsidiaries throughout China according

to each company's sales data. The subsidiaries sent office staff members to the corporate headquarters for training on the purpose of the research and the specific operational processes. The trained staff members then contacted local dealers, service stations, and truck customers to conduct the research. The second method involved trained graduate students traveling throughout China to locations such as motorway service stations, truck repair stations, and truck freight stations, to administer the survey to participants in the trucking industry.

We collected data from 3581 respondents (594 carriers and 2987 owner-operators). Out of the 594 surveys from carriers, 84 surveys contained incomplete data and were deleted from analyses. Out of 2987 surveys from owner-operators, 307 had missing data. After excluding these surveys with missing data, we retained 3190 surveys with complete data from 510 carrier drivers and 2680 owner-operators.

Among the survey respondents, 713 were owners (22%), 594 were partners of the corporation (19%), 536 were purchasing directors (17%), 852 were marketing directors (27%), 457 were business directors (14%), and 38 were not known (1%). Table 3 presents the sociodemographic profile of the respondents.

Table 3. The sociodemographic profile of the survey respondents.

Variable		Carrier (N = 510)		Owner-Operator (N = 2680)	
		Mean	S.D.	Mean	S.D.
Age		38.114	7.280	36.578	7.349
Annual Income (RMB)		138,489.74	73,519.69	114,407.74	65,551.61
Number of Truck Purchases in the past 12 months		2.690	0.970	2.320	1.130
Driver Experience (Years)		8.582	3.034	8.516	3.070
Truck Industry Experience (Years)		22.639	6.521	22.867	6.437
Business Experience (Years)		27.394	7.551	27.029	7.765
		Frequency	Percent (%)	Frequency	Percent (%)
Sex	Male	425	83.33	2510	93.66
	Female	85	16.67	170	6.34
Education	High School	342	67.06	2474	92.31
	College	93	18.24	206	7.69
	Graduate Degree	75	14.71		

We analyzed the data collected using two different methods to check for biases. Because we had more control over the training and research processes engaged in by our graduate student team, we used the data the graduate students collected as the quality control group and conducted a *t*-test at the 95% confidence level to check whether the two sets of data were different. The results showed that the two samples had no statistically significant differences ($p < 0.10$). In addition, we used Podsakoff's method to test for common method bias [71]. We performed factor analysis of the data along with Harman's single-factor test to determine whether there were nonrotating solutions in the exploratory factor analysis [71]. The results of the analysis suggested no common method bias in our data.

4.3. Final Study Measures

The sustainable technological demand items in our study cover five different functional areas: comfort, service, information, safety, quality and image, and TCO (see the Appendix A for the specific measure in the survey). Our survey respondents rated their willingness to purchase each technological feature on a 7-point scale ranging from not at all (1) to extremely willing (7).

4.4. Data Analyses

We standardized the data collected from each respondent so that cross-respondent comparisons could be made [72–74]. A standardized item value greater than zero indicates that, on average, the

respondent shows relatively more preference on that item [72–74]. An item with a standardized value less than zero indicates that the respondent's preference is lower than the average, but it does not mean that this item is not important.

To test our hypotheses, we performed a series of *t*-tests on each demand item. The results can be found in Table 4. The second part of the *t*-test was used to judge whether there were significant differences between the two groups on each demand item. The basic idea was to compare the mean differences of the actual observations (e.g., for a specific item, the mean difference is equal to the mean of group one minus the mean of group two) and the expected random error (the standard deviation of the sample mean). Statistical index *t* was used to represent the result.

Table 4. Owner-operator verses carrier comparisons ^a.

