



RESEARCH ARTICLE

The Influencing Factors Affecting Customers' Willingness to Pay for Green Agricultural Products via E-Commerce Live Streaming: Testing the Moderating Role of Ascription of Responsibility

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This study explores the determinants of willingness to pay for green agricultural products via live streaming platforms. By integrating the Technology Acceptance Model (TAM) and Norm Activation Theory (NAT), we analyze factors such as health consciousness, environmental concern, perceived usefulness, perceived ease of use, attitude, and ascription of responsibility. Utilizing Partial Least Squares Structural Equation Modelling (PLS-SEM) and SPSS, we evaluate data collected from Chinese consumers who have engaged with e-commerce live streaming of green products. The findings indicate that health consciousness and environmental concern significantly enhance perceived usefulness, which in turn positively affects attitudes toward purchasing green products. Additionally, perceived ease of use also contributes positively to these attitudes. A positive attitude toward live streaming platforms significantly increases the willingness to pay a premium, with ascription of responsibility strengthening this relationship. These findings provide insights for optimizing marketing strategies and product offerings to boost the market share of green agricultural products

1. INTRODUCTION

With the overall spread of the "Internet plus" era, the online shopping market has become increasingly influential in the global economy. Especially in rural areas, the improvement of infrastructure, the progress of information technology, and the continuous optimization of national e-commerce support policies have jointly driven the vigorous rise of e-commerce models for green agricultural products in some regions of China. In recent years, e-commerce live streaming, as a new favorite of online shopping, has rapidly emerged in China and become a key force leading the trend of online shopping. The anchors showcase the entire process of agricultural products from the fields to the dining table from a first-person perspective, allowing consumers to have a deeper understanding and recognition of the quality and value of green agricultural products (Hong, Hoo, 2022). In addition, live streaming platforms provide consumers with richer experiences and communication spaces, creating an active community atmosphere and further enhancing consumers' willingness to purchase. Many mainstream e-commerce platforms have laid out their presence in the live streaming field, providing strong support for the rapid development of green agricultural product e-commerce models. The extensive promotion and application of this model has effectively promoted the process of agricultural modernization and improved the level of infrastructure and public service capacity in rural areas; Improved the livelihood conditions of farmers, increased their income, and raised their living standards; And by promoting the transformation and upgrading of rural industries, achieving the strategic goals

of rural revitalization, and assisting in the construction of beautiful countryside and the achievement of a comprehensive well-off society.

In China, environmental issues are receiving attention, and consumers are gradually realizing the role they play in solving environmental problems (Statista, 2021). Although more than half of consumers have this understanding, the Chinese green agricultural product market still faces challenges (Zheng et al., 2022). The key issue is that the high prices of green agricultural products have suppressed market demand (Yang et al., 2021; Zheng et al., 2022). Researchers have found that although consumers express high environmental awareness and are willing to pay additional fees, their actual purchasing behavior fails to reflect this willingness. This attitude behavior gap is evident in the green agricultural product market. In developed economies, consumers are usually willing to pay a premium for low-carbon agricultural products, but in China, this market phenomenon is not yet significant, mainly because the low-carbon agricultural market in China is still in its infancy, the transaction scale is relatively small, and consumers' awareness and acceptance of green agricultural products still need to be improved (González-Rodríguez et al., 2020). In addition, there is a lack of effective solutions in the live streaming e-commerce market to narrow the gap in consumer attitudes and behaviors towards green agricultural products. How to ensure green quality, reduce costs, enhance market competitiveness, and attract more consumers is a problem that needs to be solved in the Chinese green agricultural product market.

Some researchers have investigated the influence of e-commerce on the market dynamics of green agricultural products. James et al. (2017) contended that digital sales channels for these eco-friendly products significantly bolster market competitiveness and amplify brand visibility. Conversely, Ma et al. (2022) observed that the green agricultural sector in China faces unique challenges due to its relatively nascent emergence, citing an evolving yet incomplete legal framework governing online sales as a primary hurdle. Scholars have examined various dimensions of this emerging market, including the trajectory of the green product online retail industry (Setterstrom, Michael, 2019), innovative e-commerce business models (Yingjie et al., 2023), integrated cold chain logistics (Alhaimer, 2022), and consumer predilections for purchasing green products online (Bölen, Özen, 2020).

Nevertheless, although the effect of e-commerce was demonstrated, little attention has been paid to the unrealized potential of live streaming for marketing green agricultural products. In addition, there is still limited research on factors influencing customers' willingness to pay (WTP) green agricultural products online. There are generally three dimensions on the WTP green agricultural products on e-commerce platforms. The first dimension considers individual demographic characteristics such as gender, education, income, age, and marital status, as these factors have been found to significantly influence WTP (Cai et al., 2020; Konuk, 2019). The second dimension encompasses internal psychological factors, including social influence, peer effects, perceived risk and perceived enjoyment, which are critical in shaping consumers' WTP (Güney, Giraldo, 2020; Khan et al., 2019; Konuk, 2018). Lastly, external contextual factors such as the market environment (sales promotion, interactive entertainment, quality assurance, and storage cost), and policies have been analyzed for their impact on the consumers' willingness to pay (Jorge et al., 2020; Lu et al., 2022; Ngah et al., 2020; Setterstrom, Michael, 2019).

However, health factor (customers' health consciousness) and pro-environmental factors (environmental concern and ascription of responsibility) are ignored. Health consciousness reflects the degree to which individuals incorporate health considerations into their daily decision-making (Tan et al., 2022). In Xu et al.'s study (2020), the relationship between consumers' pursuit of health concepts and product selection was explored, emphasizing that consumers who pursue a healthy lifestyle are more inclined to choose beneficial and healthy products, which often overlap with green or organic products. Shah et al (2021), validated the relationship between consumer health awareness and preference for organic food, and pointed out that altruism is also a reason why consumers pay for green products, considering the impact of the environment and others. Ho et al(2022). found that consumers who are concerned about environmental issues are more likely to participate in recycling, energy conservation, and

purchasing green products. The research by Hao and Chen Yue (2021) also confirms the positive impact of environmental issues on consumers' attitudes and willingness to purchase environmentally friendly products. However, there is limited research on these impacts in the context of live streaming commerce. The characteristics of live streaming commerce attract consumers, but how to effectively convey health and environmental awareness still needs to be addressed. Future research needs to focus on the performance and mechanisms of these factors in live streaming commerce, in order to provide support for promoting green consumption.

