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Preference Characteristics on Consumers’ Online Consumption of Fresh Agricultural Products under the Outbreak of COVID-19: An Analysis of Online Review Data Based on LDA Model

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Abstract

Since the outbreak of the COVID-19 pandemic in 2020, China has adopted a zero-clearing policy under closed control. It is rather common for residents who are quarantined at home to buy fresh agricultural products online, when COVID-19 spread in big cities. Many e-commerce platforms are trying to develop online shopping channels for fresh agricultural products. However, negative comments and news about those platforms have been increasing because of several reasons, such as the difference in the quality of fresh products, inadequate categories of commodity and inefficient delivery caused by the shortage of personnel and so on. The smooth daily supply of online fresh agricultural products is conducive to soothing the pessimistic emotions and to encouraging their active obedience to epidemic prevention and control policy. Therefore, it is of great importance to explore the preference characteristics of consumers’ online purchase of fresh agricultural products under this critical situation. In this paper, firstly, Pycharm software is used to collect online comment texts of fresh agricultural products on the online platforms with a total of 34,546 pieces of evaluation data. Secondly, the collected data is preformed into the text preprocessing. To be specific, the obtained online comments are processed by Python, including the process of text duplication between sentences, text duplication within sentences and short sentence filtering. After that, processed texts are subjected to Jieba Text Segmentation to form the final word frequency ranking, involving two procedures, part-of-speech tagging and stop-words removal. Lastly, the results of the LDA model indicate the factors that influence consumers’ preferences when they purchase fresh agricultural products online. This study could not only identify the typical features of residents’ online shopping preference in the context of the spread of COVID-19, but also provide pragmatic suggestions for the local government to appease the residents’ negative emotions for the prevention of widespread complaints at the social level.

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1. Introduction

Ever since the outbreak of the COVID-19 pandemic in 2020, owing to the strict zero-clearing policy carried out in China, the consumption for daily necessities of many home-quarantine families has changed from traditional offline purchase in shopping malls, supermarkets, vegetable markets and restaurants to online purchases, which creates numerous opportunities for the development of e-commerce enterprises and their contributing role in this period of time.

However, because of the explosive growth of orders altogether with the imbalance between demand and supply, the whole supply chains are almost blocked, causing ineffective marketing and distribution as well as dissatisfactory purchasing experience. As a result, this situation discourages consumers’ online purchasing behaviors and leads to incessant anxiety and complaints. Hence, it is necessary to understand the characteristics of consumers’ preference for online shopping of fresh agricultural products during the pandemic, for which is beneficial to cultivating consumers’ consumption habits, improving the supply chains of fresh agricultural products, meeting consumers’ demand and promoting the further development of e-commerce.

Many scholars have researched the characteristics of consumers’ preference for agricultural products. Chaniotakis et al. (2009) used the structural equation modeling to analyze data and found that consumers’ intention to purchase own-brand frozen vegetables was directly affected by consumers’ attitudes towards the products. Moreover, consumers’ attitudes were influenced by the direct effect of consumers’ trust and indirect effect of perceived economic conditions. Lin et al. (2015) adopted SPSS and PLS Graph to carry out an empirical study of the online questionnaire about the comments of consumers who brought fruits online. The research indicated that the fruit quality and perceived value played the most significant roles in consumers’ trust. Suki (2018) applied the Least Square Analysis to explore the mediating effect of the relationship among Corporate Social Responsibility (CSR), product identity and corporate reputation on consumers’ intention to buy organic vegetables. The findings showed that product identity is the contributing factor to consumers’ intention to buy organic vegetables. Sun et al. (2020) distributed questionnaires to consumers who love dried fruits and, according to their data analysis of structural equation modeling, the results revealed that from the perspective of social demography, buying dried fruits essentially is a hedonic behavior, and dried fruit manufacturers are suggested to improve the quality of health and the level of convenience. Lei et al. (2020) established the logit regression model, and found that from the perspective of transaction that the effect of affordable prices, logistics quality and logistics speed are all significantly related to consumers’ satisfaction. Additionally, if merchants frequently change prices (both the increase and the decrease of price), there is a negative impact on consumers’ satisfaction. After processing the content of the agricultural products review through the methods of keyword extraction, weight calculation and Snownlp emotion analysis, Li (2020)’s research proved that consumers are more concerned about the logistics, packaging, taste, quality, delivery, size, price, service, after-sales and taste characteristics provided by the fresh e-commerce providers, but they are relatively less satisfied with the customer service and delivery. Hu et al. (2021) used the “OLS+ Robust Standard Error” stepwise regression to study the number of total reviews, review length and the number of poor reviews towards mutton with the visualization of the above reviews. They provided the suggestion that businesses should adopt reasonable measures to encourage consumers to write reviews with more pictures and words. Fan et al. (2021) used questionnaires and multiple response analysis to demonstrate that consumers with high income, high education and low age are more likely to purchase fresh agricultural products online, particularly buying products on MISS FRESH, Boxed Horse Fresh platforms. Chen et al. (2022) believed that the quality of logistics services is directly associated with the customers’ purchasing experience, and emphasized that the quality of fresh e-commerce logistics services needs to be improved.