No.	Sustainable Technology Attributes	Unstandardized Scores		Standardized Scores			Group Comparisons			
		Owner Operator Means	Carrier Means	Owner Operator Means	Carrier Means	T-Value for H0: $\mu_p = \mu_g$	Group	Owner Operator Means	Carrier Means	T-Value for H0: $\mu_p = \mu_g$
1	Human engineering (comfortable driving; less tiring; easy to operate)	5.29	5.33	0.30	0.23	1.08				
2	Driver assistant (e.g., GPS)	4.94	5.08	-0.01	0.08	-1.42				
3	Interior environment (air quality, storing space, and layout of operation equipment)	5.09	4.99	0.12	0.00	2.26 *	Comfort	0.12	0.07	2.06 *
4	Noise reduction system (e.g., quiet in high speed)	5.17	5.16	0.20	0.12	1.30+				
5	Ride comfort (e.g., comfortable seating and the driving, less turbulence driving, good shock absorption)	5.37	5.38	0.35	0.29	1.18				
6	Rest comfort (e.g., spacious and adjustable seats, better entrainment features such as internet, music, refrigerator, etc.)	4.75	4.69	-0.20	-0.20	0.06				
7	Vehicle's agility (e.g., easy to steer wheel and to make turns, etc.)	5.24	5.26	0.23	0.23	0.11				
8	Interior design (e.g., cozy and artistic)	4.91	4.72	-0.02	-0.19	2.89 **				
9	Security management system (e.g., anti-theft devices)	4.76	4.73	-0.15	-0.19	0.71	Safety	-0.20	-0.18	-0.51
10	Cargo safety management system (e.g., anti-theft and loss prevention of cargo)	4.61	4.63	-0.28	-0.24	-0.65				
11	Mayday system (e.g., SOS, emergency aid system)	4.70	4.80	-0.18	-0.11	-1.04				
12	Image (e.g., modern and beautiful design, neat wiring arrangements)	5.00	4.90	0.03	-0.08	2.02 *	Quality and Image	0.23	0.28	-0.95
13	Quality (e.g., high reliability, high quality, good workmanship, etc.)	5.48	5.70	0.44	0.64	-3.46				
14	Convenience in work (e.g., self-diagnoses, electronic fleet management)	4.81	4.92	-0.15	0.00	-2.58 **	Information	-0.19	-0.19	0.00
15	Logistic system (e.g., logistics information)	5.04	4.89	0.09	-0.01	1.59 +				
16	Customer training services (e.g., vehicle driving, maintenance)	4.49	4.28	-0.40	-0.48	1.38				
17	Route management system (e.g., providing the most economic or the fastest routes)	4.74	4.58	-0.17	-0.27	1.76 *				
18	Truck related information system (e.g., service station location, weather forecast, etc.)	4.54	4.76	-0.33	-0.21	-1.90				
19	Easy to load and unload (e.g., hydraulic lift)	4.63	4.51	-0.28	-0.37	1.51 +	Service	-0.11	-0.17	1.86 *
20	Pre-sale service (sales consultation and professional configuration recommendation)	4.82	4.82	-0.12	-0.11	-0.17				
21	In-sale service (free trial, loans, insurances, truck title processing, etc.)	5.00	4.99	0.08	-0.02	1.71 *				
22	Higher value of the used truck in the second hand market	5.00	5.40	0.05	0.42	-5.54 **	Total Ownership Cost	0.15	0.30	-4.08 ***
23	Out-of-warranty repair options (optional extended warranty services)	5.19	5.33	0.21	0.27	-1.06				
24	Operation cost reduction (e.g., tax reduction provided by local governments, etc.)	5.15	5.25	0.19	0.20	-0.13				

^a One-tailed tests were used to check the possibility that the former was significantly bigger than the latter. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; + $p < 0.10$.

5. Results

Contrary to our predictions, our results show that carrier drivers and owner-operators have similar preferences for 14 out of the 24 sustainable technologies we assessed. This result provides empirical support for the conclusion that organizational buying and individual buying behavior have become more similar [20,21]. At the same time, we found significant differences between these groups in only a few areas. The results add to our understanding of the differences between carriers and owner-operators [62].

With regard to comfort technologies, our results show that owner-operators ($\mu = 0.12$) have a significantly ($p < 0.05$) higher preference than carrier drivers ($\mu = 0.07$), specifically for three out of the eight items in this dimension: interior environment ($p < 0.05$), noise reduction ($p < 0.10$), and interior design ($p < 0.01$). This finding supports H1a and is consistent with our expectation that owner-operators care more about comfort technologies such as spacious cabins and cozy and quiet interior environments that improve their quality of life on the road. This is consistent with recent research conclusions [62].

