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Research on China's agricultural product sales transformation: online marketing mix strategy and performance on post pandemic area

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At the end of 2019, the sudden outbreak of the pandemic brought a significant impact on the sales of agricultural products in China and all over the world. To reduce the unmarketable problem caused by the pandemic in the agricultural industry, operators who used to focus on offline sales changed their marketing strategy and began to build online sales channels through e-commerce platforms and adopt various online marketing strategies to improve their marketing performance. Furthermore, the performance of online marketing of agricultural products is affected by the interaction of multiple factors in the complex environment. This study aims to distinguish between the performance of different online marketing strategies by using necessary comparative analysis (NCA) and qualitative comparative analysis (QCA) method, to help operators to grasp the critical elements of the online marketing of agricultural products, and how configuration effective impact the online marketing performance. The results show that: (1) NCA's results show that a single online marketing dimension cannot constitute the necessary conditions for producing high marketing performance of agricultural products, but e-commerce broadcasting, visual effects and government cooperation play an obvious role in improving marketing performance. (2) online marketing performance is influenced by the interaction of various strategies, and no single factor has a significant effect on it. (3) a good online marketing performance configuration path is divided into four, namely "the government cooperation—e-commerce broadcasting" domination; "the government cooperation—visual effects—e-commerce broadcasting" leading; "customer relationship—the government cooperation—visual effects—e-commerce broadcasting" leading; "platform number—visual effects—e-commerce broadcasting" leading. (4) There are four driving paths with no-good online marketing performance, and there is a causal asymmetric relationship of the driving paths with good online marketing performance. This study provides management enlightenment for agricultural operators on how to effectively improve the performance of online marketing, help operators to solve practical problems, and facilitate the development of agricultural e-commerce.

KEYWORDS

post-pandemic, agriculture, online marketing performance, sales transformation, online marketing mix strategy

Introduction

From 2012 to 2020, nearly 462,000 villages have been deprived of labor due to young and strong people going out for work, accounted for 78.4% of totally villages in China and it has led to the increasingly serious situation of land abandonment in rural areas, which has largely affected the development of rural economy (Agricultural and rural big data, 2020; Ministry of Agriculture and Rural Affairs of the People's Republic of China, 2020). However, agricultural production is the guarantee for the stable development of the country, and sufficient food supply is the basis for people's normal life, especially in developing countries (Jiang and Chen, 2019). Chinese General Secretary Xi Jinping and the Party Central Committee attach great importance to rural revitalization to promote poverty alleviation in rural areas. Therefore, under the strong advocacy and support of Chinese government, the data of the Ministry of Agriculture showed that in China, totally 10.1 million people returned to villages and more than 30 million people started to operate agricultural products industry in 2020, and it has become the new tendency of agricultural development (Ministry of Agriculture and Rural Affairs of the People's Republic of China, 2021). Furthermore, with the improvement of people's living standard in China, people's demand of high-quality, safe, fresh, and diversified agricultural products is increasing, which has put forward higher requirements and challenges for agricultural products and related operators (Jingjing and Jie, 2019). However, the demand cannot be fully satisfied due to the geographical transportation limitations, freshness, information asymmetry, inventory issues and high sales costs of offline sales channel. Therefore, building online channels for agricultural products is becoming urgent. In recent years, the development of e-commerce related to agricultural products has also been very rapid. According to Alibaba, the sales of agricultural products category in Ali's online platform have grown from RMB 3.7 billion in 2010 to RMB 300 billion in 2020. In addition, with the acceleration of the Chinese poverty alleviation policy, the online sales of agricultural products reached 193.77 billion RMB in the first half of 2020, an increase of 39.7% year-on-year, which is 6 percentage points higher than the growth rate in the first half of 2019 (Xinjing News, 2021; Yi and Weihua, 2021). Agricultural products e-commerce has become a new trends and boom of e-commerce product category sales.

At the end of 2019, the pandemic broke out in China and all over the world. The sudden public health event has brought a great impact on economy and society. To prevent the spread of the pandemic, the central and local governments have introduced a series preventive and control measures, such as strict traffic control, closure of villages and roads, suspension of production and work, and prohibition of gathering (Xicai, 2021). These control measures brought great obstacles to the agricultural products industry. On the supply side, the transportation, import and export of raw materials were greatly restricted, which seriously affected the income of agricultural products operators. Moreover, because people were unable to go out for normal purchases during the pandemic, market supply and demand were disrupted, and many operators were unable to complete their original sales plans, resulting in a large backlog and damage of agricultural products, which aggravated the business risks of agricultural products (Rongping et al., 2022). According to People's Daily, as of March 1, 2020, the data of national agricultural products stagnation and supply–demand matching platform has accumulated 6,379 pieces of information on stagnant and urgent sales of agricultural products across the country, with a total weight of about 7.29 million tons, accounted for 40% of total national production (People.cn, 2022).

With transportation channels closed, the offline distribution of agricultural products was almost completely called off, the advantages of e-commerce are fully revealed, and sales of agricultural product operators through online platforms become the only feasible way to solve the problem of stagnant sales (Qalati et al., 2021). The government and related business entities have also noticed this, and to reduce the impact of the pandemic, the central and local governments have introduced a series of measures to guide agricultural product operators to sell through Internet platforms to solve the problem of stagnant agricultural products and help agricultural operators to tide over this difficult time. Under this circumstance, agricultural operators, who were originally focus on offline distribution, have embarked on the e-commerce, and started to build online sales channels. In addition, during the period of the pandemic, consumers had more free time to surf the Internet, and they browsed the online platforms to obtain information of agricultural products and placed orders for them, thus expanding the demand market for agricultural products in online sales (Bingcheng, 2020). Therefore, the simultaneous expansion of supply and demand markets has rapidly promoted the development of e-commerce and online channels for agricultural products. However, due to the different levels of government support, the scale of agricultural business and operators' acceptance of online marketing methods, there are still a large proportion of agricultural enterprises that do not enjoy the dividends of e-commerce development. This part of agricultural product operators still experiences poor sales and low consumer satisfaction after adjusting their marketing strategies. Therefore, how to help agricultural product operators build an efficient and reasonable online marketing strategy after the outbreak of the pandemic, achieve sales growth and finally satisfying consumer demand has become an urgent goal to accomplish.

Although existing studies have explored various aspects of online marketing of agricultural industry, the special period after the outbreak of the pandemic needs to be further deepened. Most of the existing relevant studies focus on qualitative analysis of field interviews and case studies, and few empirical studies are taken, which cannot reveal the universal problems of online marketing of agricultural products in China in a more comprehensive way. Therefore, in order to help agricultural operators solve the practical problems encountered in online marketing, and considering that the performance of online marketing of agricultural products is affected by the interaction of multiple factors in the complex environment of the pandemic, this study adapted a combination of necessary condition analysis (NCA) and fuzzy qualitative comparative analysis (fsQCA) to construct a model combining actual cases and empirical data, explored the degree of influence of individual dimensions of online marketing strategy on the marketing performance and the synergy of multi-dimensional grouping, and finally find out the combination of the best condition grouping in order to achieve the optimal marketing performance (Larkin, 2019). Specifically, this paper takes the outbreak of the pandemic in early 2020 as the starting point, combines the complex situation of the pandemic period and the post-epidemic era, chose six important dimensions in the online marketing strategy, namely: customer relationship, price adjustment, number of platforms, government cooperation, visual effect and e-commerce broadcasting

as conditional variables for configuration analysis, and studies the effect of different grouping paths on the online marketing performance including online turnover, number of positive consumer reviews and online sales.

Literature review and model construction

Online marketing

The rapid development and popularity of the Internet not only changed the way and speed of information transmission, but also subvert the traditional offline business supply chain, providing a new opportunity and challenge for the operators (Ma and Guo, 2021). Online Marketing is a new type of marketing based on the Internet and information technology, using a virtual network platform for product information dissemination, sales, customer communication and service, and ultimately achieve profitability (Chenglong, 2016). In related research, many domestic and foreign scholars have proposed that "online marketing is an integral part of the overall marketing planning of enterprises (Chenglong, 2016). In the increasingly competitive business environment, traditional marketing methods have been unable to meet the market demand for massive amounts of information and products, the rise of online marketing not only solves the problem of information dissemination channels, time, space, etc., but also greatly reduces the large costs incurred by traditional marketing activities (Huang and Xiaomeng, 2015). With the continuous emergence of various online platforms and the maturity of the Internet environment, online marketing has become an irreplaceable marketing channel. In recent years, China's rapid development of e-commerce, online marketing gradually showed the development trend of diversified ways, content, and comprehensive coverage. Relevant scholars have also conducted multi-angle and all-round research on it, including social marketing, word-of-mouth marketing, price marketing, live broadcast marketing, other marketing methods and the factors influencing the effect of online marketing and the path of action (Xuping and Xin, 2011; Yongsheng et al., 2011; Wang et al., 2015).

At present, the boundaries of the systematic research on the antecedents and the related influencing factors of online marketing are relatively vague, and most of the existing studies focus on the theoretical analysis, specific applications, and the summary of the advantages and disadvantages of online marketing. Among the existing studies, Hong and Xu (2015) found that consumers' rational and emotional perceptions of online marketing strategies determine their perceptions of products, and customer relationships can influence their assessment of products and purchase intentions, which in turn affect marketing performance. Huang and Xiaomeng (2015) stood at the level of corporate stakeholders and proposed that relevant leaders, including industry government support, business leaders, and managers of online platforms directly influence the brand positioning, information presentation, and marketing performance, and implementing strategies for future development strategies. Based on the company's perspective, Gang et al. (2019) explored the marketing strategy in which product price, marketing creativity, uniqueness, and promotional efforts significantly influenced the enhancement of marketing performance. In addition, Yang (2014) suggested that resources and capabilities including promotion costs, number of online platforms and other strategies significantly influenced the marketing performance.