The Technology Acceptance Model (TAM) is a theoretical framework proposed by Davis in 1989, mainly used to predict and explain users' acceptance and subsequent adoption behavior of new technologies. The TAM model has been widely applied in fields such as e-commerce, online shopping, mobile e-commerce, and online gaming, revealing that users decide whether to adopt new technologies and generate purchasing behavior based on perceived usefulness and ease of use. In green product market research, the TAM model can analyze the effectiveness of live streaming sales in promoting green products (Wang et al., 2022). If live streaming activities effectively convey the value and advantages of green products, enhance users' sense of contribution to environmental protection and sustainable lifestyles, the perceived usefulness will be improved; If the live streaming process is simple and clear, the information presentation is friendly and intuitive, and users can quickly grasp and effectively use the live streaming channel to obtain green product information, then the perceived ease of use will be enhanced. Two major factors will directly affect users' acceptance, purchase intention, and behavior towards live streaming sales of green products, thus testing the successful impact of live streaming on the green product market. However, most studies which researched online consumer behavior applying TAM merely considered the logical and conscious decision-making process, ignoring customers' intrinsic psychological factors (personal belief) as well as external social factors (peer-group) impacting on the behavior (Venkatesh et al., 2022). Therefore, this study adds health consciousness and environmental concern as prerequisite of perceived usefulness to complete TAM.

The theory of attribution of responsibility (NAT) plays a central role in the field of green consumption, emphasizing that when individual behavior is linked to their subjective sense of responsibility for the outcome, people are more willing to participate in prosocial behavior (Schwartz, 1973). Afsar et al. (2020) investigated the relationship between responsibility attribution and consumer behavior in the context of green consumption within this theoretical framework, and proposed that consumers' sense of responsibility attribution may inspire them to adopt positive and sustainable behaviors to reduce adverse environmental impacts. Scarpi et al.'s study (2023) confirmed this viewpoint and found a significant positive relationship between sense of responsibility and willingness to pay for eco-friendly hotels. When consumers recognize their environmental responsibility and impact, they are willing to pay additional fees to support environmental actions, believing that investing in environmental protection is a moral choice and a responsible behavior. Furthermore, McCullough and Trail (2023) highlighted AR's pivotal role in shaping consumer behaviour in pursuit of a low-carbon society. While a number of studies have identified ascription of responsibility as a strong predictor of behaviour (Nordlund, Garvill, 2003; Steg, de Groot, 2010), no studies have empirically examined its role as a moderator between attitude and WTP. Cheng et al.'s study (2021) showed that when leaders fulfill their duties, they focus on the economic benefits and social responsibility of the enterprise, seek to balance the needs of various stakeholders, and enhance the reputation and image of the enterprise (Steg et al., 2005). Ariestingsih et al.'s study (2018) showed that attribution of responsibility has an impact on individual behavior, regulating the relationship between mutual trust and recycling behavior. When individuals have a sense of social and environmental responsibility, they are more inclined to follow values and moral beliefs, and actively participate in recycling activities. Therefore, ascription of responsibility is added as moderator between attitude and WTP to provide a more comprehensive view from pro-environmental perspective.

In order to further explore the behavioral motivations and decision-making processes of consumers purchasing green agricultural products on live streaming platforms in current

research, this study systematically proposes three key empirical research questions: (1) What impact do health issues and environmental awareness have on consumers' perceived usefulness of purchasing green agricultural products on live streaming? (2) How do customers' perceived usefulness and ease of use of live shopping affect their shopping attitudes? (3) Does consumer attitude affect WTP green agricultural products in live broadcasts through the moderating effect of responsibility attribution?

This article takes the Technology Acceptance Model (TAM) as the basic framework and analyzes in detail how consumers' perceived usefulness (influenced by health issues and environmental awareness) and perceived ease of use of green agricultural products shape and affect their shopping attitudes when facing live shopping scenarios. Meanwhile, the study further explored how the psychological factor of responsibility attribution plays a moderating role between consumer attitudes and willingness to purchase green agricultural products during live broadcasts. To obtain accurate data, this study conducted a questionnaire survey among Chinese consumers who have watched green agricultural product e-commerce live broadcasts for more than six months through online distribution. To ensure the validity and reliability of the survey results, Cronbach's Alpha and other analytical methods will be used to check for reaction bias based on the various live streaming platforms used by the respondents. Through rigorous analysis of recycling data, this study helps businesses better understand consumers' acceptance and purchase intention of green agricultural products in live streaming scenarios, providing strategic recommendations for business managers to strengthen marketing effectiveness on live streaming platforms, enhance the attractiveness and market share of green agricultural products among Chinese consumers.

2. LITERATURE REVIEW

This section reviews literature related to live streaming applications, customer themes, and WTP, covering multiple fields such as marketing, consumer behavior, digital economy, and new media. Through analysis, we have sorted out the development of live streaming marketing, customer purchasing behavior, the impact of live streaming on product promotion and service optimization, as well as consumers' acceptance and satisfaction with live streaming content. Summarize and extract key academic viewpoints and practical inspirations, provide reference for enterprise marketing strategies in the current market environment, and promote work innovation and development.

2.1 Green agricultural products

Green agricultural products, defined by their environmentally sustainable production methods, emphasize reducing the environmental impact of agriculture while promoting health and safety. The importance of green agricultural products extends beyond environmental benefits, contributing to the well-being of consumers by offering food free from chemical residues, thereby reducing potential health risks associated with conventional agricultural practices (Ma et al., 2022).

In this article, green agricultural products refer to environmentally friendly agricultural products (Zheng et al., 2023), including those that have obtained green food certification and organic certification. Unlike the pollution-free certification, which emphasizes ensuring basic food safety, green food and organic certifications focus more on controlling production practices and their environmental impacts (Zhang et al., 2015).

The study on the willingness to purchase green agricultural products reveals multiple key points. Early research has shown that consumers have a strong willingness to purchase green agricultural products and are willing to pay additional fees. This is due to the increasing awareness of environmental protection, consumers are concerned about food safety and health, and tend to choose agricultural products that are free of chemical residues, environmentally friendly, and harmless to health (Li et al., 2022; Han et al., 2018). With the improvement of agricultural product quality, consumers' sensitivity to certification decreases, that is, the positive impact of certification on prices weakens (Xue, Li, 2022). This may be due to consumers'

increased trust in the quality of agricultural products and their emphasis on the overall quality experience. In addition, factors that affect consumers' purchase intention include marketing factors such as food safety concerns, product understanding, appearance, packaging design, and brand reputation (Brown et al., 2011). These factors work together to form a comprehensive cognitive framework for consumers towards green agricultural products. Individual characteristics of consumers, family traits, level of awareness, and product pricing are major factors influencing purchasing behavior (Pan et al., 2021). Additionally, consumption of green agricultural products significantly enhances subjective well-being (Zhong, Chen, 2019), and there is a notable substitution effect between green labels and traceability labels, as well as between green labels and animal welfare labels (Anuga et al., 2020). There are significant differences between the purchase intention and actual purchase behavior of domestic and foreign consumers in the field of green agricultural products, with high purchase intention and low actual purchase rate coexisting. There are multiple factors that affect the difference between purchase intention and actual purchase behavior, including price, income, education, food safety awareness, green awareness, purchasing convenience, and difficulty in distinguishing products (Chen et al., 2020).