With regard to the safety dimension, our results reveal that there is no significant ($p > 0.10$) difference between carrier drivers ($\mu = -0.18$) and owner-operators ($\mu = -0.20$) on any of the items; thus, rejecting H1b. We expect owner-operators to be highly concerned about safety features, but profit-maximizing firms may also invest in safety technologies for various reasons, including enhancement of their reputation, which could increase revenue, and reduce administrative costs and costs associated with crashes. Poor safety performance also has negative consequences in terms of higher insurance costs, financial liabilities to the victims of accidents, and loss of corporate goodwill [75]. In such a highly competitive industry with narrow profit margins, any loss stemming from safety deficiencies can have an enormous impact on firms' operations for both carriers and owner-operators. As a result, neither group dares to take the risk of compromising on safety measures. The study findings add to existing research in the importance of emerging safety technologies [5,7,15].

As we expected, owner-operators care more about image than carrier drivers do ($p < 0.05$), but both groups seem to have the same preferences with regard to quality ($p > 0.10$). However, in terms of overall quality and image, the data indicate that there is no significant difference ($p > 0.10$) between owner-operators ($\mu = 0.23$) and carrier drivers ($\mu = 0.28$); thus, rejecting H1c. We know that purchase decisions in organizations are made by decision-making units, which usually involve many individuals from different functions within the organization [20], whereas owner-operators, unlike purchasing professionals, also shop for social and recreational reasons. As a result, owner-operators may be more willing to pay a higher price for or select trucks with a better image. Because they lack the professional knowledge necessary to judge the intrinsic attributes of the product, owner-operators may view product image as an indication of quality and reliability. The similar preference between owner-operators and carrier drivers for quality attributes may be a result of overall improvements in truck quality. With the introduction of advanced sustainable technology and manufacturing and management skills, the quality of trucks produced is likely very similar across manufacturers and is, thus, not a primary concern for either owner-operators or carriers [14,25,33].

We observe that, although they show differences on three items, carrier drivers and owner-operators exhibit no significant difference in preferences on the overall information dimension ($p > 0.10$); thus, rejecting H2a. However, their preferences for information vary, which is in line with TCE. Carrier drivers ($\mu = 0.00$) show a higher preference for the convenience of products ($p < 0.01$) than owner-operators ($\mu = -0.15$), indicating the higher value carrier drivers place on sustainable technological features that can afford convenience during work. Owner-operators care more about logistics systems than carrier drivers ($p < 0.10$), which makes sense, because owner-operators have to rely on manufacturer-provided training to gain familiarity with the product. Owner-operators also care more about route management than carrier drivers ($p < 0.05$), likely because carriers have economies of scale and unified planning, so the importance of route management systems for them is relatively low. These empirical results

enhance our existing knowledge about the differences in preferences for information technologies between carriers and owner-operators [1,3].

With regard to service attributes, we find that owner-operators ($\mu = -0.11$) have a significantly ($p < 0.05$) higher preference than carrier drivers ($\mu = -0.17$); thus, rejecting H2b. The results indicate that the marginal revenue brought by technologies related to services is greater for owner-operators than for carriers [25,27]. There may be several reasons for this counterintuitive result. With the development and updating of technologies, truck manufactures introduce and embody various technologies into trucks at an unprecedented rate. As a result, it becomes harder for owner-operators to learn how to select the right equipment, gain product knowledge, learn how to do maintenance, and so on. In addition, outsourcing all services to professional manufactures, dealers, and service providers not only spares owner-operators from dealing with those trivial issues and keeps them focused on their primary business, but also ensures that service is done in an efficient and cost-effective way. As a result, the high diversity and professionalization of service providers enable them to play an indispensable role in the business chain of the trucking industry.

Finally, we found that carrier drivers and owner-operators differ significantly in their preferences in the TCO dimension ($p < 0.001$), with carrier drivers expressing greater preference in this area. Among the three items used to measure TCO, higher value of the used truck in the secondhand market most significantly differentiates carrier drivers from owner-operators ($p < 0.001$). These outcomes support H2c, which again provides empirical supports for TCE, and our assumption that purchase managers adopt a long-term perspective, rather than a short-term and initial-price perspective, when evaluating purchase situations. The study findings add to existing research in TOC between carriers and owner-operators [28,59,60].