With the rapid development of the Internet and social media, more and more participants join the co-creation process of online marketing performance, which is created and determined by all participants of the online platform in the digital era (Ramaswamya and Ozcan, 2016; Weiwei, 2018; Williamson et al., 2020; Shen et al., 2021). The existing literature defines the composition of online marketing performance from three perspectives: based on the financial perspective, based on the consumer perception perspective, and based on the product market perspective. Specifically, from the financial perspective, good marketing performance is reflected in high product sales revenue for the enterprise (Cheng et al., 2017); from the consumer perception perspective, good marketing performance is reflected in the recognition, trust and praise of the products purchased by consumers (Time and Yutian, 2020); from the product market perspective, good marketing performance is reflected in the sales of products under the competition in the same industry (Gang et al., 2019).

Online marketing of agricultural products

In the information era, online marketing breaks the geographical limitations of traditional marketing methods and cannot be ignored (Sony and Naik, 2020). With the wide application of information network in business activities, more and more industries begin to introduce the mode of e-commerce, and how to use online marketing strategy has become significant (Wang et al., 2014). In the process of exploring e-commerce models, diverse business models such as business to business (B2B), business to customer (B2C), and customer to customer (C2C) have been gradually formed (Shen et al., 2021). In the agricultural industry, operators are also trying to find new e-commerce business models and online marketing strategies that meet the business characteristics of agricultural products. Agricultural sections of mainstream e-commerce platforms go online one after another, a large number of agricultural product operators have begun to realize the advantages brought by online marketing (Dong and Rui, 2019). The operation through the online platform can eliminate intermediaries, and product information breaks through the original geographical and spatial limitations, which not only reduces labor and time costs, but also expands the original business market on a large scale (Xiao, 2020). For the online marketing researches related to agricultural industry, academics have also conducted a lot of exploration, mainly refers to the marketing activities of agricultural products carried out on the Internet, including publishing information, pricing, organizing promotional activities, selecting delivery channels, maintaining consumer relations, and other activities to ultimately achieve the purpose of expanding sales (Xiao, 2020). In foreign related studies, scholars mostly focus on the current situation of online marketing of agricultural products and the exploration of future e-commerce models. Canavari et al. (2010) constructed a trust model based on trust dimensions in e-commerce environment to detect consumers' perceptions and purchase intentions for online sales of agricultural products. Shivraj (2004) presented a new trading model for agricultural products in the Netherlands, where operators chose a joint auction without regional

restrictions for the characteristics of local agricultural products, and suggested the necessity of online marketing for the implementation of this new business model. Banker and Mitra (2007) took Indian coffee online sales as an example, and carried out empirical analysis to propose a procurement model for the agricultural product supply chain to provide new theoretical ideas and practical guidance for the online marketing.

As a traditional agricultural country with a large population and a wide geographical area, Chinese agricultural operators transform their traditional marketing methods to online marketing can substantially improve the sales problems, which caused by geographical dispersion, closed information and backward logistics. Furthermore, online marketing can improve the publicity effect, sales volume, and competitive advantage (Xiao, 2020). Due to hindrance of scale, technology, standardization, branding and many other factors, the status of China's agricultural online marketing is still in the primary stage. However, in recent years, with the vigorous support of Chinese government and the advent of the "Internet +" era, the e-commerce model of agricultural products has become increasingly mature, and the online marketing methods have diversified and flourished (Xiao, 2020). How to use online marketing to shape the core competitive advantage and enhance the competitiveness of agricultural products is urgent.

Many scholars have proposed that there are obvious deficiencies in online marketing of Chinese agricultural industry. Especially after the Covid pandemic, the traditional marketing channels of agricultural products have received serious obstacles, but the online marketing platform is not even established. This situation caused more difficulties to the agricultural products marketing, the current situation of agricultural products is in a worse condition (Jie and Qihua, 2015; Aiping, 2018; Weiwei, 2018). Specifically, relevant scholars clearly pointed out that the backwardness of the publicity channels, logistics services and the use of online platform has seriously affected the sales and hindered the healthy development of China's agricultural industry (Yawen, 2018). In terms of comprehensive domestic related research, scholars have analyzed agricultural products online marketing mainly from the following three dimensions. Firstly, from the marketing model: Aiping (2018) chose Shanxi province as an example, summarized three typical models: the government-led model, the characteristic product-driven model, and the independent choice model. Then he further expounded the advantages, disadvantages, and application scope of the three marketing models, respectively. In addition, Weiwei (2018) analyzed the online marketing mode of agricultural products in Sichuan Province, such as WeChat, Tiktok, Red and other third-party social media online platforms. She pointed out that, compared with other online marketing models, the third-party platforms have perfect network functions, huge network flow volume, wide geographical coverage, and rapid information communication (Weiwei, 2018). After a series of explorations on the marketing model, scholars found that the operators of agricultural products in China still generally have obvious defects. Such as weak network awareness, lack of professional employees, lagging technology, weak infrastructure, and inadequate logistics systems. Secondly, from the marketing strategy: Yawen (2018) analyzed the advantages and necessity of marketing strategy based on online community and emotional construction. He proposed that agricultural product operators should combine the characteristics of online community to implement brand marketing strategy. Moreover, Gang (2016) took "Three Squirrels" as an example, pointed out that operators should focus on user's experience and use big data to build user portraits to implement the precision and personalization. Both scholars pointed out that the following problems need to be solved in the process of online marketing strategy: (1) to gain a deeper understanding of consumer needs through information technology such as big data, and to transform or improve the original traditional agricultural production methods and categories; (2) to actively respond to the government's call to hire professionals and build rural online platforms; (3) to raise the awareness of agricultural product operators to build and maintain online consumer relationships, improve customer service quality and consumer satisfaction; (4) to strengthen and improve logistics and distribution, etc. Thirdly, from the problems and countermeasures of online marketing: Jie and Qihua (2015) discuss the problems and countermeasures in the online marketing of characteristic agricultural products. Their study includes analysis of strategic positioning, standardization, industrial chain, and brand. Aiping (2018) believes that although the government strongly supports the development of online marketing, however, currently there are huge differences in the development of agricultural markets. Therefore, the operators should improve core competitiveness and build brands to help solve the related problems.

In addition, since the SARS pandemic in 2003, many domestic studies have been conducted around the impact of public health emergencies on agricultural products. A study by Wu et al. (2015) found that in the case of information asymmetry, if the scope of the emergent event disturbance has a large impact on retailers' costs, the supply chain strategy needs to be changed to achieve a new equilibrium. Jingjing and Jie (2019) used raw chicken and carp prices as examples to study the extent of shocks brought by unexpected pandemics or food safety events such as agricultural market prices. All the above studies focused on the impact brought by pandemic on the operation of agricultural products. Since the e-commerce model in China was not yet developed at that time, the relevant studies did not involve the introduction and strategies of online marketing. During Covid pandemic in 2019, experts and scholars have also noticed the significant impact of this unexpected event on the agricultural industry and explored the perspectives of marketing strategy: Houkai and Qianwen (2020) elaborated that the Covid pandemic had a comprehensive, continuous, and in-depth impact on the agricultural industry and rural areas. Specifically, You et al. (2021) explored the impact of the Covid pandemic on the price volatility of agricultural products, and found that the effect of the pandemic varied by type and region, thus suggesting that the regulatory policies should be tailored to local conditions. Hainan et al. (2020) pointed out the optimization path of the supply chain after the pandemic for the fresh agricultural products, such as insufficient risk management and low standardization. However, these studies are less informative, some of the studies start from the macro level, focus on the agricultural industry and livelihood economy, and their findings are mainly directed at government measures (You et al., 2021). Although a few studies focused on agricultural products online marketing strategies, their improvement suggestions are more enlightening for the government and specific agricultural products categories. There are less informative for a wide range of agricultural products categories and micro agricultural operators, so there is still a gap for further research (Hainan et al., 2020; You et al., 2021). In the Internet era, online marketing has become a necessary tool for agricultural

products to explore the market, and has a prominent role in enhancing the sales of agricultural products. However, the development of online marketing of Chinese agricultural industry is relatively backward (Lei et al., 2021). The network platform construction, professional quality of operators, communication services for customers, government support policies, or diversification of network promotion, several aspects need to be vigorously developed and improved.

According to the above-mentioned literature, the effect of online marketing of agricultural products is influenced by several dimensions in the relevant aspects. These including leaders (support from government departments, strategic choice of online marketing and platform construction by agricultural product operators); online platforms (number of platforms, diversity of sales methods); and consumers (customer relationship, consumers' perception). All dimensions have positive significance, but there is a lack of strong empirical evidence on how it works. In addition, the existing literature is limited in its approach, which focused on the "net effect" of the impact of a single dimension, while ignoring the "joint effect" of multiple dimensions. Whether the online marketing situation of agricultural products changed in this special period has not been mentioned in the relevant studies. How the implementation of agricultural products online marketing strategy affects the marketing performance is an important issue to be solved.

Model construction

Through the review of domestic and foreign literature, to distinguish the performance of different online marketing strategies, help agricultural operators grasp the key elements, and improve the final performance, this paper combines a large number of relevant cases to analyses the relationship between the online marketing strategy and the marketing performance adopted by agricultural operators in the context of the Covid pandemic. Specifically, this paper takes the outbreak of Covid pandemic in early 2020 as the starting point, combines existing studies to summarize six important dimensions in online marketing strategies, which are: customer relationship, price adjustment, number of platforms, government cooperation, visual effect, and e-commerce broadcasting. In order to study the impact of different grouping paths on the performance of online marketing, this study draws on relevant results, and selects three evaluation indexes: corporate turnover from the financial perspective, the number of positive consumer reviews from the consumer perception perspective, and online sales volume from the product market perspective (Cheng et al., 2017; Gang et al., 2019; Time and Yutian, 2020).