The e-commerce model has a profound impact on consumer behavior research, forming a new focus. There are three types of existing research: the first type explores the factors that consumers consider when choosing online and offline shopping. The reduction of transportation costs and the convenience of product delivery have lowered the threshold for online shopping, attracting more consumers; Additional postage and uncertainty about product quality may hinder online shopping. Consumers' willingness to shift from offline to online is influenced by perceived switching costs and product risks (Ma et al., 2018).

The second type of research analyzes the unique characteristics of the e-commerce market and its impact on consumer behavior. The e-commerce market promotes new consumption models such as "bundled sales of agricultural products" and "delayed consumer pre orders", which are not common in traditional markets (Vinholis et al., 2021). The e-commerce market is conducive to cultivating consumer loyalty to channels and brands. Saving time is an important factor in attracting consumers to shop online, and it is encouraged to choose low-cost search methods, such as referring to "past purchase lists", to reduce brand search costs (Xue, Li, 2022). The way products are displayed in the e-commerce market affects consumer purchasing decisions and significantly reduces the purchase of unhealthy foods.

The third type of literature focuses on unique information search and adoption behaviors in the e-commerce market. Digital footprints are easy to collect and analyze, allowing researchers to track consumer product search behavior. Research has found that the majority of consumers (95%) prefer to search through navigation windows and make decisions based on image information after product pages (Zheng et al., 2023). Information perception, satisfaction, platform security, and technology influence consumers' willingness to adopt information, and this willingness is positively correlated with adoption behavior (Pan et al., 2021).

Existing research has measured the differences in consumer willingness and behavior towards green agricultural products, explored influencing factors, and compared the differences between e-commerce and traditional markets in promoting the consumption of green agricultural products. However, there is relatively little research on the combination of e-commerce and green agricultural product consumption, analyzing the impact of on-site e-commerce on the willingness to purchase green agricultural products. This combined research will help to understand the role of on-site e-commerce in promoting the consumption of green agricultural products and provide useful references for the future.

2.2 Factors affecting willingness to pay

WTP is commonly defined as the measure of a customer's pricing power, reflecting the extent to which they value and are ready to exchange resources for a product or service perceived as beneficial (Konuk, 2019; Rihn et al., 2019). In the context of live streaming, WTP might be regarded as the amount users are willing to pay above the base cost for added values such as

premium content, sustainability assurances, and enhanced streaming experiences (Doran et al., 2015). Thus, for the purposes of this study, WTP will be conceptualized as the degree to which consumers are prepared to pay for the enhanced experience and additional features offered by green agricultural products within live streaming platforms (Ma et al., 2022).

Scholarship on WTP has traditionally focused on tangible goods and services, such as environmental commodities (Cai et al., 2020) and green electricity (Setterstrom, Michael, 2019). It has also been a vital concept for marketing professionals in establishing price-related market barriers (Ali, Bhasin, 2019). However, research on WTP in online platforms, such as live streaming, remains underexplored (Dong et al., 2022). Unlike physical retail, online platforms offer indirect contact between customers and products, which challenges consumers who are accustomed to using all five senses for product evaluation. Therefore, identifying critical antecedents to purchasing and usage behaviour in the online context—especially for intangible services like live streaming green agricultural products—is imperative.

In the context of live streaming commerce, the conventional sensory engagement experienced in the physical retail of agricultural products is absent, making the prediction of consumers' willingness to pay (WTP) for green agricultural products less straightforward. Unlike the tangible interaction with products in physical stores, WTP within live streaming platforms is largely dependent on perceived intangible benefits. There is a notion that consumers exercise a greater degree of autonomy when purchasing through live streaming, making independent decisions without the persuasive presence of sales representatives (Yang et al., 2021a).

The willingness to pay (WTP) in online markets, particularly live streaming platforms, has emerged as a critical area of interest in recent academic discourse. Researchers have sought to understand the drivers behind consumers' valuation of products and services offered in this virtual environment. WTP is often influenced by several key factors including perceived value, trust, and the experience provided by the platform (Chinh et al., 2021).

Studies by Yang et al. (2021) suggest that in the domain of live streaming, the interactivity and real-time engagement with the audience significantly elevate the customers' social influence, thereby influencing WTP. Because consumers often willing to pay more when they feel a sense of community and connectedness, as found in the live streaming contexts (Meng, Lin, 2023).

Another vein of research has explored the impact of influencer endorsements within live streaming platforms on WTP. According to Yang et al. (2021), influencers can serve as trust agents, reducing perceived risk and encouraging higher WTP among viewers. Additionally, the perceived expertise and authenticity of the influencer have been shown to positively correlate with viewers' WTP (Davidovic et al., 2020).

The exploration of online behaviour has not been limited to media consumption but extended to online shopping environments, where research has aimed to pinpoint variables that sway WTP within e-commerce settings (Alhaimer, 2022). Within the realm of live streaming, similar factors are considered, though the research is still nascent. Studies have highlighted the challenges in the live streaming sector, where consumers are unable to use sensory evaluation, thus live streaming platforms should facilitate their technology construction to increasing information transparency and consumer trust (Wang, Wu, 2019).

3. THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

3.1 Technology acceptance model

The Technology Acceptance Model (TAM) is an important theoretical framework in the fields of information science and information systems, mainly used to explain and predict users' acceptance of information technology and their subsequent behavioral intentions and actual behaviors. This model emphasizes two core beliefs: perceived ease of use (PEOU) and perceived usefulness (PU) (Davis, 1989). Perceived usefulness (PU) refers to an individual's subjective belief that using a specific information system or technology can improve their work efficiency, quality of life, or achieve personal goals. This perception affects whether users are willing to

spend time learning and frequently using the technology, as well as the likelihood of making adoption decisions when faced with alternative technology solutions. Perceived ease of use (PEOU) refers to users' subjective evaluation of the difficulty level of operating a certain information system or technology (Chi, 2018). High perceived ease of use means that users do not need to spend too much effort adapting and learning new technologies, which not only lowers the threshold for users to use, but also largely determines their long-term willingness and actual frequency of use of technology. In empirical research, many scholars have conducted extensive and in-depth studies on different scopes and types of information systems based on the fundamental framework of the Technology Acceptance Model (TAM) (Davis, 1989). With the rapid development of Internet economy and the popularization of e-commerce applications, the influence of TAM model has further expanded to the online shopping field (Chi, 2018). With the help of this model, researchers analyzed consumers' acceptance and willingness to use various Internet technologies (Agag, El-Masry, 2016). In addition, the TAM model has also played a guiding role in practice, helping enterprises and organizations optimize product design, improve service quality, and develop effective marketing strategies (Shang, Wu, 2017). By gaining a deep understanding of users' PU and PEOU, enterprises can innovate products based on potential demand, improve user experience (Anh et al., 2024), enhance product market competitiveness, and promote effective promotion and application of information technology (Naz et al., 2023). Additionally, TAM has been employed in studies related to Willingness to Pay (WTP) for various products, including green agricultural products (Dong, Wang, 2018), demonstrating its suitability for the present investigation.