6. Conclusions, Implications, and Future Research

6.1. Conclusions

In this study, we focused on China, the largest manufacturer of medium and heavy trucks that are important for achieving sustainable development goals in the world. Through content analysis of survey responses from participants in the trucking industry, we identified the most influential and popular truck sustainable technologies among truck customers in China. These attributes cover the functional areas of comfort, service, information, safety, quality and image, and TCO. Although buying behavior theory suggests that organizational and individual buyers may differ significantly with regard to their decision-making processes and preferences, our results indicate that organizational (carriers) and individual customers (owner-operators) in the trucking industry exhibit considerable similarities in their preferences. We found differences in only nine of the 24 sustainable technological attribute items; those findings were contrary to our expectations for three of these items (ease to load and unload, logistics system, and route management). These results are not consistent with the predictions of traditional buying behavior theory. In an emerging economy like China's, organizational and individual customer buying behavior is prone to be similar, and any differences in sustainable technology preferences of organizational and individual customers in such countries may not as significant as in developed countries [17,22,23].

6.2. Theoretical Implications

It has long been held by organizational marketing scholars that organizations purchase as rational groups [33,36,76], while consumers buy as willful individuals. The fundamental decision-making processes of buying are widely assumed to be protracted, collective, and rational in organizational contexts [17,33] and prompt, individual, and idiosyncratic in consumer contexts [76]. Organizational buying processes usually involve many individuals who play different buying roles in an organization, such as users, influencers, buyers, deciders, and gatekeepers [17,33,77]. Consumer buying is more leisurely and casual, which reflects the fact that consumers shop for reasons other than just

practical utility [43]. While organizational marketing theory can be applied to explain the differences between organizational and individual buying behaviors in a wide range of industries in developed countries, in our study, we found that organizational and individual customers in China exhibit great similarity in their preferences toward the sustainable technologies of trucks and achieving sustainable development goals. Our research, thus, expands the application of organizational buying behavior theory into the trucking industry in an emerging market [22–24] and shows that the factors affecting organizational buying decisions may play very different roles in an emerging market context [17,22,23]. Our results echo those of other scholars who have identified similarities between organizational buyer behavior and consumer behavior as being related to cultural effects on purchasing behavior, norms governing purchase behavior, and the role of others' expectations on purchasing behavior [22,24,34,38,39,78]. When making purchase decisions, organizations and individuals are becoming more similar in gathering and processing information about alternatives, learning about products available on the market, determining which alternatives best match their potential needs, and making purchases [47].

Previous studies, such as Bowersox et al. [79], suggested that building successful long-term relationships with customers requires understanding that different customer segments have different expectations, needs, and preferences. Recognizing and taking account of these differences is critical to managing sustainable organizational growth and performance for each group. Yet, despite the intuitive appeal of this concept, there have been few empirical studies addressing segmented customers and their specific needs. Thus, in this study, we demonstrated how a segmentation approach can be used to identify and understand differences between carriers and owner-operators in the Chinese context.

6.3. Managerial Implications for Achieving Sustainable Development Goals

Our research findings suggest some practical strategies for business marketing practitioners and managers for achieving sustainable development goals. Each year, truck manufactures spend millions of dollars on R&D to better sustainable technologies and cater to consumers. However, without an in-depth understanding of the real needs of customers, it is almost impossible for truck manufactures to achieve development goals and to satisfy all the needs of all customers, and it is also impossible for the trucking industry to develop sustainably. In our study, we conducted face-to-face interviews throughout the country, and, using content analysis, identified 24 sustainable technologies that are important to customers in China's trucking industry when making truck-purchasing decisions. By focusing R&D resources on these specific sustainable attributes and equipping trucks with those functions, truck manufactures may increase their competitive advantages and achieve sustainable development goals. In particular, based on our findings, we recommend the following:

(1) Truck manufactures do not need to invest too much to differentiate between carriers and owner-operators in China. Although these are two distinct consumer segments for truck manufactures, there are very few differences between them in their preferences for sustainable technologies.

(2) For carriers, it is an effective approach to improve the retention rate of truck drivers by using needs-based segmentation [63]. Our study provides useful information to motor carriers about which sustainable technologies are most valuable to their employee drivers and how the working environment and equipment can be improved so as to reduce turnover rates. Driver turnover has been, and continues to be, a serious problem for many truckload, irregular route motor carriers [75].