1 Customer relationship: traditional offline marketing channels establish customer relationships in a single way, mostly based on the one-way relationships initiated by the enterprise itself. In contrast, online marketing uses the Internet platform as a carrier, it breaks the limitations of time, space and has the characteristics of wide involvement, long duration, and two-way interaction (Shen et al., 2021). At the same time, due to the virtual nature of online platform, consumers cannot visually judge the quality of products through sight, smell, and touch. In order to avoid the risks brought by information asymmetry, consumers will be more cautious when making purchase decisions, especially food products directly related to health such as agricultural products, and the maintenance of customer relationships becomes an important way to build trust and loyalty. In the previous study of customer relationship related to agricultural products, scholars found that consumers' perceived trust, value, and evaluation of merchants significantly contribute to the online sales through modeling and empirical analysis (Kexi and Jun, 2014). Based on this, the customer relationship maintenance is one of the key factors to determine the online sales of agricultural products, and is also the focus of marketing strategy adjustment for agricultural operators.
2 Price adjustment: research shows that consumers pay high attention to the price difference between online and offline purchase of agricultural products and the price difference between similar products online (Shanshan, 2018). Product price is the reference basis for consumers to purchase agricultural products online, and its fluctuation will affect consumers' demand and purchase decision, which in turn has certain influence on the sales volume of agricultural products (Yijian, 2014; Peirong and Mingxuan, 2019; Yanfang, 2020). Therefore, for agricultural product operators, price adjustment strategy is an important part of their online marketing mix strategy. Especially in the complex environment of the Covid pandemic, whether to adopt the strategy of low price and the effectiveness of this strategy has become a concern for operators.
3 Number of platforms: e-commerce platforms are the basis for online business activities and play an important role in China's agricultural modernization process. On the one hand, e-commerce platforms provide new distribution channels and large consumer groups for relevant agricultural products operators; on the other hand, with the big data, cloud computing and other technologies, the powerful information feedback mechanism of e-commerce platforms can provide timely and abundant market information for relevant operators. Agricultural product operators can precisely adjust their marketing strategies based on the information to satisfied the consumption needs of target groups and thus promote sales (Ruifeng, 2020; Zhanpeng, 2020). For agricultural products operators, the choice and number of platforms are important for their channel strategy. If operators choose a single e-commerce platform, the advantage is to reduce the cost of channel construction. Contrastly, they may face more homogeneous products, competition pressure, traffic, information acquisition costs and other problems. Then, if operators choose multiple platforms, although there will be more potential customers and sales, but high costs will be incurred.
4 Government cooperation: with the national policy of "precise poverty alleviation" and the goal of poverty eradication, e-commerce is seen as an important way to realize this goal (Foresight Research Institute, 2020). With the Government's call and assistance, many agricultural product operators have begun to adopt online sales, promoting the rapid development of e-commerce for agricultural products (Foresight Research Institute, 2020). After the outbreak of the pandemic, in order to reduce the impact, the government not only guided operators use online platform, but also helped operators who

just started and lacked experience in online marketing through a series of measures such as "one-to-one" support, government website promotion, and live broadcast by county governors to solve the "difficulty in selling" (Foresight Research Institute, 2020). Under the complex environment of Covid pandemic, compared to commercial e-commerce platforms, government platforms are public welfare and usually more targeted and helpful. Whether to participate in government programs and the depth of cooperation have also become major factors affecting the performance of online marketing for agricultural operators.

5 Visual effect: vision is one of the important ways for humans to obtain information, and research shows that 83% of human access to information comes from vision (Huang et al., 2020). Therefore, how to convey product information and attract consumers' attention through visual display has become the focus of business attention. In online marketing, the importance of visual effects is even more prominent. Due to the virtual nature of the Internet, consumers can only obtain product information by browsing pictures, text color and format, and video esthetics uploaded by operators. Besides, studies have shown that product display, web design, and page layout will significantly affect consumers' purchase intention (He et al., 2014; Hongxia et al., 2014; Lin et al., 2015). However, an important problem in the current online sales of agricultural products is the high degree of homogenization of product pictures and text descriptions, and even many operators use the same online pictures, which leads to the inability of consumers to perceive the difference between the product and other similar products. As the competition in the agricultural products e-commerce market becomes more and more intense, many merchants realize that beautiful pictures and detailed descriptions are important to stimulate consumers' purchase intention, and start to pay attention to web design quality and product visual display effects. Therefore, this paper incorporates visual effects into the antecedent variables that affect the performance of agricultural products online marketing.

6 E-commerce broadcasting: in order to further attract traffic, Taobao, Jingdong and other e-commerce platforms began to launch broadcasting functions and gradually improve the related supporting system in 2016 (Ren, 2021). In the following years, more and more online platforms have joined the broadcasting to sell products. The short video platforms such as Tiktok and Kuaishou, which already have huge traffic, have further realized the importance of the broadcasting function (Hongdong and Jiang, 2020). As a new marketing method, the agricultural operators have also adopted the broadcasting method to sell their products. E-commerce broadcasting of agricultural products can help consumers understand the products more intuitively, vivid, and meticulously (Ren, 2021). It can also solve the problem of lagging response in traditional sales, which in turn increases consumers' trust in the products and promotes product sales (Zhaoyang, 2021). The study has shown that the attraction effect, interaction effect, experience effect, and inducement effect of e-commerce broadcasting can better drive the development and performance of agricultural products. During the Covid pandemic, the new marketing model of online e-commerce broadcasting has obvious advantages, such as low cost, low threshold, intuitive, vivid, and interactive, and it has become an important marketing tool for agricultural operators to attract traffic and solve the problem of stagnant sales (Thanh et al., 2022). Therefore, weather adopt e-commerce broadcasting is one of the important dimensions of the antecedent variables affecting the performance of online marketing of agricultural industry.

In the special context of the Covid pandemic, the reality of agricultural products sales is more complex than usual, a single dimension or a certain marketing theory cannot explain the causal relationship between online marketing strategies and marketing performance in a traditional way. Based on the above theoretical analysis, the complete model of the research on the combination strategy of agricultural products online marketing is shown in Figure 1.

Research design

Research method of QCA and NCA

Adequate and necessary relationships are interpretations of two causal relationships, and this study first uses qualitative comparative analysis (QCA), which detects adequate causality, to explore whether the antecedent cause (a combination of online marketing strategies) can adequately produce the outcome (the performance of online marketing of agricultural products). The research methods of QCA can be divided into: clear set QCA (csQCA), multi-value set QCA (mvQCA), and fuzzy set QCA (fsQCA; Yunzhou and Liangding, 2017). Considering that fuzzy set qualitative comparative analysis (fsQCA) has the advantage of dealing with partial affiliation as well as degree change problems compared to the other two categories, and that fsQCA takes a holistic perspective and performs comparative analysis across cases, it is dedicated to exploring the causal complexity of which groups of conditional elements cause the appearance of the expected outcome and which groups cause the lack or absence of the expected outcome (Fiss, 2011). For agricultural operators, the use of different marketing strategy may have diverse and complex effects on the marketing performance. Therefore, this study chooses the fsQCA approach to explore the full causal mechanism. Secondly, the fsQCA method not only makes up for the deficiency of qualitative research methods by using a large sample set of cases to solve the problem of applicability and uniqueness of traditional qualitative analysis; but also compensates to some extent for the deficiency of large sample analysis for individual phenomenon analysis in quantitative research methods. Finally, this paper focuses on the "joint effect" between the dimensions of online marketing strategy and the "interaction" between different indicators to find the best way to improve the marketing performance.

In order to explain the causal relationships of the variables more comprehensively, the necessary comparative analysis (NCA) method was used to analyze the necessary causal relationships among the study variables (Du et al., 2020; Dul et al., 2020). Compared with the fsQCA method, the NCA approach not only detects whether a condition is necessary for the outcome to arise, but also shows the degree of necessity of this condition and can explain the importance of the condition variables more precisely and deeply (Vis and Dul, 2018). Therefore, the approach of combining fsQCA and NCA can not

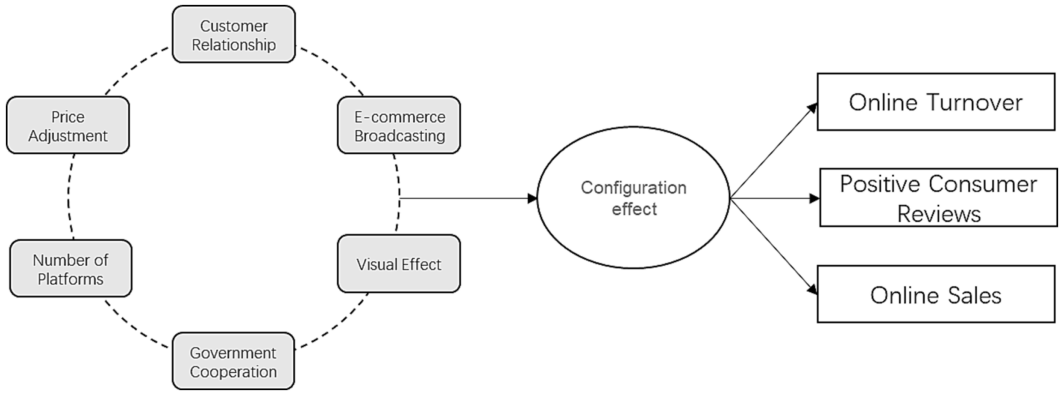

FIGURE 1
Research model.

only test the influence of different groupings of online marketing strategies on marketing performance, but also show the degree of influence of separate online marketing dimensions, which has greater utility and significance for this study.