To draw a conclusion, it can be seen that the research on the characteristics of consumers’ preference for purchasing fresh agricultural products is one of current hot research topics. Nevertheless, in the research on agricultural products, the majority of them targeted research objects as fruits or meat, while the research on fresh vegetables with high requirements of storage and appearance still remains a huge research gap.
LDA (Latent Dirichlet Allocation) topic model or Potential Dirichlet distribution, is a three-level Bayesian probability distribution model including three-level structure of word, document and topic which was proposed by Blei et al. (2003) and usually used as a document-generated topic model. By analyzing the words in the statistical text, the topic with approximate text meaning is abstractly simulated. And the abstracted text data is represented as a topic form, which could realize the dimension reduction of the text data. In recent years, the LDA model has been continuously applied to mining consumer review data. Ma (2013) has conducted an empirical analysis on consumer reviews of four products, which shows that compared with association rule mining, LDA topic model is more effective among many methods or models of extracting text topics. Alshamrani (2020) built an LDA topic model on the basis of review data of songs in Japanese YouTube to test the use of emotional words, finding that the LDA model is a feasible method to quantify the audience’s emotional expression and classify music stimuli. Wang et al. (2020) conducted modeling analysis on the commodity review data of JD.COM Home. The results show that the characteristics of sensory experience are the key to influencing the purchase decision of e-commerce agricultural products. Wang et al. (2020) used intuitionistic fuzzy method to process the emotional analysis on the agricultural product line reviews. The results proved that the intuitionistic fuzzy analysis method is reasonable and practical. Xue et al. (2021) crawled the data from JD.COM Home’s mobile phone review and through the analysis of LDA model, they advised that the merchants should establish a user review mining and display platform to improve the realizability of the data. Feng et al. (2021) set up an LDA model for fresh goods online review information in T-mall website based on the random dominance criterion. The study found that the most influential factors of customer satisfaction in fruit goods are cost performance and customer service, whereas the least influential factors of customer satisfaction are product description and freshness.

To sum up, the research on the characteristics of consumers’ preference for purchasing fresh agricultural products is a hot research topic. In the research on agricultural products, the majority of them focus on the research objects of fruits or meat, while few people have conducted research on fresh vegetables with the requirements of high storage and appearance. Furthermore, there are also minor scholars who take advantage of the comprehensive LDA model to systematically analyze the factors that influence consumers’ preference of buying fresh agricultural products from their online reviews. Consequently, this study will combine the data crawling technology with LDA model to model the vegetable review data on e-commerce sites such as Yonghui Supermarket, JD.COM Home, Boxed Horse Fresh, etc., to probe into the characteristics of fresh agricultural e-commerce platforms that consumers prefer most. The final research results may help to provide the referable suggestions for the local government for formulating e-commerce-oriented policies for agricultural products, and to optimize the decision-making of agricultural products transportation and sale for e-commerce companies.

This paper consists of five chapters. The first section is an introduction; the second one is research methodology; the third part is data processing; chapter four is the analysis of the LDA model; the last part will conclude the study and give policy suggestions.

2. Research Methodology

Aiming at online review and consumer preference degree of fresh agricultural products, this study collects current literature and studies and uses relevant methods to conduct research. The research methods are as follows.