(3) In marketing to carriers, truck manufacturers should focus on the sustainable technologies related to TCO and ease of use of truck operating systems. Truck manufacturers should highlight the comprehensive after-sales service network, the guarantee of the supply of spare parts for that type of truck, and higher market share and retention rate, which will improve the value of the trucks in the secondhand market. They should also emphasize improving the trucks' operating systems in the production process to make the truck more convenient for drivers to operate, which will help to improve drivers' work efficiency and job satisfaction.

(4) When marketing to owner-operators, truck manufacturers should emphasize sustainable technologies related to comfort and additional services. They should highlight improvements in truck interior environments, such as increased softness of driver seats, expanded space for drivers to move, and additional humanized designs that can meet the physiological needs and alleviate the fatigue of drivers. In addition, truck manufacturers can highlight improvements in truck start systems, which reduce the noise generated during truck operation and create a quiet driving environment. They should also emphasize enhancements to the purchase and use experiences of owner-operators, such as improved loading and unloading functionality and function and operation guidelines that are easier to understand.

6.4. Limitations and Future Research

Our results suggest several avenues for further research. First, in this study we used data from the truck industry in China. Future work should consider other emerging markets and mature markets to conduct comparative cross-country investigations. Second, our study explored only the similarities and differences between carrier drivers and owner-operators in their preferences for sustainable technologies in the trucking industry in China. It would also be interesting to explore how these two consumer segments moderate the impact of sustainable technologies on the performance of truck manufacturers. Finally, further study is needed to ascertain how our results may be affected by other variables, such as different market types (emerging markets and mature markets), gender, family characteristics, and personal proclivities.

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Appendix A

Appendix A.1 International Survey on Trucking Industry

If you purchase another truck, how willing are you to pay for the following features in a truck? Please choose a number between 1 and 7: (1 = not at all willing to spend money for the feature; 4 = somewhat willing; 7 = very willing to pay for the feature).

Table A1. Please answer the following questions regarding purchase.

Sustainable Technology Items	Not at All Willing							Very Willing						
1. Human engineering (comfortable driving; less tiring; easy to operate)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2. Driver assistant (e.g., GPS)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3. Interior environment (air quality, storing space, and layout of operation equipment)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4. Noise reduction system (e.g., quiet in high speed)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5. Ride comfort (e.g., comfortable seating and the driving, less turbulence driving, good shock absorption)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6. Rest comfort (e.g., spacious and adjustable seats, better entrainment features such as internet, music, refrigerator, etc.)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7. Vehicle's agility (e.g., easy to steer wheel and to make turns, etc.)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8. Interior design (e.g., cozy and artistic)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9. Easy to load and unload (e.g., hydraulic lift)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10. Logistic system (e.g., logistics information)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11. Convenience in work (e.g., self-diagnoses, electronic fleet management)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12. Route management system (e.g., providing the most economic or the fastest routes)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13. Image (e.g., modern and beautiful design, neat wiring arrangements)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14. Truck related information system (e.g., service station location, weather forecast, etc.)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15. Quality (e.g., high reliability, high quality, good workmanship, etc.)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16. Operation cost reduction (e.g., tax reduction provided by local governments, etc.)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
17. Higher value of the used truck in the second hand market (the value of two years old trucks is higher than 50% of the original price)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
18. Pre-sale service (sales consultation and professional configuration recommendation)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
19. In-sale service (free trial, loans, insurances, truck title processing, etc.)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
20. Out-of-warranty repair options (optional extended warranty services)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
21. Customer training services (e.g., vehicle driving, maintenance)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
22. Security management system (e.g., anti-theft devices)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
23. Cargo safety management system (e.g., anti-theft and loss prevention of cargo)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
24. Mayday system (e.g., SOS, emergency aid system)	1	2	3	4	5	6	7	1	2	3	4	5	6	7

Table A2. Please provide the following information.

1. How long have you been a truck owner?
2. How long have you been a truck driver?
3. Type of Driving License Light Truck Middle Truck Heavy Truck
4. What is the main use of your truck City Distribution Long-distance Transporting Goods
 Short-distance Transporting Goods Special Project (such as constructions, mining, etc.)
5. I am: Owner; Partners; Purchasing Director; Marketing Director; Business Director; Others
6. How can a truck company help you make more money?
7. What can a truck company do for you so that you will switch to buy their truck?

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