Case selection

Firstly, in fsQCA studies, the representativeness of sampling directly affects the results, and the valid sample equals appropriately selected cases (Yunzhou and Liangding, 2017). fsQCA is a case-oriented research method which should follow the principles of theoretical sampling and select samples based on the characteristics of the theory and cases (Dul et al., 2020). In addition, representativeness of sampling should consider sufficient homogeneity among overall cases, specifically, selected cases should be similar and comparable. Furthermore, maximum heterogeneity also should be considered among cases, the selected cases should include both positive and negative cases to avoid presenting excessive consistency (Yunzhou and Liangding, 2017). Second, the complex situation of online sales of agricultural products requires consideration of many external objective circumstances, such as the scale of agricultural e-commerce enterprises, competitive strength, and sales channel differences. Large and medium-sized agricultural enterprises have matured operational marketing systems and the Covid pandemic affects them to a much lesser extent than small agricultural enterprises (Mengsi and Jian, 2016). In addition, in terms of government participation, although some agricultural product operators participate in online sales, they rely entirely on government support and do not have subjective initiative, which does not help this study. Therefore, to ensure the quality of the study, this paper sets three qualifications in selecting cases: firstly, the target cases under investigation should be small agricultural enterprise, the participants are agricultural product operators. Specifically, they are in the middle stage of the industry chain, taking over the work between producers (farmers) and consumers of agricultural products. Their main responsibilities are distribution, sells, promotion and consumer service. According to National Development and Reform Commission's regulations, the classification of small agricultural enterprises is annual operating income between 500,000 RMB to 5 million RMB and total number of employees is less than 80 (Ministry of Agriculture and Rural Affairs of the People's Republic of China, 2017). Secondly, the problem of stagnant sales brought by Covid pandemic, which caused huge economic losses to agricultural product operators, was the catalyst that prompted small agricultural product operators to open online sales channels. Therefore, based on the cyclical nature, agricultural products with a short shelf life that are newly available in spring or without a clear distinction between low and high seasons and face stagnation problems during the pandemic are selected. Thirdly, the agricultural products operators had no experience in online sales before the pandemic, or had contacted online sales but mainly focused on offline sales, and began to pay attention to online sales only after the pandemic occurred, building sales channels independently, conducting online marketing, and not relying entirely on government help to solve the problem.

To avoid the influence of excessive geographical differences, four provincial units, Shandong Province, Henan Province, Hebei Province and Hubei Province, which have the middle ranking of GDP and are large agricultural provinces in China, were selected. The districts and counties under the prefecture-level cities with the middle to upper ranking of GDP in each province were chosen as the areas for questionnaire distribution. A total of 247 agricultural products operators in 8 districts and counties under the above 4 provincial units were involved. The survey involved agricultural products including grain, fruits, vegetables, aquatic products, livestock, and other categories; finally, 236 questionnaires were collected, and the actual number of valid questionnaires collected was 208, with an effective rate of 84.21%, and coded as CASE1-208 (see Table 1).

Variables measurement

(1) For the customer relationship dimension, this paper draws on the study of Zhiwen et al. (2021) to comprehensively evaluate. (2) for price adjustment, this study considered that small agricultural enterprises generally adopted price reduction strategies to attract traffic and solve the problem of stagnant sales after the Covid pandemic, so the dimension of product price is examined and evaluated in terms of the range of price reductions (You et al., 2021). After conducting fieldwork on 208 target cases, this study found that

TABLE 1 Descriptive statistics of sample cases.

Province	City	District and County	Main agricultural products	Number of interviewees	Number of questionnaires collected
Shandong Province	Liaocheng	Xin County	Fruits, vegetables	32	28
	Weifang	Shouguang City	Vegetables	35	31
Henan Province	directly administered counties	Sliding County	Grain, livestock	29	27
	Hebi City	Joon County	Grain, livestock	31	28
Hebei Province	Tangshan City	Fengnan District	Aquaculture	26	23
	Xingtai	Ningjin County	Grain, fruit	23	22
Hubei Province	Huanggang City	Huangzhou District	Livestock, fishery, vegetables	34	32
	Yichang City	Changyang County	Food, livestock	19	17

the adjustment range of price reduction by small agricultural operators is controlled within 30% of the original price. (3) after fieldworks, this study found that a small percentage of agricultural operators chose single-online platform strategy, while most of the remaining operators chose multi-platform development strategy. Combining the specific conditions of 208 cases, this study found that the operators set up mostly five online platforms after the pandemic. (4) during the pandemic, governments around the world provided numerous policies and forms to help agricultural product operators, including: sales channel introduction, financial subsidies, online broadcasting by government officials, building online platforms, issuing bonuses, etc. (You et al., 2021). Focusing on the cooperation between small agricultural enterprises and the government, this section adopts Huang's study to evaluate the degree of cooperation between small agricultural operators and the government (Huang et al., 2020). (5) since the operators of agricultural products are less specialized in the visual design of web pages and products, the visual effect of products is from the operators' own subjective perspective and situation. Visual effect dimension was evaluated based on the previous research which focusing on importance they attach to the visual effect of products, whether the web pages are specially designed and the cost of design (Hongxia et al., 2014). (6) for the broadcasting of e-commerce, this study adopts Lu's measurement (Zhaoyang, 2021). (7) in order to investigate the performance of different grouping paths on online marketing performance, based on the relevant research (Cheng et al., 2017; Gang et al., 2019; Dong et al., 2020), this study adopted three evaluation indicators: from the financial perspective, this study chose corporate online turnover; from consumer perspective, chose the number of positive consumer reviews; and from market perspective, chose the online sales volume.

In summary, all the variables have been collected using a Likert scale and refer to Table 2 for more details.

Reliability and validity analysis

The reliability test reflects the consistency of the measurement results and the stability of the data, which is generally tested by using Cronbach's alpha value (Hair, 2010). In this study, the SPSS18.0 software was used to test the reliability of the questionnaire, and the results are shown in Table 2, and the Cronbach's alpha values based on standardized items are all greater than 0.8, which indicates that the reliability of this questionnaire is good (Hair, 2010). Then, validity assesses the closeness of the results to expectations and further reflects the validity of the scale. The measurement items are the questions for agricultural operators in questionnaire. Due to the actual situation of participants, the measurements of dimension 2 products price and dimension 3 number of platforms are defined by author depends on the fieldwork. Other 5 dimensions are referenced and refined from established scales and were better in terms of content validity. In addition, the Kaiser Meyer Olkin (KMO) and Bartlett's sphericality values were calculated for each variable, and the KMO and factor loading coefficients were greater than 0.7. The Bartlett's sphericality values were significant. The fit between the study variables and the measured items was tested by AMOS 24.0, where Chi-Square Value/degree of freedom (CMIN/df) = 1.79, standard fit index (NFI) = 0.94, goodness-of-fit index (GFI) = 0.92, comparative fit index (CFI) = 0.95, Tucker-Lewis's index (TLI) = 0.94, adjusted fit index (AGFI) = 0.89, Root Mean Square Error of Approximation (RMSEA) = 0.017, indicating good validity of this questionnaire (see Table 2).

Variable assignment and anchor point determination

First, to ensure the reliability and validity of the variables measured in this study, the variables were selected from established studies by existing scholars and modified according to the purpose of this study. Second, to accurately reflect the inter-case variability and with reference to previous studies, the three calibration points of the five independent variables with one respondent variable fully affiliated, crossover point, and fully unaffiliated were set as the upper and lower quartiles of descriptive statistics in this study, which were 75% fully affiliated, 50% crossover point, and 25% fully unaffiliated (Yunzhou and Liangding, 2017). Fiss (2011) study suggested that in the process of fsQCA anchor point determination and fuzzy value calibration, there is a possibility that the anchor point will be the same as the original data value. Therefore, to avoid this situation, this study further reviewed the data and increased the calibration points where the same values occurred by 0.001, while ensuring that the maximum value did

TABLE 2 Reliability and validity analysis.

Variables	Measurement items (basis of assignment)	Scale source	Crobach's alpha	KMO value
Customer relationship	Little effort and money spent on word-of-mouth and customer feedback.	Zhiwen et al. (2021)	0.931	0.843
	Willing to spend effort on word-of-mouth and consumer feedback maintenance, but basically no capital investment			
	Willing to spend effort to word-of-mouth and consumer feedback and willing to invest little money to maintain			
	Word-of-mouth and consumer feedback are very important, willing to spend effort to handle and maintain customer relationship and willing to invest some money to maintain			
	Customer relationship is very important, attach great importance to word-of-mouth and consumer feedback, hire a person to handle and maintain customer relationship, and willing to spend a lot of energy and money to maintain			
Price adjustment	Price reduction of agricultural products in the range of 0–5%	Fieldwork by Author	0.820	0.872
	Price reduction of agricultural products in the range of 6–11%			
	Price reduction of agricultural products in the range of 12–17%			
	Price reduction of agricultural products in the range of 18–23%			
	Price reduction of agricultural products in the range of 24–30%			
Number of platforms	Choose a single e-commerce platform to sell	Fieldwork by Author	0.927	0.925
	Choose two e-commerce platforms to sell			
	Choose three e-commerce platforms to sell			
	Choose four e-commerce platforms to sell			
	Choose five or more e-commerce platforms to sell			
Government cooperation	No participation in government support and cooperation	Huang et al. (2020)	0.893	0.867
	Less cooperation with the government and only involved in short-term government activities			
	More cooperation with government and involvement in short-term activities			
	Cooperate with the government and participate in short-term activities more, and participate in some long-term activities			
	Frequently involved in government cooperation, and actively involved in both long and short term activities			
Visual effect	The product web design is not important, and the product display pictures are self-photographed and use unprocessed original pictures to promote	Hongxia et al. (2014)	0.915	0.874
	Product web design may affect sales, product display pictures are taken by themselves, and use retouching software to adjust pictures and make simple web design			
	Product web design is more important, ask professionals to take photos and design web page, invest less money			
	Product and web design is more important, ask professionals to take photos and design, and invest more money			
	Product and web design is very important, hire professionals to take photos and design, and invest a lot of money			
E-commerce broadcasting	No broadcasting interactive marketing method is used	Zhaoyang (2021)	0.937	0.906
	Seldom adopt broadcasting interactive marketing			
	More often adopt broadcasting interactive marketing			
	Often adopt broadcasting interactive marketing methods and operators participate in broadcasting			
	Often adopt broadcasting interactive marketing, operators participate in live streaming and broadcasting is an important marketing tool			
Online marketing performance	Enterprise online turnover	Cheng et al., 2017; Gang et al. (2019); Dong et al. (2020)	0.903	0.876
	Number of online consumers' positive feedback			
	Total online sales			

TABLE 3 Descriptive statistics and anchor points for variable calibration.