2.1. Text Mining Method

Online reviews reflect consumers’ real feelings after they purchase goods. For one thing, consumers can obtain information related goods via reviewing other consumers’ comments in advance before shopping. For another, they could also comment about received products and share their actual shopping experience, which may provide reference for future shoppers. Hence, in this study, online reviews of commodities are examined, and they will be processed and selected by Python software for text mining. First of all, invalid online review texts are removed through data cleaning. Second, the word frequency of online review texts is calculated through Jieba Text Segmentation.
2.2. The LDA Analysis Model

The LDA thematic model includes documents, topics and words, and the specific operation process is as follows: (1) The general topic distribution \( \mathbf{a}_n \) of each article will be produced according to the parameters \( \alpha \); (2) After obtaining the theme \( \mathbf{a}_n \), each word in the original article will be given to another theme \( \mathbf{b}_{ij} \), where \( i \) represents the sequence of one article and \( j \) represents the sequence of one word; (3) According to the parameter \( \beta \), the topic \( \mathbf{b}_{ij} \) in the last result helps to find the corresponding word distribution \( \mathbf{c}_k \); (4) By using the word distribution \( \mathbf{c}_k \), the word \( \mathbf{b}_{ij} \) under each topic will be easily identified. The specific implementation process is shown in Fig. 1.

![Fig. 1. Implementation Process of LDA Model.](image)

As can be concluded from the above analysis, one document corresponds to multiple themes and a theme also corresponds to multiple words. This study will use LDA model to analyze the crawled review data about cucumbers and dedicate to find the topics behind these data as the consumers’ preference factors to vegetables sold on online platforms.

3. Data Preprocessing

3.1. Data Collection

Through the comparison of various vegetables, it was found that cucumbers have the advantages in sales volume and the variety of categories. That’s why in this study, Pycharm software was selected to crawl review data from the online platforms that sell fresh agricultural vegetables such as Yonghui Supermarket, JD.COM Home, Boxema Fresh and so on. And the time span of the intercept is during the outbreak of pandemic in Xi’an province from 2021.12.09 to 2022.01.26 and from 2022.03.08 to 2022.03.25. The Pycharm software is commonly used in text crawling research and it could select online links of cucumbers which have high sales volume and high ranking and represent new products under online food shopping platforms, including Yonghui Supermarket, JD.COM Home, Box Horse Fresh, etc. After the coding process of Python, Pycharm is used to crawl the online reviews on the product online links. The total number of original comments crawled is 34546, and the total number of comments after deduplication is 30120. Besides, the total number of invalid comments removed is 4426, and the effective rate is 87.18%.
3.2. Data Cleaning

The obtained online comment text usually contains a large amount of duplicate and invalid data, such as systematic and automatic comments or repeated comments. Although these data have no practical significance and contribute less to data analysis, they are likely to influence the final results. For this reason, in order to ensure the accuracy of the final results, Python is used to clean the obtained text data and eliminate inappropriate comments. Data cleaning mainly includes three aspects: text deduplication between sentences, text deduplication within sentences and short sentences filtering.

3.2.1 De-duplication of Text Between Sentences

E-commerce platforms usually set up an automatic praise system, this is to say, when some users do not make comments within a certain period of time, the platform will automatically select the default comment or positive reviews; Apart from that, there are also some users who copy and paste other users’ comments in order to get points or for convenience. The mentioned situations will all bring about the same evaluation content or express similar meaning in the different review texts. Such repeated data have no real meaning, but may bring bias to the model and then affect the results. Therefore, the collected text data needs to be de-duplicated, and the study only keeps the initial comments appearing in the repeated comments. The processed comments are detailed in Table 1.

| Serial Number | Duplicate Statement Examples                           | Repeat Frequency |
|---------------|--------------------------------------------------------|------------------|
| 1             | The user thought the product was very good and gave a favorable comment of 5 stars. | 1332             |
| 2             | Good or Great.                                         | 271              |
| 3             | Delicious.                                             | 86               |
| 4             | It’s OK.                                                | 10               |

3.2.2 De-duplication of Text Within Sentences

Moreover, the repeated words and phrases in different comments or within the same comment are also taken into the deduplicated process. Some consumers will comment on the same product with a lot of repeated sentences to lengthen the reviews with similar meanings, such as “Many many many likes.” In the text de-duplication between sentences, the software can only eliminate the duplication between different comments, but it cannot delete the duplicate statements in the same comment. In this case, the text deduplication within the sentences should be adopted to remove some meaningless duplicate statements and streamline the comment text, so as to ensure the filtering of useless information. Table 2 Text Repetition Table within Sentences illustrates the mentioned cases.