Despite TAM's widespread adoption in the IT/IS acceptance literature, scholars have criticized its narrow focus on system usage, overlooking variables that could significantly predict IT/IS use (Anh et al., 2024). Especially, in the context of live streaming platforms, interactions are dynamic, and the decision-making process is potentially more complex (Dong, Wang, 2018).

TAM focus more on the logic and conscious decision processes that individual used when interacting with technology, but it ignores the inner psychological factors: emotion, personal view, and external social factors: cultural, peer-group (Venkatesh, 2000). So this study focus more on prerequisite of perceive usefulness. This study aims to extend TAM by integrating it with the Norm Activation Theory (NAT). This integrated approach seeks to offer a more comprehensive explanation and prediction of consumer behaviours related to willingness to pay (WTP) a green premium, considering not only the rational assessments of technology acceptance but also the altruistic and social influences that drive sustainable consumer behaviours in live streaming contexts.

Previous studies have shown that introducing external variables can significantly enhance the predictive performance and accuracy of the Technology Acceptance Model (TAM) (Sun, Zhang, 2021). When evaluating the adoption and usage behavior of new technologies and products, multidimensional influences such as external environment, individual differences, and socio-cultural backgrounds should be considered. Given the importance of the green agricultural product market and the correlation between environmental issues and health, researchers have incorporated environmental concerns and health awareness into the TAM model (Hua, Wang, 2019). This helps to understand users' acceptance of green technology and emphasizes the value of addressing environmental issues and raising health awareness for technological development and social progress.

3.2 Norm activation theory

The Norm Activation Theory (NAT) is a foundational framework within environmental psychology, developed by Schwartz in 1977 to explain individuals' motivations and behaviors towards pro-environmental actions. This theory has become prominent for its focus on the psychological processes that drive environmentally responsible behavior, positing that such behavior is influenced by individuals' awareness of environmental issues, personal norms, and perceived responsibility (Schwartz, 1973).

NAT has been extensively applied across various disciplines, particularly in studies on environmental conservation, sustainable practices, and green consumerism (Anh et al., 2024; Liu et al., 2019). Researchers have used NAT to investigate consumers' intentions and behaviors related to environmentally friendly products and practices, including the willingness to pay a premium for green agricultural products (Chou et al., 2020; Wibowo et al., 2020). Furthermore, NAT has been employed to explore individuals' engagement in eco-friendly behaviors in diverse contexts, such as household recycling, energy conservation, and transportation choices (Rita et al., 2019).

Despite its utility, NAT has certain limitations that warrant consideration. One significant limitation is its narrow focus on individual-level factors, which often overlooks broader contextual influences and structural barriers that may impact pro-environmental behaviors. Additionally, the application of NAT to emerging phenomena, such as consumer behavior on online platforms like live streaming, remains understudied.

Although the NAM model has demonstrated its ability to predict and explain individual behavior in multiple fields, it appears overly simplified when dealing with complex behavioral motivations (Ki, Kim, 2016).

The Normative Activation Theory (NAT) provides a valuable framework for understanding individual environmental behavior, but it has limitations (Confente, Scarpi, 2021; Park, Ha, 2014). This study combines the NAT and TAM (Technology Acceptance Model) to explain the customers of green agricultural products from an eco-friendly perspective. This research design not only helps to reveal the inherent mechanism of the green agricultural product market, but also provides richer theoretical basis and practical guidance for relevant enterprises to optimize product design and marketing strategies, thereby effectively promoting the popularization of environmentally friendly consumption behavior and achieving sustainable development goals.

3.3 Hypotheses development

The TAM and NAT provide theoretical support for current research. This study is based on two theoretical frameworks to explore multiple key factors that influence consumers' perception of green agricultural product WTP in live streaming scenarios, as well as the moderating effect of responsibility attribution. These factors include health awareness, attention to environmental issues, usefulness and ease of use of live streaming platform information perception, and attitudes towards green agricultural products. System analysis reveals how these factors interact and affect purchase intention, providing theoretical basis and practical guidance for the promotion and sustainable development of green agricultural products in the market.

3.3.1 Health awareness and environmental concern as predictor of perceived usefulness

Health consciousness reflects an individual's awareness and proactive attitude towards their health and well-being (Lu et al., 2022). Health-conscious consumers may perceive such platforms as more useful due to the direct access to healthier, environmentally friendly food options (Yadav, Pathak, 2017). By aligning their health priorities with their purchasing decisions, they are likely to find platforms that facilitate access to green products as enhancing their ability to maintain a healthy lifestyle, thus perceiving them as more useful (Tan et al., 2022).

Therefore, the core objective of this study is to analyze how environmental awareness and health awareness independently and interactively affect consumers' perceived usefulness of purchasing green agricultural products on live streaming platforms.

This study will focus on exploring the following causal relationships:

H1: Health awareness has a positive impact on the perceived usefulness of purchasing green agricultural products on live streaming platforms.

Environmental consciousness is hereby conceptualized as the degree to which individuals incorporate environmental considerations into their daily decision-making processes, particularly in their consumption habits (Lin, Huang, 2012; Sharma, Bansal, 2013).

Environmental concern, characterized by an individual's awareness and apprehension regarding environmental issues and their willingness to engage in behaviours that mitigate adverse environmental impacts, plays a crucial role in shaping consumer preferences and behaviours towards sustainable products (González-Rodríguez et al., 2020). Despite the burgeoning interest in how digital engagement platforms like live streaming can influence purchasing decisions for green products, research remains scant on how these platforms' perceived usefulness is affected by consumers' environmental and health consciousness (Hameed et al., 2021; Hosta, Zabkar, 2021). This gap is critical as understanding the perceived usefulness of live streaming technologies in promoting green agricultural products could significantly enhance engagement strategies and consumer willingness to pay a premium for such products. Therefore, this study hypothesizes:

H2: Environmental concern has a positive effect on perceived usefulness of purchasing green agricultural products in live streaming platforms.