	Descriptive analysis				Fuzzy set calibration		
Variables	Mean value	Standard deviation	Min	Maximum value	Completely unaffiliated	Almost	Fully affiliated
Customer relationship	2.90	1.37	2.00	5.00	2.25	2.70	3.98
Price adjustment	2.40	1.41	1.00	5.00	1.03	2.16	4.20
Number of platforms	2.52	2.03	1.00	4.00	1.78	2.92	4.60
Government cooperation	3.04	1.07	1.00	4.00	2.00	3.05	3.92
Visual effect	3.71	2.24	2.00	5.00	2.13	3.50	4.46
E-commerce broadcasting	3.89	2.05	2.00	4.00	2.61	3.47	3.25
Online marketing performance	112392.6	39205.1	13572.3	176286.7	35247.2	73623.2	143215.3

TABLE 4 Analysis results of necessary conditions of NCA method.

Conditional variables	Method	Accuracy	Upper limit zone (Ceiling zone)	Range	Effect size(d)[b]	*p* value
Customer relationship	CR	100%	0.000	0.098	0.000	1.000
	CE	100%	0.000	0.098	0.000	1.000
Price adjustment	CR	100%	0.000	0.098	0.000	1.000
	CE	100%	0.000	0.098	0.000	1.000
Number of platforms	CR	100%	0.000	0.099	0.000	1.000
	CE	100%	0.000	0.099	0.000	1.000
E-commerce broadcasting	CR	100%	0.014	0.096	0.014	0.069
	CE	100%	0.018	0.096	0.018	0.061
Visual effect	CR	100%	0.003	1	0.004	0.098
	CE	100%	0.007	1	0.008	0.094
Government cooperation	CR	100%	0.021	1	0.019	0.098
	CE	100%	0.019	1	0.007	0.096

[a]Calibrated fuzzy set affiliation values. [b]$0.0 \leq d < 0.1$: "low level"; $0.1 \leq d < 0.3$: "medium level." [c]The permutation test (permutation test, number of resampling = 10,000) in NCA analysis (Dul et al., 2020).

not exceed 1. The results of descriptive statistics and calibrated anchor points for each variable in this study are shown in Table 3. Based on the above criteria for assignment of outcome and condition variables, the raw data of 208 agricultural products cases were assigned and imported into the fsQCA software for calculation in this paper.

Research results and analysis

Necessary condition analysis

The NCA method identifies whether the study variable is a necessity condition and detects the effect size of the necessity condition. The effect size is indicated by the bottleneck level in the NCA method. Dul et al.'s study states that the value of bottleneck level is between 0 and 1, and when the value is less than 0.1, it means that the effect size is too small, and on the contrary when the value is closer to 1, it indicates that the necessity effect size is larger (Dul et al., 2020). The upper limit regression (CR) and upper limit envelopment (CE) methods of the NCA method can be used to deal with different levels of discrete variables as well as continuous variables. The CR method is chosen if the variables in the study are all discrete or continuous variables and are at or above level 5; the CE method is chosen if the variables in the study are dichotomous or do not reach level 5. The CR or CE method allows the corresponding functions of the variable relationships to be obtained and the effect sizes to be analyzed accordingly. According to Dul, in the NCA method, two conditions are required to satisfy the necessary conditions, which are that the effect size (d) is greater than or equal to 0.1 and that the results of Monte Carlo simulations of permutation tests show significant (Dul et al., 2020).

In this study, the results of effect sizes for each variable were calculated using both CR and CE methods (see Table 4). In addition, this paper reports the results of the NCA analyses, including effect sizes derived using two different estimation methods, CR and CE. Necessary conditions in the NCA approach require two conditions

TABLE 5 Results of NCA method bottleneck level (%) analysis.

Online marketing performance	Customer relationship	Price adjustment	Number of platforms	E-commerce broadcasting	Visual effect	Government cooperation
0	NN	NN	NN	NN	NN	NN
10	NN	NN	NN	NN	NN	NN
20	NN	NN	NN	0.2	NN	NN
30	NN	NN	NN	0.3	NN	NN
40	NN	NN	NN	0.5	NN	0.1
50	NN	NN	NN	0.6	0.1	0.2
60	NN	NN	NN	0.8	0.3	0.6
70	NN	NN	NN	1.0	0.5	0.7
80	NN	NN	NN	1.2	0.6	1.0
90	NN	NN	NN	1.3	0.7	1.1
100	NN	NN	NN	1.5	0.9	1.4

[a]CR method, NN, not necessary.

TABLE 6 Necessary conditions analysis.

Condition Variables	Good online marketing performance		Non-good online marketing performance	
	Consistency	Coverage	Consistency	Coverage
Customer relationship	0.404	0.750	0.532	0.424
~Customer relationship	0.729	0.724	0.721	0.585
Price adjustment	0.432	0.525	0.805	0.631
~Price adjustment	0.715	0.731	0.371	0.288
Number of platforms	0.570	0.759	0.673	0.560
~Number of platforms	0.699	0.608	0.540	0.453
Government cooperation	0.726	0.574	0.434	0.328
~Government cooperation	0.685	0.546	0.567	0.536
Visual effect	0.714	0.765	0.428	0.313
~Visual effect	0.404	0.537	0.613	0.547
E-commerce broadcasting	0.845	0.785	0.455	0.350
~E-commerce broadcasting	0.155	0.314	0.546	0.528

to be met: the effect size (d) is not less than 0.1 (Dul et al., 2020) and the Monte Carlo simulation replacement test shows that the effect size is significant (Dul et al., 2020). The results of the NCA tests showed that among the online marketing dimensions, the results of e-commerce broadcasting, visual effects, and government cooperation were significant, but produced effects that were too small to be identified as necessary to influence marketing effectiveness (Yunzhou and Liangding, 2017). In addition, the test results for customer relationship ($p = 1.0$), price adjustment ($p = 1.0$), and number of platforms ($p = 1.0$) were not significant, indicating that they are also not necessary to produce good marketing results. In addition, the bottleneck level in the bottleneck analysis indicates the range of the maximum observed level values that the antecedent conditions need to satisfy when the level of the maximum observed range of results is met, and the specific results of the bottleneck analysis in this study are shown in Table 5. The data results show that to achieve a 60% level of marketing effectiveness, 0.8% level of e-commerce broadcasting, 0.3% level of visual effects and 0.6% level of government cooperation are needed, and no bottleneck level exists for any other dimensions.

In fsQCA, "necessary" means that the condition always occurs when the result exists, and if the condition does not occur, the result cannot be generated. Generally, when the consistency is greater than 0.9 or close to 0.9, this antecedent condition is considered as the necessary condition of the outcome variable (Dul et al., 2020). By analyzing the fsQCA software, the consistency and coverage values of each condition variable can be obtained, as shown in Table 6. From the calculated results, the consistency of all antecedent conditions is less than 0.9, i.e., none of the six factors constitutes a necessary condition for generating an effective online marketing strategy. This result indicates that a good online marketing performance is the result of a combination of factors together, and no single factor has a significant effect on it.

Grouping analysis

After the analysis of the necessary conditions, it is necessary to analyze the effect of the combination of the condition variables on the

outcome variables (Dul et al., 2020). According to related studies, the consistency threshold was set to 0.8, the PRI threshold was set to 0.7, and the case threshold was set to 1. The complex solution, intermediate solution, and parsimonious solution were derived through the standardization operation of fsQCA software (Yunzhou and Liangding, 2017). In general, the intermediate solution has the advantage of not allowing the elimination of necessary conditions compared to the complex solution. In addition, comparing the output results of the parsimonious and intermediate solutions, the core conditions of the grouping appear in both the parsimonious and intermediate solutions, and the edge conditions appear only in the intermediate solution, so the grouping structure of the intermediate solution is adopted in this study.

Analysis of the grouping of good online marketing performance

There are four paths (H1, H2, H3, H4) to generate good online marketing performance, as shown in Table 7.

fsQCA analysis of the cases yielded an overall solution consistency of 0.937, which is higher than the acceptable level of consistency of 0.8, and an overall coverage of 0.418, indicating that the four groupings explain more than 41% of the reasons for good online marketing performance, and the specific groupings are analyzed as follows.

In group H1 (~customer relationship* ~ price adjustment* ~ number of platforms* government cooperation* e-commerce broadcasting), the presence of government cooperation, e-commerce broadcasting and the absence of customer relationship are the core conditions. The absence of price adjustment and number of platforms is the marginal condition. This result shows that regardless of the visual effect of the product, increasing the degree of cooperation with the government, adopting e-commerce broadcasting to sell products and do not increase the investment in customer relations, even if the number of platforms is small and the price is not significantly reduced, it will also produce a good online marketing performance. This pattern is the dominant type of "government cooperation—e-commerce broadcasting," and the consistency is higher than 0.977 patterns, indicating that its positive effect on online marketing effect is obvious.

In group H2 (~customer relationship* ~ number of platforms* government cooperation* visual effect* e-commerce broadcasting), the presence of government cooperation, e-commerce broadcasting and the absence of customer relationship are the core conditions. The presence of visual effect and the absence of number of platforms are the marginal conditions. This path shows that price adjustment has little relationship with the outcome, and small agricultural operators do not invest too much in customer relationship, but actively cooperate with the government and take measures to improve the visual effect of products by e-commerce broadcasting, so that they can still achieve the result of good online marketing performance even if the number of platforms is small. This grouping is the dominant type of "government cooperation—visual effect—e-commerce broadcasting," and its consistency is higher than 0.979 groupings, which indicates that the positive effect on the performance of online marketing.