| Type                                      | Before Weight Removal                             | After Weight Removal |
|-------------------------------------------|---------------------------------------------------|----------------------|
| Meaningless Repetition                    | Yes, yes, yes.                                     | Yes                  |
|                                           | Nice! Nice! Nice!                                  | Nice                 |
| Repeat at the beginning or the end of a sentence | Cucumbers are the really really really necessary fresh vegetables for daily cooking. | Cucumbers are the necessary fresh vegetables for daily cooking. When I get them first, I make the main dishes with fresh cucumbers. Very good, very good. |
|                                           | When I get them first, I make the main dishes with fresh cucumbers. Very good, very good. | When I get them first, I make the main dishes with fresh cucumbers. Very good, very good. |
|                                           | I really, really, really like it.                 | Like.                |

3.2.3 Short Sentence Filtering

Some comments have fewer sentences, such as comments with fewer than 4 words. Such reviews with fewer than 4 words may do little contribute to the subsequent data analysis. So, most of them are filtered and the specific information of such comments are in Table 3.

| Serial Number | Examples       |
|---------------|----------------|
| 1             | Received the goods |
3.3. Text Segmentation

After the data cleaning, the text data are performed into Text Segmentation and Stop Words and so on for the next analysis. Table 4 presents the Text Segmentation and Part-of-speech Tagging.

Table 4. Text Segmentation and Part-of-speech Tagging.

| Serial Number | Before Text Segmentation | After Text Segmentation |
|---------------|--------------------------|-------------------------|
| 1             | Delivery is fast. Gherkins are fresh, crisp and juicy. Do a cucumber salad at noon, feel fresh and refreshing. So, we ate it up pretty instantly. | ('Delivery', 'n') ('fast','d') ('crisp','a') ('juicy','n') ('at noon','t') ('Gherkins','n') ('fresh','ns') ('crisp','a') ('juicy','n') ('taste','n') ('crisp','a') ('and','d') ('yummy','v') ('. ', 'x') |
| 2             | Recently, the price of vegetables in offline markets is too high, but online vegetables are cheap and fine. | ('Recently','t') ('price','n') ('high','a') ('but','but') ('online','s') ('cheap','n') ('and','d') ('fine','vn') ('. ', 'x') |
| 3             | The received cucumbers taste very fresh, crisp and yummy. | ('received','v') ('cucumbers','n') ('very','d') ('fresh','ns') ('. ', 'x') |
| 4             | The packaging was tight and there were no injuries or bad melons. Very satisfied. | ('packaging','v') ('very','d') ('tight','t') ('a','a') ('or','c') ('injured','v') ('or','c') ('bad melons','n') ('very','zg') ('satisfied','v') ('. ', 'x') |
| 5             | I've been eating familiar cucumbers for a long time and now I'm hoarding them. | ('eating','v') ('ve been','v') ('familiar','v') ('cucumbers','n') ('. ', 'x') |

4. Results and Analyses of LDA Model

The results of the LDA model are shown in Fig. 2. The right side of the figure lists the 30 keywords with the highest frequency of occurrence among all topics, mainly including “fresh, delicious, good, taste”, etc. In general, it can be observed that consumers’ overall purchase evaluation of cucumbers is positive. In Fig. 2, the circle on the left side represents the frequency of occurrence of each topic. The larger the circle, the higher the frequency of occurrence. And the distance between topics shows the correlation of each topic: the farther the distance, the lower the correlation. For instance, theme 1 and theme 3, theme 5 and theme 6 correlated with each other.
Fig. 2. The Results of LDA Model

(Note: “好吃”: “Delicious”; “不错”: “Not bad”; “味道”: “Taste”; “满意”: “Satisfactory”; “喜欢”: “Like”; “口感”: “Flavor”; “质量”: “Quality”; “新鲜”: “Fresh”; “好评”: “Great”; “包装”: “Packaging”; “物流”: “Logistics”; “水分”: “Moisture”; “多次”: “More Than Once”; “下次”: “Next Time”; “清甜”: “Refreshing and Sweet”; “值得”: “Worthy”; “很快”: “Fast”; “嫩脆”: “Crisp and Tender”; “价格”: “Price”; “爽口”: “Tasty and Refreshing”; “评论”: “Evaluation”; “很脆”: “Crisp”; “实惠”: “Low Price and Good Quality”; “快递”: “Delivery”; “减肥”: “Lose weight”; “回购”: “Buy-back”; “清脆”: “Crisp and Refreshing”; “图片”: “Photos”; “速度”: “Speed”; “大小”: “Size”.)