3.3.2 Perceived usefulness and attitude

The optimistic effects of perceived usefulness (PU) on consumer behaviour have been confirmed in many information systems studies. TAM theorizes that PU is one of the two fundamental beliefs that influence the desire of the user to adopt the technology (Davis, 1989). PU has been defined as "the degree to which an individual is confident that using a specific system would improve his or her job performance" (Davis, 1989). Users who consider the information system to be important and helpful will have a favourable stance towards it. The effect of PU on technology acceptance, satisfaction, continued usage, and intentional behaviour has been verified in numerous previous research (Kanchanatane et al., 2014; Purnawirawan et al., 2012). In most innovation technology studies, it is believed that if an individual perceived that the technology saved them the effort to complete a task, then the PU of that technology will increase.

Makmor et al. (2019) indicated that PU did not improve the desire of customers to shop using mobile devices, although it directly affects attitude, suggesting that users would buy the technology even if it had no special advantages. In the realm of e-commerce, Sun and Zhang (2021) established the foundation by positing that PU significantly affects users' attitudes toward using technology, which in turn influences their actual usage. This has been extended by Marquez et al. (2020), who examined how PU influences online shopping intentions, demonstrating that consumers' perceptions of the usefulness of online shopping platforms positively affect their attitudes toward shopping online. Xie et al. (2023) investigated the factors affecting users' loyalty to live streaming platforms and found that PU, among other factors, positively impacts users' attitudes towards these platforms. Their research suggests that when users perceive live streaming services as useful, their satisfaction and continued usage intention increase.

Regardless of the significant usefulness regarding convenient shopping, customers' purchasing intention may not transfer into WTP (Basuki et al., 2022). It is, therefore, still unclear whether or not the live streaming platform's usefulness is among the factors used to make a purchase decision for green agricultural products. In this study, following the TAM theory, PU is tested towards the attitude to WTP. Hence, the next assumption is thus established:

H3: Perceived usefulness has a positive effect on attitude to purchasing green agricultural products in live streaming.

3.3.3 Perceived ease of use and attitude

Perceived ease of use (PEOU) is another key factor that is inversely associated with the amount of effort required to learn new technology. Davis (1989) defined PEOU as "the degree to which a person believes that using a particular system would require minimum effort." It is also described as the degree to which the customer thinks such technology should be effortless and simple to understand or perform (Prastiawan et al., 2021; Rahmiati, Yuannita, 2019).

PEOU has been found to significantly influence consumer attitudes towards online shopping, with ease of navigation and user-friendly interfaces contributing to more favorable attitudes and

increased purchase intentions (Basuki et al., 2022). Studies specifically examining e-commerce platforms demonstrate that when users perceive a system as easy to use, they are more likely to develop positive behaviours toward online purchasing, contributing to an overall efficient and satisfying shopping experience (Lien et al., 2021). Within mobile commerce, research has found that PEOU directly impacts the behavioural intention to use mobile shopping apps, suggesting that optimizing mobile app usability is crucial for enhancing user engagement and increasing sales (Marquez et al., 2020; Xie et al., 2023). In live streaming contexts, user-friendly interfaces and seamless interaction mechanisms are crucial for encouraging viewer participation, fostering positive attitudes towards the platform, and enhancing the overall user experience, thereby increasing the likelihood of purchasing behaviour and continuous platform use (Basuki et al., 2022).

Despite the extensive research on the relationship between PEOU, attitude, and WTP in various contexts, gaps and inconsistent findings persist that justify further investigation in the domain of live streaming for green agricultural products. For instance, while Xie et al. (2023) identified a direct impact of PEOU on the usage intentions for live streaming platforms, they found it did not necessarily translate to a willingness to pay. Similarly, the findings by Marquez et al. (2020) suggest a significant influence of PEOU on the intention to use online e-commerce platforms for shopping, implying that this relationship might vary significantly across different types of applications and user contexts. Therefore, based on the discussion above, it is critical to determine how PEOU impacts the consumer's attitude in terms of willingness to pay for green premium in live streaming. Given the above, the following hypothesis is posited:

H4: Perceived Ease of Use has a positive effect on attitude to use live streaming platforms to purchase green agricultural products.

3.3.4 Attitude and willingness to pay

Attitude changes emerge from the attitudinal-behaviour theory family that includes the TRA, TPB, and TAM (Davis, 1989). Attitude is described as the psychological affinity and positivity of consumers in clarifying their assessments and convictions (Ajzen, 1991).

There is an extensive volume of distributed studies that describe the role of attitude in the context of online market studies. A strong relationship between attitude and behaviour (either intentional behaviour or actual behaviour) has been reported, showing the impactful and positive effect of attitude on individual behaviour (Baldi et al., 2021; Qian et al., 2021). Prior studies that have noted the importance of attitude and behaviour have focused on e-commerce (Sadiq et al., 2023), online content consumption (Purnawirawan et al., 2012); and mobile e-commerce (Cai et al., 2020). In the domain of e-commerce, Ahmad et al. (2022) found that consumer trust, a component of overall attitude, plays a pivotal role in determining WTP. The research suggests that a positive attitude towards online shopping platforms increases consumers' WTP. Similarly, Al-Rahmi et al. (2021) corroborates the importance of perceived usefulness and ease of use, key factors of the Technology Acceptance Model (TAM), in forming a favorable attitude that enhances WTP in online environments. Regarding mobile e-commerce, Sarkar and Khare (2019) noted that consumers' attitudes towards the convenience and accessibility of mobile shopping platforms positively affect their WTP. Additionally, Wang et al. (2022) observed in their study of online games that the enjoyment and satisfaction derived from the game influence the players' attitudes, which in turn impacts their WTP for in-game purchases and subscriptions.

Despite the numerous publications on this subject, most have failed to address how attitude, in regard to WTP premium for green agricultural products, applies specifically in the live streaming context. Therefore, this study describes attitude as the customer's positive view of paying a higher price for green agricultural products showcased on live streaming platforms (Wang, Wu, 2019). If a customer has a favorable feeling about shopping green agricultural products in live streaming, their desire to pay green premium will be greater. Therefore, this study proposes that:

H5: Attitude to use live streaming platforms to purchase green agricultural products has a positive effect on a customer's willingness to pay a premium for green agricultural products in live streaming.

3.3.5 Ascription of responsibility as moderator

Ascription of responsibility is a pivotal construct in the Norm Activation Theory (NAT), positing that individuals are more likely to engage in pro-social behaviour, such as purchasing green products, when they feel a sense of responsibility towards the outcomes of their actions (Schwartz, 1973). Notably, prior investigations have underscored AR's impact on green consumption behaviours and WTP in various domains. Confente and Scarpi (2021), McCullough & Trail (2023) and Scarpi et al. (2023) suggested AR's potential to shape green conservation actions among consumers. Ariestiningsih et al. (2018) unveiled a meaningful and robust linkage between AR and the propensity to spend more for environmentally friendly lodging options, emphasizing AR's influence in green hotel preferences. Hiller et al. (2021) highlighted AR's critical role in fostering a willingness to invest in initiatives that contribute to a reduced carbon footprint, advocating for its significance in promoting sustainable behaviours. Moreover, Dong and Zhong (2022) presented the notion that AR serves as a catalyst for adults in the workforce to show a greater inclination towards investing in sustainable architectural projects, underscoring AR's impact across different domains of green consumption. However, the exploration of AR's role in shaping WTP for green agricultural products via live streaming remains scant.