In group H3 (customer relationship* ~ price adjustment* government cooperation* visual effect* live e-commerce), the presence of visual effect, e-commerce broadcasting and the absence of price adjustment are the core conditions. The presence of government cooperation and customer relationship is the marginal condition. The cases that satisfy this path reflect the role of e-commerce broadcasting and visual effects driving. It shows that regardless of the number of platforms, operators who adopt e-commerce broadcasting, improve the visual display of web pages without significantly reducing prices, and establish cooperation with the government and take certain measures in customer relations will produce good online marketing results. The consistency of this group is 0.901, which is the lowest among the four groups, indicating that the positive effect of this group is the weakest.

In group H4 (~customer relationship* ~ price adjustment* number of platforms* ~ government cooperation* visual effect* live e-commerce), the presence of visual effect, e-commerce broadcasting and the absence of price adjustment are the core conditions. While the presence of the number of platforms and the absence of customer relationship and government cooperation are the marginal conditions. This suggests that small agricultural operators' multi-platform investment, enhancement of product visual effects, and adoption of e-commerce broadcasting, while not significantly adjusting prices, will produce positive online marketing performance even with less investment in customer relations and government cooperation.

Analysis of the grouping of non-good online marketing performance

There are four groupings of non-good online marketing performance (NH1, NH2, NH3, NH4), as shown in Table 8.

After the fsQCA analysis of the case, the overall solution consistency is 1, higher than the acceptable degree of consistency 0.8, the overall coverage of 0.569, indicating that the four configurations explain more than 56% of the reasons to produce non-good online marketing performance, the specific configuration analysis is as follows.

In group NH1 (~customer relationship* price adjustment* ~ number of platforms* ~ government cooperation* ~ visual effect), the presence of price adjustment and the absence of customer relationship and visual effect are the core conditions. The absence of government cooperation and number of platforms is the marginal condition. This group indicates that the absence of number of platforms and government cooperation has low-level impact on non-good online marketing performance. However, it is worth mentioning that, even if agricultural operators adjust the product price, failure to focus on visuals effect and consumer relations will inevitably lead to non-good online marketing performance.

In group NH2 (~customer relationship* ~ number of platforms* government cooperation* ~ visual effects* ~ live e-commerce), the absence of customer relationship and e-commerce broadcasting is the core condition. The presence of government cooperation, the absence of number of platforms and visual effects are the marginal conditions. This path illustrates that small agricultural operators who neither maintain customer relationships nor adopt e-commerce broadcasting cannot produce good online marketing performance even if they cooperate with the government and adjust the price.

In group NH3 (customer relationship* price adjustment* number of platforms * ~ government cooperation* ~ visual effect* ~ live e-commerce), the presence of price adjustment and number of platforms, and absence of government cooperation are the core conditions. The presence of customer relationship and absence of visual effect and e-commerce broadcasting are the marginal

TABLE 7 Group structure of good online marketing strategies.

Condition variable	Grouping			
	H1	H2	H3	H4
Customer relationship	⊗	⊗	•	⊗
Price adjustment	⊗		⊗	⊗
Number of platforms	⊗	⊗		•
Government cooperation	●	●	•	⊗
Visual effect		•	●	●
E-commerce broadcasting	●	●	●	●
Original coverage	0.206	0.229	0.211	0.094
Unique coverage	0.047	0.070	0.118	0.024
Consistency	0.977	0.979	0.901	1
Solution coverage	0.418			
Consistency of the solution	0.937			

● Indicates "core condition exists"; • indicates "edge condition exists"; ⊗ indicates "core condition is missing"; ⊗ indicates "edge condition is missing "; blank spaces indicate that the presence or absence of the condition has no effect on the results.

TABLE 8 Grouping structure of non-good network marketing effect strategies.

Condition variable	Grouping			
	NH1	NH2	NH3	NH4
Customer relationship	⊗	⊗	•	•
Price adjustment	●		●	●
Number of platforms	⊗	⊗	●	●
Government cooperation	⊗	•	⊗	⊗
Visual effect	⊗	⊗	⊗	•
E-commerce broadcasting		⊗	⊗	•
Original coverage	0.265	0.190	0.076	0.114
Unique coverage	0.190	0.152	0.076	0.076
Consistency	1	1	1	1
Solution coverage	0.569			
Consistency of the solution	1			

● Indicates "core condition exists"; • indicates "edge condition exists"; ⊗ indicates "core condition is missing"; ⊗ indicates "edge condition is missing "; blank spaces indicate that the presence or absence of the condition has no effect on the results.

conditions. This group suggests that cooperation with the government is the key dimension which produce good online marketing performance, even if they make huge effort to decrease the price or adopt several platforms, without government cooperation, the agricultural operators cannot achieve a good online marketing performance.

In group NH4 (customer relationship* price adjustment* number of platforms* ~ government cooperation* visual effect* live e-commerce), the presence of price adjustment, the number of platforms and the absence of government cooperation are the core conditions. The presence of customer relationship, visual effect and e-commerce broadcasting is marginal condition. The findings of group 4 are like those of group 3, no matter how much effort agricultural operators put into other dimensions, they cannot generate a good online marketing performance without cooperating with government. This result proves that cooperating with government plays a significant role to achieve a good online marketing performance once again.

Robustness check

Checking the robustness of the analysis results is a key step in QCA research. In this study, the data were analyzed again after adjusting the case frequency to 2 and the consistency threshold to 0.81 to compare the changes in the groups to assess the results (Yunzhou and Liangding, 2017). It was detected that the combination of paths affecting online marketing did not lead to substantial changes in the number of groupings, components, and consistency and coverage after the parameter adjustment. Therefore, it is concluded that the results of the analysis obtained in this study are reliable and robust.

Conclusion and implications

Conclusion of the study

In this paper, 208 small agricultural enterprises in China were analyzed in the context of the Covid pandemic, and a combination of NCA and QCA was applied to investigate the effectiveness of online marketing mix strategies on marketing performance. The study indicates that (1) the results of NCA show that individual online marketing dimension cannot be the necessary condition to produce high marketing performance, but strengthening e-commerce broadcasting, visual effects, and government cooperation can obviously improve marketing performance. (2) Online marketing performance is influenced by the interaction of multiple online marketing strategies adopted by operators. None of the six dimensions are necessary to produce good market performance, indicating single online marketing strategy dimension does not achieve good marketing results, a good performance of online marketing is the result of the configuration effect of multiple dimensions. (3) The study obtained four paths to produce good online marketing performance, namely H1: "government cooperation—e-commerce broadcasting" dominant, H2: "government cooperation-visual effect—e-commerce broadcasting" dominant, H3: "customer relationship—government cooperation—visual effect—e-commerce broadcasting" dominant, and H4: "number of platforms—visual effect—e-commerce broadcasting" dominant. This illustrates the multiplicity and complexity of paths to achieve good online marketing performance. In addition, the four specific paths reflect the important role of three dimensions: e-commerce broadcasting, visual effects, and government cooperation. (4) There are four path of online marketing strategies to generate non-good performance, namely NH1: "customer relationship—visual effect" dominant, NH2: "customer relationship—e-commerce broadcasting" dominant, NH3 and NH4 are both "government cooperation" dominant, but the marginal conditions are different. Furthermore, there is an asymmetry with the paths that generate good online marketing performance.

Theoretical implications

The transformation of traditional marketing strategy to online marketing strategy is necessary, especially in the era of the Covid pandemic and post-pandemic, small agricultural operators should respond positively to the call of the state and the government's strong support, and quickly understand the market dynamics. According to the changes in demand, the operators should allocate resources, optimize the logistics and transportation path, increase the efficiency of the circulation, break through the original time and geographic location limitations, improve sales of agricultural products, broaden the target market, and make a greater contribution to the development of rural economy. Compared with existing studies related to agricultural online marketing, this paper has the following theoretical contributions.

Firstly, by combing the existing related literature, this paper selects the important dimensions that affect the online marketing performance of agricultural products, constructs a new and multi-dimensional variable model, put the six dimensions including customer relationship, price adjustment, number of platforms, government support, visual effect, and e-commerce broadcasting into the same research system to analyze the influence of the optimal combination on the online marketing performance, and scientific development suggestions are provided for small agricultural enterprises in the pandemic environment.

Secondly, based on the existing research, this paper enriches the research related to agricultural products online marketing. The results of the study reveal that under the impetus of Covid pandemic, how the multi-dimensional online marketing combination strategy adopted by small agricultural operators in the process of sales transformation can improve marketing performance, and the specific causal relationship between them, which further enriches the research related to the online marketing strategy of agricultural products.

Thirdly, most of the studies related to agricultural marketing use traditional regression analysis, focusing on the analysis of the unique "net effect" of a single antecedent variable, and few studies have systematically and comprehensively interpreted the mechanism of multiple online marketing strategies on the final performance, and compare the similarities and differences between the effects of each strategy. In view of the above-mentioned problems and research deficiencies, this study adopts a combination of NCA and QCA from the perspective of holism and comprehensively study the configuration effects of several dimensions, providing a holistic perspective on the complex interactions and causal asymmetries among the dimensions behind the performance of online marketing, which has certain implications for development of small agricultural enterprises in the post-pandemic era.

Management insights

From a practical point of view, the development of agricultural products online marketing can help enhance the influence and competitiveness of local agricultural products, solve the real problems of rural labor loss and the difficulty of selling agricultural products. Specifically, the findings of this paper can provide management insights for the formulation of relevant government policies and the development of small agricultural enterprises in the post-pandemic era.

Firstly, agricultural operators should focus on e-commerce broadcasting as a marketing method. According to the four combined paths, it can be found that e-commerce broadcasting is the core condition of the four groups, it has an important role in the online marketing of agricultural products. On the one hand, e-commerce broadcasting has the advantages of low capital investment, low technical requirements, and less content restrictions, which can be easily grasped by agricultural operators. On the other hand, it is more intuitive to show products than other marketing methods, which in turn can increase consumers' trust and sense of security in products and ultimately improve the performance of sales. During the pandemic, governments took measures to quarantine residents at home, and they had more time to browse web information than usual. It was a good opportunity for agricultural operators to capture consumers' attention and raise awareness of their products. The most effective way to take advantage of this opportunity is to increase product exposure online. When collecting cases, the study found that most of the agricultural operators adopted scenario-based broadcasting to promote their agricultural products, which not only played a good role in solving the

problem of stagnant sales, but also enhanced the visibility of the new stores and laid the foundation for sales after resumption of work and production. However, as more and more agricultural operators join the e-commerce broadcasting, how to be "attractive" has become a new problem. This study suggests that operators should avoid homogeneous and monotonous publicity, find the right positioning, the highlights, and enrich the video content to attract the consumers' attention. In addition, more interaction with consumers is an effective way to enhance the popularity of broadcasting.