Through the observation and screening of results in the model, it is found that the LDA model has better results when the number of topics is 6. This study determines that there are 6 topics in the LDA model, and derives the frequency of the feature words under each topic. Each topic and its corresponding feature words and frequency table are shown in Table 5.

Table 5. Keywords and the Frequencies for Each Themes.

| Product Taste                          | Logistics Packaging                        | Repurchase Value                           |
|----------------------------------------|--------------------------------------------|--------------------------------------------|
| Fresh (0.0232)                         | Packaging (0.0162)                         | Delicious (0.0461)                         |
| Taste (0.0112)                         | Logistics (0.0107)                         | Repurchase (0.0197)                        |
| Moisture (0.0124)                      | Fast (0.0086)                              | Next Time (0.0083)                         |
| Sweet (0.0115)                         | Delivery (0.0082)                          | Worthy (0.0066)                            |
| Lose weight (0.0109)                   | Speed (0.0027)                             | Recommended (0.0057)                       |
| Crisp and Tender (0.0107)              | S.F. Express (0.0025)                      | More Than Once (0.0046)                    |
| Tasty and Refreshing (0.0098)          | Intact (0.0024)                            | Low Price and Good Quality (0.0018)        |
| Size (0.0078)                          | Evaluation (0.0021)                        | Patronage (0.0017)                         |
| Refreshing (0.0063)                    | Time (0.0019)                              | Friends (0.0015)                           |
| Juice (0.0061)                         | Arrival (0.0018)                           | Fondle Admiringly (0.0013)                 |
| Product Taste                          | Perceived Value                            | Service Quality                            |
| Yummy (0.0163)                         | Like (0.0172)                              | Satisfactory (0.0187)                      |
| Flavor (0.0114)                        | Price (0.0157)                             | Everybody (0.0037)                         |
| Fresh and Tender (0.0094)              | Fresh (0.0146)                             | Cheap (0.0095)                             |
| Filar (0.0080)                         | Affordable (0.0126)                        | Merchant (0.0048)                          |
| Crisp and Sweet (0.0076)               | One Box (0.0080)                           | Trustworthy (0.0045)                       |
| A Lasting Aroma Aftertastes (0.0075)   | More Than Once (0.0100)                    | Available (0.0043)                         |
| Crisp and Refreshing (0.0072)          | Moisture (0.0036)                          | Must (0.0041)                              |
| Sufficient Quantity (0.0071)           | Green (0.0027)                             | Thanks (0.0044)                            |
| Sweetness (0.0069)                     | Not bad (0.0029)                           | Business Prosperity (0.0027)               |
| Delicious (0.0065)                     | Cheap (0.0025)                             | Reliant (0.0026)                           |

The extracted keywords in the table help to summarize the corresponding thematic words and draw the following conclusions.

Theme 1 corresponds to the theme of product taste, including keywords such as “Fresh”, “Taste”, “Moisture” and “Sweet”, which proves that when consumers buy cucumbers, they will first pay attention to whether the cucumbers in this store are good or not and how the water is. When consumers are buying cucumbers, they are more likely to choose cucumbers that not only have enough juice but also taste sweet. So, the merchants are supposed to focus more on the sensory experience of consumers. Furthermore, the keyword “lose weight” also indicates that consumers also pay attention to those vegetables that help to keep their body shape and health.

Theme 2 is logistics packaging, which shows that consumers are concerned about the impact of logistics packaging of cucumbers. The keywords, such as “Packaging”, “Fast”, “Speed”, rank the first three and serve as the primary factors that consumers are concerned about. More specifically, they are eager to receive the products as soon as possible.

Buy-back value and taste are presented in theme 3 and theme 4. In theme 3, Buy-back value reflects the customers’ willingness to recommend the products to their relatives or friends after buying the cucumbers. Whether the cucumbers are “Cheap and good in quality” and “Delicious” determines whether consumers buy back the
cucumbers, and whether or not they buy back the cucumbers has also become one of the key factors that consumers consider when buying cucumbers. In terms of the taste, the theme 4 again reproves that the quality and flavor of products will, to some extent, influence the customers’ intention.