Additionally, while existing scholarship has consistently affirmed AR as a significant determinant of behaviour (Koleva et al., 2023; Onel, 2024), its moderating function has not been empirically tested, especially in context of live streaming. Therefore, this study hypothesizes:

H6: Higher ascription of responsibility will strengthen the positive relationship of customers' attitude to use live streaming platforms to purchase green agricultural products on the willingness to pay for green agricultural products in live streaming.

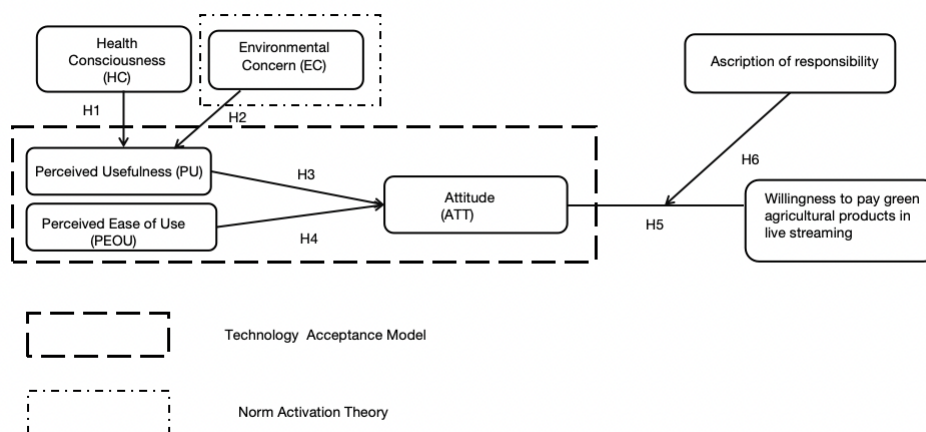


Figure 1: Presents the conceptual framework and summarizes the proposed hypotheses in our study.

4. EMPIRICAL METHODOLOGY AND ANALYSIS

4.1 Questionnaire design

The questionnaire consists of three parts. The first part is to obtain a closed statement, setting at least six months of experience in watching live broadcasts of green agricultural products e-commerce. The second part explores potential variables that affect consumers' willingness to purchase green agricultural products through measurement tools, examining psychological, socio-cultural, platform services, and other factors. The third part collects demographic information, including core content such as age, gender, educational background, family

structure, income level, and willingness to pay for green agricultural product e-commerce live streaming. On this basis, five experts were invited to review the questionnaire measurement items, namely from the National University of Malaysia, Peking University, and Henan University of Science and Technology. Resolve concerns through system revisions and form the final questionnaire. All projects are evaluated using the five point Likert scale.

The online survey was conducted by the Wen Juan Xing website, which is the most widely used data collection technology online platform in China. Using a purposive sampling method, ensure that the questionnaire is distributed to participants who have at least six months of experience watching green agricultural product e-commerce live broadcasts and are willing to pay. Subsequently, a total of 581 questionnaires were collected. During the data filtering process, incomplete data and blank questionnaires were removed, and ultimately 515 questionnaires were used for data analysis.

4.2 Data analysis

In statistical analysis, we adopted the PLS-SEM method from SmartPLS 3.0 software (Hair et al., 2019), which is widely used for modeling complex multivariate data and conducting causal relationship tests. Especially suitable for research in fields such as social sciences, behavioral sciences, and marketing. The first step in constructing a two-step model is to conduct confirmatory factor analysis to ensure that the data of the measurement tool reflects its design intent and theoretical concept (Hair et al., 2014). Through analysis, we obtained the standardized factor loadings of various measurement indicators on latent variables, which are important indicators for measuring measurement effectiveness. Normally, it is required that the standardized factor load should be at least 0.5 or higher (Anderson, Gerbing, 1992). The second step is to establish a structural model to test the theoretical hypothesis relationships. Focus on the path coefficient and its significance level, which directly reflects the degree of influence of the independent variable on the dependent variable and whether it is statistically significant. To verify the overall goodness of fit and explanatory power, we calculated AVE and CR. In an ideal state, AVE should be greater than 0.5; CR needs to reach 0.7 or above (Fornell and Larcker 1981). To evaluate the effectiveness of the model discrimination, check if the square root of AVE is greater than the correlation coefficient with other latent variables. Ensure that latent variables are independent and undisturbed (Rani et al., 2023). Through these steps, we evaluate and optimize the quality of measurement tools and the rationality of theoretical models, providing support for subsequent research inference and decision-making.

5. FINDINGS

5.1 Socio-demographics

Based on the provided data, we have detailed the specific demographic information of the respondents. Out of a total of 515 respondents, 205 were male (39.8%) and 310 were female (60.2%), with female participation slightly higher than male participation. The age distribution is wide, covering four age groups: 18-24 years old, 25-34 years old, 35-44 years old, and 45-54 years old, with a balanced proportion. In terms of marital status, there are more married individuals, accounting for 80.2%, indicating that married people have a higher level of attention to related topics or activities; The proportion of respondents who are single is relatively small, at 19.8%. The education background is generally good, with bachelor's degrees accounting for 39.8% and master's degrees accounting for 19.8%, indicating a high level of education for this group. In terms of income, the average monthly income is mainly concentrated between 3001 yuan and 5000-yuan, accounting for 30.5%, becoming a clear peak in income distribution. The proportion of people above 5001 yuan is also not low, reaching 24.6%, indicating that the participation of high-income groups is relatively high. The survey shows that 41.9% of respondents have had the experience of paying for green agricultural products, while the remaining 58.1% of respondents have not yet attempted to pay on green agricultural product live streaming platforms.

Table 1: Demographic characteristics of the respondents (N = 515)

Demographic Variable	Category	Frequency	Percentage
Gender	Male	205	39.8
	Female	310	60.2
Age	18-24	51	9.9
	25-34	156	30.3
	35-44	205	39.8
	45-54	77	15
	Over 55	26	5
Marital status	Single	102	19.8
	Married	413	80.2
Education	Primary school and below	26	5
	Junior school	28	5.4
	Senior school	154	29.9
	Bachelor's degree	205	39.8
	Master's degree and over	102	19.8
Monthly income	¥3000 and below	154	29.9
	¥3001-5000	157	30.5
	¥5001-10000	102	19.8
	¥10001-20000	51	9.9
	¥20001 and over	51	9.9
Have you ever paid for green agricultural products in live streaming	Yes	216	41.9
	No	299	58.1

5.2 Measurement model testing

In PLS path modelling, the evaluation of the measurement model is carried out through three key indicators: indicator reliability, convergence validity, and discriminant validity. In terms of indicator reliability, all standardized factor loadings of the model in this study were significantly higher than 0.80, far exceeding the commonly considered acceptable threshold of 0.50 (Hair et al., 2014), fully demonstrating the high reliability of the indicators. In terms of convergent validity, the effectiveness of the measurement model in data fitting is confirmed by testing two parameters: composite reliability (CR) and average variance extraction (AVE) (Fornell and Larcker 1981). In this study, the CR scores of all measured variables were greater than 0.70, indicating strong internal consistency (Fornell and Larcker 1981); At the same time, the AVE score also meets the requirements, ensuring that the impact of measurement errors is controlled within an acceptable range.