Secondly, the study found that good product visual effect helps to improve the performance of online marketing. The overall esthetic and artistic quality of agricultural online layout is low, and the operators do not pay attention to the importance of web design quality and product visual display effects. As far as the current situation of agricultural products business, most of the agricultural operators have not gone through professional training. Usually, they are producers, website designers and marketers, so their professional awareness of all aspects of marketing is relatively weak. In the process of online marketing, the operators are unable to optimize the website, take quality product pictures, and are relatively weak in handling online customer service communication, transaction guarantee, and product feedback. Therefore, agricultural operators should hire professional team to response for online marketing to further distinguish their products from other similar agricultural products.

Thirdly, agricultural operators in need to actively cooperate with the government and respond positively to the government's support policies in various aspects of agriculture. In both (H1) and (H2) paths, government cooperation is the core condition. By participating in government activities and obtaining government support, agricultural enterprises can also achieve sales growth. However, it should be noted that in the context of the pandemic, to solve the problems related to the people's livelihood, the government's support efforts are usually greater than usual, therefore in the post-pandemic era, cooperation with the government may not reap good results.

Finally, the effect of price reduction is not significant. In actual operation, agricultural operators often use price reduction measures to attract traffic and solve offline stagnation problems in a timely manner. However, the research results show that attracting traffic by lowering prices is not a good remedy to solve sales problems and achieve their own development. During the pandemic, the stagnation of agricultural products was caused by the contradiction between the obstruction of transportation and the short shelf life of agricultural products. Price reductions will directly harm the economic interests of agricultural operators; moreover, because the price of agricultural products is too low, it may leave a negative impression of poor quality to consumers, which is not conducive to the online sales. Under this situation, agricultural products operators should: 1. strengthen their awareness and professionalism of brand construction through participation in relevant professional training, understand the importance of brand construction of agricultural products, and build a distinctive brand depends on their own product attributes; 2. clarify target consumers and consumer needs, attract consumers through effective online marketing strategies; 3. Improving production through new agricultural planting technology, developing deep processing products, enhancing added value, and meeting diversified consumer demands.

Research limitation and future research

With the facilitation of the Covid pandemic and "rural revitalization," the traditional marketing strategy of agricultural industry has brought unprecedented challenges and new opportunities of online marketing strategy. With the strong support from the government and the popularity of the Internet in rural areas, the online marketing strategy has rapidly become the first choice of agricultural operators. Based on the problems and opportunities faced by operators in the special context, this paper explores the configuration influence of different online marketing strategies on the online marketing performance from multiple dimensions, proposes countermeasures from both government and agricultural operators to promote the efficient development of the agricultural industry and the national plan for rural revitalization.

However, there are several limitations in this paper which are as follows: firstly, the samples collected are not extensive enough, and future research can improve the generalizability and validity through the validation of larger samples; secondly, the formation mechanism of marketing performance of different types of agricultural products distributed in different regions and types may be different; finally, this paper only considers customer relationship, price adjustment, number of platforms, government cooperation, visual effect, and e-commerce broadcasting six conditional variables, and whether there are other factors that have an impact on marketing results need to be further discussed. Moreover, the only dimension of sustainability that is addressed in this study is the economic performance. However, online marketing strategies can contribute to the sustainability of agricultural industry in more dimensions, for example, online data can be used to predict the sales of agricultural products, which can reduce the planting of excess agricultural products and protect land resources and the environment; online sales volume can help operators better calculate the inventory, which can reduce the corruption and waste of agricultural products, and further reduce the carbon emission; the digitization of agricultural products can facilitate operators to learn new technologies and improve their professionalism, which can increase the yield per unit area and contribute to the agricultural industry. Therefore, future research can be more detailed and in-depth according to the characteristics of agricultural products, supplemented with relevant cases, and further explored how to achieve sustainable development and corporate social responsibility by enhancing the online marketing strategy of agricultural industry.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the author, without undue reservation.

Ethics statement

The studies involving humans were approved by China university of political science and law. The studies were conducted in accordance with the local legislation and institutional requirements. The

participants provided their written informed consent to participate in this study.

Author contributions

YZ: Writing – original draft, Writing – review & editing.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

Agricultural and rural big data. (2020). National agricultural products stagnation returns visit report: http://www.agdata.cn/newsdata/getagdatanewsdetails-459.html.2020/03/15

Aiping, L. (2018). Research on the marketing mode of "internet+agricultural products" in Shanxi Province. *Economic Issues* 4, 70–76. doi: 10.16011/j.cnki.jjwt.2018.04.012

Banker, R. D., and Mitra, S. (2007). Procurement model in the agricultural supply chain: a case study of online coffee auctions in India. *Electron. Commer. Res. Appl.* 6, 309–321. doi: 10.1016/j.elerap.2006.06.002

Bingcheng, X. (2020). Research on the factors influencing the online sales of geographical indication agricultural products. *China Forestry Econ.* 4, 58–73. doi: 10.13691/j.cnki.cn23-1539/f.2020.05.016

Canavari, , Fritz, M., Hofstede, G. J., Matopoulos, A., and Vlachopoulou, M. (2010). The role of trust in the transition from traditional to electronic B2B relationships in Agri-food chains. *Comput. Electron. Agric.* 70, 321–327. doi: 10.1016/j.compag.2009.08.014

Cheng, C., Xiaolin, Q., Wanqi, M., and Dongyan, S. (2017). An empirical study of factors influencing the effectiveness of mobile social network marketing. *China Manag. Sci.* 25, 145–149. doi: 10.16381/j.cnki.issn1003-207x.2017.05.017

Chenglong, Guo. *Online marketing of agricultural and forestry products*. Nanjing: Southeast University Press, (2016). 42–55.

Dong, Z., and Rui, Y. (2019). Influencing factors of rural e-commerce development and government support-an empirical study based on qualitative comparative analysis of fuzzy sets. *Rural Economy* 2, 110–116.

Dong, Y., Time, and Shi, Y. (2020). Research on the influence of online marketing on online consumers' purchasing behavior. *Exploration of economic issues* 10, 45–55.

Du, Y. Z., Liu, Q. C., and Cheng, J. Q. (2020). What kind of business environment ecology produces high entrepreneurial activity in cities? --an analysis based on institutional grouping. *Manage. World* 36, 141–155.

Dul, J., van der Laan, E., and Kuik, R. (2020). A statistical significance test for necessary condition analysis[J]. *Organ. Res. Methods* 23, 385–395. doi: 10.1177/1094428118795272

Fiss, P. C. (2011). Building better causal theories: a fuzzy set approach to typologies in organization research. *Acad. Manag. J.* 54, 393–420. doi: 10.5465/amj.2011.60263120

Foresight Research Institute. (2020). 2018–2020 first half of China's agricultural products online retail sales statistics analysis. Available at: https://bg.qianzhan.com/wuliu/detail/616/201118-3bc8c95f.html. 2020/11/18.

Gang, W. (2016). *Exploration of China's agricultural products internet marketing strategy*. Hubei, China: Huazhong Normal University.

Gang, Z., Zongshui, W., and Hong, Z. (2019). Marketing model innovation in the internet+ environment:a value network reconstruction perspective. *Manag. Rev.* 31, 94–101. doi: 10.14120/j.cnki.cn11-5057/f.2019.03.009

Hainan, W., Aizhao, N., and Jiujie, M. (2020). Optimization paths and strategies of China's fresh produce supply chain after the epidemic. *Rural Economy* 10, 107–113.

Hair, (2010). *Multivariate data analysis. A global perspective* (*7th ed.*). New Jersey: Pearson.

He, D. W., Han, X. Y., and Li, Y. Z. (2014). Research on the purchase intention of fresh produce e-commerce consumers. *J. Northwest Agricul. Forestry Universityof Sci. Technol. (Soc. Sci. Edition)* 14, 85–91. doi: 10.13968/j.cnki.1009-9107.2014.04.020

Hong, H., and Xu, D. (2015). A study on the factors influencing persistent usage intention of mobile social applications-exploring the joint role of network externalities and herding behavior. *Econ. Manag.* 5, 40–50. doi: 10.19616/j.cnki.bmj.2015.05.008

Hongdong, G., and Jiang, Q. (2020). Research on the sustainable development of direct broadcasting with goods to help farmers. *People's Forum* 20, 74–76.

Hongxia, Z., Wisdom, C., and Shan, H. (2014). A study on online product display, online interaction and impulsive purchase based on virtual haptic perspective. *J. Manag.* 11, 133–141.

Houkai, W., and Qianwen, L. (2020). The impact of the new pneumonia epidemic on the "three rural areas" and countermeasures. *Econ. J.* 5, 36–47. doi: 10.16528/j.cnki.22-1054/f.202005036

Huang, Y., Luo, X., and Tang, L. (2020). The influence of market trust on farmers' biopesticide application behaviour - an analysis of the moderating effect based on the institutional environment. *Yangtze River Basin Resources and Environment* 29, 2488–2497.

Huang, L. J., and Xiaomeng, X. (2015). Review and prospect of mobile marketing research. *Foreign Econ. Manag.* 10, 58–68. doi: 10.16538/j.cnki.fem.2015.10.005

Jiang, J. G., and Chen, S. Y. (2019). Online "grass planting": social marketing, consumption induction and aesthetic fatigue. *Learn. Prac.* 4, 125–131. doi: 10.19624/j.cnki.cn42-1005/c.2019.12.015

Jie, Y., and Qihua, Y. (2015). Research on some problems and countermeasures of China's special agricultural products marketing. *Agric. Econ.* 11, 126–128.