Theme 5 perceived value is also one of the main factors affecting customers’ purchase of cucumbers. Whether the “Price” of products is “Affordable” and color is “Green” or the good quality could affect customers’ evaluation of products such as cucumbers. When satisfied with the above conditions, merchants have “Preferential” activities for this product, which will draw extra attention from customers.

In theme 6, the service quality of merchants plays a rather critical role in affecting consumers’ shopping intentions. From “Satisfaction”, “Merchant” and “Business Prosperity” and other keywords, it can be seen that the service attitude of merchants affects customers’ purchasing experience. Store reputation is a key factor in evaluation, because every customer wants a reassuring shopping experience.

From the above discussion of 6 themes, it can be concluded that consumers will first consider the sensory experience of cucumbers, and then pay close attention to the efficiency and use value of logistics. At the same time, products with good quality, low price and strong promotion will be more appealing to customers. Among the above factors, the quality of business service is the last consideration.

5. Conclusions and Policy Suggestions

In this study, taking Yonghui Supermarket, JD.COM Home, Boxed Horse Fresh Food and other online food shopping platforms as examples, the review data of fresh agricultural products are crawled during the pandemic. With the help of text mining software, the cucumber review data of Xi'an during the time span of 2021.12.09-2022.01.26 and 2022.03.08-2022.03.25 are collected and analyzed. According to the analysis of text feature and LDA model analysis, the influencing factors of consumers’ cucumber preference under the outbreak of pandemic are identified. The following are the major findings summarized from the results provided by a series analysis.

- Because fresh vegetables can directly bring sensory experience to consumers, businesses need to consider how to better ensure the quality of fresh agricultural products.
- Under the spread of pandemic scenario, logistics packaging with safety guarantee for products will have more competitive advantages.
- It is helpful that stores hold preferential activities or offer affordable prices for fresh agricultural products, which will attract more consumers to buy back.
- Store owners who enter the platform should improve their service awareness and try to give customers a good shopping experience.

Based on the above conclusions, the author put forward the following suggestions for policy makers from the perspective of the impact of the pandemic on the lives of the residents and the fresh e-commerce industry.

- Governments should attach importance to the brand building of local agricultural products. Local governments and local fresh vegetable enterprises should actively explore the advantages and characteristics of their own products, and publicize their own-brand products via new social media such as WeChat, Tik Tok and Weibo, so as to help consumers clearly understand the attributes and characteristics of the products before buying, increasing more sales volumes.
- The shipping companies should ensure and strengthen the disinfection of agricultural and vegetable products in transit. Before transportation of fresh agricultural goods, responsible staff should package correctly and strictly disinfect the products. After arriving at the destination, non-contact distribution is highly suggested. The distribution personnel should take protective measures and remind customers that those fresh agricultural products should be picked up as early as possible.
- The platforms should explore new distribution models to ensure the rapid circulation of fresh agricultural products. With the outbreak of the pandemic, most of the fresh group purchase platforms were able to arrange the goods out of the warehouse in one and a half hours. However, it will take at least three times or more time to package the orders and the delivery time will also be prolonged. And the timeliness and time length of distribution is one of the factors that influence customers’ purchasing behaviors. Hence, fresh vegetable e-commerce providers should energetically attempt new distribution models according to their
front warehouses and convenience stores, and the distribution models on the basis of pre-sale and self-lifting, tackling the problem of “last kilometer” fresh distribution.

- The platforms should guide businesses to correctly interpret consumers’ sentiment during the spread of pandemic. The platform needs to hold regular group lectures, trainings and other activities for merchants and employees, in order to help them better understand customers’ emotions and demands by using platform resources. For example, during the pandemic period, stores and platforms cooperated to eliminate or reduce negative feelings of consumers and stabilize fixed customer sources and sales quota through some commercial means.