In terms of discriminant validity, according to the data comparison results in Table 3, for each structure, the square root of its AVE is greater than the correlation coefficient with all other structures, and there is no serious multicollinearity problem, verifying that the theoretical model has good discriminant validity (Henseler et al., 2009).

In summary, this model has excellent fitting, reliability, and effectiveness, which can provide a solid foundation for subsequent structural equation analysis.

Table 2: CR and convergent validity of the measures

Variable	Item	Factor loading	Cronbach's alpha	CR	AVE
Ascription of Responsibility	AOR1	0.832	0.841	0.904	0.758
	AOR2	0.897			
	AOR3	0.882			
Attitude	ATT1	0.871	0.902	0.928	0.720
	ATT2	0.808			
	ATT3	0.827			
	ATT4	0.862			
	ATT5	0.873			
Environmental Concern	EC1	0.872	0.820	0.893	0.735
	EC2	0.818			
	EC3	0.881			
Health Consciousness	HC1	0.883	0.849	0.909	0.768
	HC2	0.868			
	HC3	0.879			
Perceived Ease of Use	PEOU1	0.843	0.805	0.885	0.720
	PEOU2	0.859			
	PEOU3	0.842			

Perceived Usefulness	PU1							
	PU2							
	PU3							
	PU4							
	PU5	0.795	0.801	0.832	0.816	0.790		
Willingness to Pay	WTP1							
	WTP2							
	WTP3	0.926	0.900	0.934	0.909	0.866		
	WTP4							
	WTP5							

Table 3: Constructs' correlations and square roots of AVE

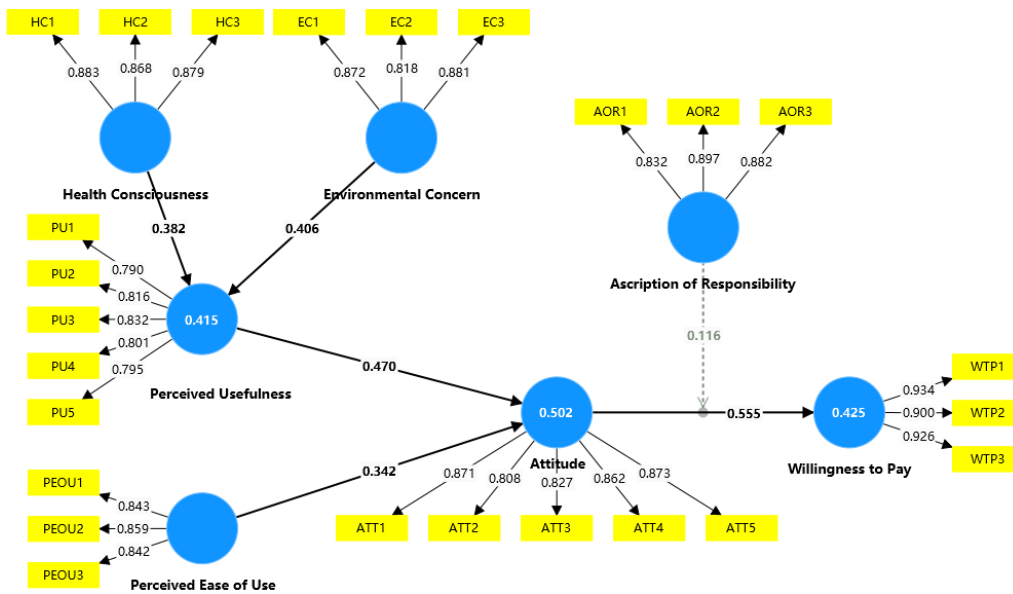
	Perceived Usefulness	Perceived Ease of Use	Health Consciousness	Environmental Concern	Attitude	Description of Responsibility	
	0.280	0.245	0.194	0.165	0.242	0.871	AOR
	0.644	0.581	0.533	0.471	0.849		ATT
	0.535	0.416	0.337	0.857			EC
	0.519	0.432	0.877				HC
	0.508	0.848					PEOU
	0.807						PU
							WTP

Willingness to Pay	0.303	0.620	0.336	0.391	0.473	0.516	0.920
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Table 4: Standardized path coefficients of the structural model and hypothesis testing

*p < 0.05; **p < 0.01; ***p < 0.001

		β	SD	t	P	Hypothesis
Ascription of Responsibility x Attitude -> Willingness to Pay	Attitude -> Willingness to Pay	0.116	0.026	4.388	0.000	Supported
Perceived Usefulness -> Attitude	Perceived Usefulness -> Attitude	0.470	0.041	11.571	0.000	Supported
Perceived Ease of Use -> Attitude	Perceived Ease of Use -> Attitude	0.342	0.039	8.683	0.000	Supported
Health Consciousness -> Perceived Usefulness	Health Consciousness -> Perceived Usefulness	0.382	0.037	10.424	0.000	Supported
Environmental Concern -> Perceived Usefulness	Environmental Concern -> Perceived Usefulness	0.406	0.037	11.109	0.000	supported



Continued: Fig.2 Results of the research model

5.3 Hypothesis testing

5.3.1 Results of path coefficient test

Table 4 provides a detailed list of the structural model analysis results, demonstrating the causal relationships between variables and their magnitude and significance. The path coefficient, t-value, and p-value indicate the direct influence strength and statistical significance between variables. Figure 2 depicts the theoretical model and variable relationships. Nodes represent potential structural dimensions, while connections reveal direct impact relationships. We used N=5000 self-service repeated sampling methods to estimate the size and statistical significance of path effects, providing accurate parameter estimates.

In summary, from Table 4, we can see that 'environmental perception promotes individuals' perceived usefulness of a certain technology' is supported by data. The beta value of the "environmental issues ->perceived usefulness" path is 0.406, with a p-value less than 0.05, indicating a significant positive impact. The path of "health awareness ->perceived usefulness" was also significant ($\beta=0.382, p<0.05$), indicating that strong health awareness leads to the belief that technology is effective. The beta value of the "perceived ease of use ->attitude" path is 0.342, $p<0.05$, indicating that ease of use has a positive impact on user attitudes. The β value of the "perceived usefulness ->attitude" path is as high as 0.47, which is also significant, confirming that perceived usefulness actively shapes user attitudes.