Jingjing, C., and Jie, H. (2019). Measurement of price shocks to agricultural markets from epidemic events. *Statist. Decision Making* 35, 109–112. doi: 10.13546/j.cnki.tjyjc.2019.22.026

Kexi, W., and Jun, C. (2014). The mechanism of IWOM on online sales of agricultural products: an empirical study on the sales of a brand of tea on Tmall. *J. Agricul. Forestry Econ. Manag.* 13, 186–191. doi: 10.16195/j.cnki.cn36-1328/f.2014.02.012

Larkin, Charles C. *Redesigning social science research: Fuzzy sets and beyond*. translated by YunzhouDu. Beijing, China: Machinery Industry Press. (2019).

Lei, B., Qiaoxia, W., and Liu, S. (2021). Local characteristics, network word of mouth and agricultural products on the market. *China Soft Sci.* 2, 34–45.

Lin, J., Wan, J.-Y., and Lu, Y.-B. (2015). Analysis of factors influencing consumer trust in fresh agricultural products e-commerce:taking fruits as an exampl. *Business Econ. Manag.* 5, 5–15. doi: 10.14134/j.cnki.cn33-1336/f.2015.05.001

Ma, S., and Guo, J. (2021). "Price wins" or "word of mouth first"-research on marketing strategy of e-commerce enterprises based on the perspective of product quality. *Res. Finance Econ.* 4, 112–120.

Mengsi, H., and Jian, S. (2016). The impact of compound governance "crowding out effect" on the performance of agricultural marketing channels: an example of "agricultural leading enterprises + farmers" model. *China Rural Economy* 4, 17–54.

Ministry of Agriculture and Rural Affairs of the People's Republic of China. (2017). Speech of Li Zhanshu, Chairman of the Standing Committee of the National People's Congress, at the Symposium on the Implementation of the Promotion of Rural Revitalization Law (moa.gov.cn)

Ministry of Agriculture and Rural Affairs of the People's Republic of China. (2021). Stable agricultural 0066oundation for well-off people (Economic Daily, July 10, p. 3; moa.gov.cn) 2021/07/12.

Ministry of Agriculture and Rural Affairs of the People's Republic of China. (2020). 农业部办公厅关于进一步推动贯彻落实农产品加工业扶持政策的通知 (moa.gov.cn)

Peirong, C., and Mingxuan, L. (2019). Analysis of the causes of willingness to purchase fresh agricultural products online based on the survey data of Hengyang City. *J. Hengyang Normal College* 40, 107–112. doi: 10.13914/j.cnki.cn43-1453/z.2019.04.019

People.cn. Value-added of the nation's agriculture and related industries to reach $16.69 trillion in 2020, accounting for 16.47% of GDP. (2022). 年全国农业及相关产业增加值达16.69万亿 占GDP比重16.47%--经济·科技--人民网 (people.com.cn)

Qalati, S. A., Yuan, L. W., Khan, M. A. S., and Anwar, F. (2021). A mediated model on the adoption of social media and SMEs' performance in developing countries. *Technol. Soc.* 64:101513. doi: 10.1016/j.techsoc.2020.101513

Ramaswamya, V., and Ozcan, K. (2016). Brand value co-creation in a digitalized world: an integrative framework and research implications. *Int. J. Res. Mark.* 33, 93–106. doi: 10.1016/j.ijresmar.2015.07.001

Ren, Z. (2021). Research on the live broadcast operation strategy of agricultural products E-commerce[C]//journal of physics: conference series. *IOP Publishing* 1992:042054

Rongping, R., Wang, R., and Cheng, Y. (2022). Farming-related poverty alleviation enterprises in the new coronary pneumonia epidemic: production and operation, poverty alleviation drive and policy environment-analysis based on the survey data of 1,269 farming-related poverty alleviation enterprises nationwide. *Agricul. Technol. Econ.* 32–49. doi: 10.13246/j.cnki.jae.20220223.001

Ruifeng, W. (2020). Assessment of the impact effect of agriculture-related e-commerce platforms on China's agricultural economic development - taking rural Taobao as an example. *China Circulation Econ.* 34, 68–77. doi: 10.14089/j.cnki.cn11-3664/f.2020.11.006

Shanshan, M. (2018). The impact of unexpected event information shock on pork price volatility. *Manag. Rev.* 30, 246–255. doi: 10.14120/j.cnki.cn11-5057/f.2018.09.023

Shen, L., Jiajing, H., and Chu, L. (2021). Research on brand value based on the logic of unity of production and consumption in sharing economy. *Nankai Manag. Rev.* 6, 1–16.

Shivraj, K. (2004). On the emancipatory role of rural information systems. *Info. Technol. People [QK]* 17, 407–422.

Sony, M., and Naik, S. (2020). Industry 4.0 integration with socio-technical systems theory: a systematic review and proposed theoretical model. *Technol. Soc.* 61:101248. doi: 10.1016/j.techsoc.2020.101248

Thanh, P. T., The Duy, D., and Bao, D. P. (2022). Disruptions to agricultural activities, income loss and food insecurity during the COVID-19 pandemic: evidence from farm households in a develo** country. *J. Agribusiness in Develo** Emerg. Econ.* 12, 531–547. doi: 10.1108/JADEE-09-2021-0243

Time, D. Y., and Yutian, S. (2020). Research on the influence of online marketing on online consumers' purchasing behavior. *Exploration of Econ. Issues* 10, 45–55.

Vis, B., and Dul, J. (2018). Analyzing relation- ships of necessity not just in kind but also in degree. Complementing fsQCA with NCA. *Sociol. Methods Res.* 47, 872–899. doi: 10.1177/0049124115626179

Wang, H., Cui, J., and Hu, B. (2014). Analysis of the role mechanism of IWOM influence on B2C transactions of agricultural products. *Anhui Agricultural Sci.* 42, 4495–4496.

Wang, Z. P., Liu, Y., and Chen, M. (2015). Measuring marketing effectiveness in the social network environment: the example of microblogging. *Intel. Sci.* 33, 118–156. doi: 10.13833/j.cnki.is.2015.03.023

Weiwei, W. (2018). Research on the internet marketing model of featured agricultural products - taking Sichuan Province as an example. *Rural economy* 4, 58–63.

Williamson, B., Eynon, R., and Potter, J. (2020). Pandemic politics, pedagogies and practices: digital technologies and distance education during the coronavirus emergency. *Learn. Media Technol.* 45, 107–114. doi: 10.1080/17439884.2020.1761641

Wu, Z. H., Chen, H., and Liang, C. R. (2015). Coordination model of asymmetric information fresh and live agricultural products supply chain under time constraint in response to emergencies. *China Manag. Sci.* 23, 126–134. doi: 10.16381/j.cnki.issn1003-207x.2015.06.016

Xiao, D. (2020). Internet marketing strategies for agricultural products in China in the context of e-commerce. *Food Res Dev* 41:14.

Xicai, Z. (2021). Research on the key links and optimization and upgrading of agricultural products supply chain in poverty-stricken areas under the COVID-19 epidemic. *Agricul. Econ. Issues* 4, 99–106. doi: 10.13246/j.cnki.iae.2021.05.011

Xinjing News. (2021). Alibaba's latest data: annual sales of agricultural products 303.7 billion yuan...Alibaba's latest data: annual sales of agricultural products 303.7 billion yuan (baidu.com)2021/05/17.

Xuping, J., and Xin, W. (2011). Analysis of key factors affecting the effectiveness of search engine marketing. *J. Manag. Sci.* 14, 37–45.

Yanfang, F. (2020). Research on pricing strategy of online shopping for fresh agricultural products-analysis based on the perspective of consumers' willingness to buy online. *Price Theory and Practice* 7, 137–140. doi: 10.19851/j.cnki.cn11-1010/f.2020.07.249

Yang, Y. J. (2014). Analysis of the impact of social network attributes on e-commerce consumer trust. *Business Times* 25, 67–69.

Yawen, Z. (2018). Research on the brand marketing strategy of agricultural products based on online community and emotion building. *Agric. Econ.* 12, 135–137.

Yi, Z., and Weihua, Y. (2021). Analysis and interpretation of mimetic marketing in the context of online live shopping based on Jieyin live platform. *J. Shanghai University of Int. Business and Econ.* 28, 114–124. doi: 10.16060/j.cnki.issn2095-8072.2021.02.009

Yijian, X. (2014). Research on factors influencing the willingness of residents to purchase fresh agricultural products online. *Jiangsu Sci. Technol. Info.* 21, 97–98.

Yongsheng, J., Rui, W., and Xiangbing, C. (2011). Short-term interaction model of corporate microblog marketing effect and followernumber. *Manag. Sci.* 24, 71–83.

You, H., Xin, C., and Chunjie, Q. (2021). Study on the impact of the new crown pneumonia epidemic on price fluctuations of agricultural products and policy effects. *J. Agricul. Forestry Econ. Manag.* 20, 59–69. doi: 10.16195/j.cnki.cn36-1328/f.2021.01.07

Yunzhou, D., and Liangding, J. (2017). Group perspective and qualitative comparative analysis (QCA): a new path for management research. *Manage. World* 6, 155–167. doi: 10.19744/j.cnki.11-1235/f.2017.06.012

Zhanpeng, S. (2020). The attachment of farmers' online business to e-commerce platform and its formation mechanism. *J. Shanghai University of Int. Business and Econ.* 27, 47–55. doi: 10.16060/j.cnki.issn2095-8072.2020.03.005

Zhaoyang, L. (2021). Webcasting and the development of fresh produce e-commerce: driving mechanism and empirical test. *China Soft Science* 3, 18–30.

Zhiwen, Z., Haodong, Z., and Jiaxi, S. (2021). IWOM value measurement and prediction method based on customer network influence. *Statist. Decision Making* 37, 166–169. doi: 10.13546/j.cnki.tjyjc.2021.07.035