- The platforms should cooperate with the local government to ensure the supply chains of fresh agricultural products under the spread of pandemic. During the period of lockdown, buying fresh agricultural products as usual is often difficult to achieve, such as abnormal premiums of some vegetables or vegetables in short supply. In this case, it is necessary to reach cooperation with fresh electricity suppliers and local governments. Specifically, after the government authorities conduct research and forecast the demand of the city, the transport of fresh vegetables will be collectively scheduled. At this time, agricultural products will not only circulate in time, but also alleviate the shortage of fresh agricultural products supplies.

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References

[1] Ioannis E. Chaniotakis, Constantine Lymeropoulos & Magdalini Soureli. A Research Model for Consumers' Intention of Buying Private Label Frozen Vegetables, Journal of Food Products Marketing[J]. 2020, 15(2): 152-163.
[2] Lin Jiabao, Wan Junyi, Lu Yaobin. Analysis of consumer trust in fresh agricultural e-commerce: A case study of fruit[J]. Business Economics and Management, 2015(05): 5-15. (in Chinese with English abstract)
[3] Norazah Mohd Suki. Determinants of Consumers’ Purchase Intentions of Organic Vegetables: Some Insights from Malaysia[J]. Journal of Food Products Marketing. 2018, 24(4): 392-412.
[4] Yuting Sun, Chaoyun Liang. Effects of determinants of dried fruit purchase intention and the related consumer segmentation on e-commerce in China[J]. British Food Journal, 2020, 123(3): 1133-1154.
[5] Lei Bing, Liu Xiaojun, Zhong Zhen. Effects of transaction attributes on consumer satisfaction in fresh agricultural products online shopping: Based on online comment mining analysis of fruit category [J]. Enterprise Science, Technology and Development, 2020(12):136-139. (in Chinese with English abstract)
[6] Li Yuechun. Study on consumer satisfaction of fresh fruit from the perspective of online review[J]. Journal of heilongjiang bayi agricultural university, 2020, 32(05): 108-113. (in Chinese with English abstract)
[7] Hu Y Q, Lin H. The impact of online comment characteristics on the sales of agricultural products in fresh e-commerce: evidence from Taobao mutton big data[J]. Journal of China Agricultural University, 2021, 26(06): 206-218. (in Chinese with English abstract)
[8] Fan Yuchen, Chen Jiaxin, Gong Xuan, Luo Jiakai, Zhang Huayu. Study on consumers' online Behavior of buying fresh agricultural products[J]. Journal of Anhui Agricultural Science Bulletin, 2021,27(02):135-137. (in Chinese with English abstract)
[9] Yi Yichen, Shi Yanxin. Research on the improvement of fresh e-commerce logistics service quality under the normal epidemic situation[J]. Journal of Jiangxi University of Finance and Economics, 2022, 01:65-75. (in Chinese with English abstract)
[10] Blei D M, Ng A Y, Jordan M I. Latent dirichlet allocation[J]. the Journal of machine Learning research, 2003, 3: 993-1022.
[11] Ma B, Zhang D, Yan Z, et al. An LDA and synonym lexicon based approach to product feature extraction from online consumer product reviews[J]. Journal of Electronic Commerce Research, 2013, 14(4): 304.
[12] Alshamrani S, Abuhamad M, Abusnaina A, et al. Investigating online toxicity in users interactions with the mainstream media channels on YouTube[C]/The 5th International Workshop on Mining Actionable Insights from Social Networks. 2020: 1-6.
[13] Wang Erpeng, Ni Zhengyu. Research on the preference characteristics of online consumers of agricultural products: Based on the analysis of online comment data of Jingdong Sales Apple[J]. Price Theory & Practice, 2020(02): 120-123. (in Chinese with English abstract)
[14] Wang Zhumei, Hu Yanrong, Liu Hongjiu. Analysis of online Comments on Agricultural products based on LDA theme Model and intuitionistic Fuzzy TOPSIS [J]. Data acquisition and processing, 2020, 35(05): 965-977. (in Chinese with English abstract)
[15] Xue J, Li J, Han Y. Evaluation and Emotional Analysis of Mobile Phone Sales of JD E-commerce Platform Based on LDA Model[C]/Journal of Physics: Conference Series. IOP Publishing, 2021, 1861(1): 012076.
[16] Feng Kun, Yang Qiang, Chang Xinyi, Li Yanlai. Customer satisfaction evaluation of fresh food e-commerce based on online reviews and random dominance criteria[J]. Chinese Journal of Management Science, 2021, 29(02): 205-216. (in Chinese with English abstract)