Attitude -> Willingness to Pay ($\beta=0.555, p<0.05$) had a significant positive effect, and the hypothesis was valid.

5.3.2 Results of the moderation effect test

Ascription of Responsibility x Attitude -> Willingness to Pay ($\beta=0.116, p<0.05$) had a significant positive effect. It shows that Ascription of Responsibility has a positive regulating effect between Attitude and Willingness to pay, and the hypothesis is valid.

6. DISCUSSION

The integration of live streaming into the marketing of green agricultural products is transforming traditional agricultural marketing strategies. It not only enhances visibility and sales but also contributes to a more sustainable and consumer-responsive farming ecosystem. In previous studies, selfishness and altruism have been seen as two independent perspectives that influence consumers' willingness to purchase green products. Egoists focus on personal interests, such as conserving resources and reducing environmental pollution; Altruists focus on collective

and social welfare and are willing to pay a premium for environmentally friendly and sustainable products. This study breaks through the binary oppositional framework and combines TAM and NAT theories to construct a comprehensive theoretical model that incorporates the influence of social responsibility, ethical norms, and ecological awareness. This model considers for the first time health awareness and environmental issues as prerequisites for perceived usefulness, influencing consumer purchasing decisions. At the same time, it emphasizes the moderating effect of responsibility attribution between consumer attitudes and willingness to pay. This study analyzes the theory of Chinese consumers' willingness to purchase green agricultural products in live streaming scenarios, deepens the understanding of green consumption behavior, and provides scientific basis for the government to formulate policies. The government can combine theoretical models, design precise measures from multiple levels such as education, regulations, and market supervision, stimulate and enhance consumers' willingness to consume green, and promote the popularization of green production and lifestyle.

Results indicate that H1 is supported, revealing that health consciousness significantly influences perceived usefulness of purchasing green agricultural products on live streaming platforms. This finding aligns with prior research indicating that health-oriented consumer behavior positively affects the adoption of eco-friendly products (Tan et al., 2022). In the burgeoning market of live-streamed eco-commerce in China, where such products are still gaining traction, consumers' awareness and acceptance play a critical role. However, despite the perceived health benefits, the relatively higher prices of green agricultural products might deter some consumers, especially when they lack sufficient understanding of these products' benefits. H2 also finds support, showing that environmental concern enhances perceived usefulness of purchasing green agricultural products in live streaming. This aligns with previous studies (Hameed et al., 2021; Leclercq-Machado et al., 2022) which found that environmental awareness directly correlates with eco-friendly purchasing habits. When consumers recognize their personal impact on the environment, they tend to prioritize green products, positioning these goods as their preferred choice. This suggests that enhancing consumer awareness of the ecological benefits of green agricultural products could further bolster this market segment. H3 confirms that perceived usefulness positively affects attitudes toward purchasing green agricultural products via live streaming platforms. This outcome corroborates findings from (Zheng et al., 2023), which highlighted that usefulness perceptions could significantly shape consumer attitudes in digital shopping environments. Similarly, H4 indicates that perceived ease of use positively influences attitudes toward utilizing live streaming platforms for purchasing green products, highlighting the critical role of user-friendly interfaces in cultivating favorable consumer attitudes. This research finding is consistent with the TAM model, emphasizing the critical role of technology usability in user adoption and acceptance of new technologies (Davis, 1989). In the context of live streaming platforms, users' positive attitude towards using live streaming platforms to purchase green agricultural products has enhanced their willingness to pay (Hiller et al., 2021; Khan et al., 2019). The H6 validation results indicate that consumers' sense of responsibility has a significant moderating effect on their willingness to purchase green agricultural products on live streaming platforms. This discovery provides empirical support for the NAT theory, emphasizing the core role of individual responsibility and ethical norms in promoting environmental behavior (Schwartz, 1977).

The implications of this study are significant for marketers and policymakers aiming to boost the market penetration of green agricultural products via live streaming platforms. By fostering a supportive cultural and technological environment that enhances the perceived benefits and ease of purchasing green products, businesses and governments can profoundly influence consumer behavior towards sustainability. Additionally, educational campaigns that increase awareness of the environmental and health impacts of consumer choices could further empower consumers, driving the growth of the green market.

7. CONCLUSION

This study combines TAM and NAT theories to construct an innovative framework and analyze the factors that influence Chinese consumers' willingness to purchase green agricultural products through live streaming platforms. The TAM model focuses on technology acceptance and adoption behavior, while the NAT theory emphasizes the influence of social norms and moral values on behavior. Integrating the two theories enhances the explanatory power of the model and reveals that consumers consider both technological utility and ethical considerations when purchasing green agricultural products. By integrating TAM and NAT theories, this study not only enhances the explanatory power of the model in predicting live shopping behavior, but also reveals that consumers, when purchasing green agricultural products, not only based on rational evaluation of the effectiveness of live streaming platform functions, but also include considerations of deep moral factors such as environmental protection, social responsibility, and personal values. Moderate analysis further reveals that the factor of responsibility attribution plays a key role in regulating the attitude towards green agricultural products and willingness to pay on live streaming platforms. This means that when consumers perceive that a company or platform has a clear and positive responsibility for providing green products and services, their attitude will have a stronger impact on the price they are willing to pay. Overall, through rigorous empirical analysis, this study greatly enriches our understanding of the psychological processes and social influencing factors that drive Chinese consumers to purchase green agricultural products, and provides valuable insights for policy makers and marketers to more accurately target and innovate when designing and implementing strategies to promote sustainable consumption behavior.

Although this study has achieved valuable results, it also candidly points out the limitations and possible future research directions. Firstly, although this study covers multiple key factors that influence consumer purchase intention, it does not fully encompass all possible influencing factors. Future research can further expand this model by incorporating variables from more dimensions such as cultural background, personal environmental values, social interaction, etc., to achieve more comprehensive and three-dimensional predictions of consumer behavior. Secondly, this study focuses on exploring the predictive ability of purchase intention. Although purchase intention is an important leading indicator of actual purchasing behavior, it cannot completely replace the actual purchasing behavior itself. Future research should focus more on measuring and analyzing actual consumer behavior, examining the entire process of consumers purchasing green agricultural products on live streaming platforms from a dynamic perspective, in order to reveal the correlation and bias between willingness and actual action; Thirdly, all the samples recruited in this study were from China, which helps to gain a deeper understanding of the specific context of domestic consumers, but also limits the generalizability of the research results. Future research should consider expanding to consumer groups from different cultural backgrounds to verify the universality of the model in different countries and regions.

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