

Analysis of the relationship between the development of agricultural e-commerce marketing model and product quality improvement based on 5g network security

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ABSTRACT

In this paper, seven dimensional variables of marketing mode development and product quality improvement are selected under the 5G network security theory. In order to clarify the relationship between the two, the questionnaire was used to obtain the quantitative values of the seven dimensional variables, and then the Pearson correlation analysis was used to test whether the dimensional variables could be used in the regression analysis. After passing the test, multiple linear regression is used to interpret the relationship between the development of agricultural e-commerce marketing mode and product quality improvement. The regression equation of strengthening brand awareness on product quality is $B1=0.511+0.439*B4+0.653*B5+0.327*B6+0.297*B7$, which demonstrates the relationship between product quality enhancement and strengthening brand awareness in the development of agricultural products e-commerce marketing model in a more intuitive way. This study makes people have a more new cognition of the role relationship between the two, which is of great significance for practicing the goal of synergistic development of the two.

Keywords: Pearson correlation coefficient, multiple linear regression, 5G network security, marketing model, product quality

1. Introduction

Today's society is an information age, we live every moment in a large pool of information, and the Internet connects all walks of life together for the transmission of information, and information relies on the Internet to spread to all corners of the world. The arrival of the "Internet +" era promotes the growth of informationization and digitization, the traditional business model is slowly changing towards e-commerce, e-commerce has gradually become the development direction of the new pattern of business [1-2]. Agricultural e-commerce as a traditional agriculture and the development of

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the Internet closely integrated with the new things, in the policy and the market under the double promotion, has now become the center of gravity of China's agricultural development [3-4].

Changes in communication technology for the development of e-commerce is of decisive significance, with the full popularization of 5G communication technology is coming, agricultural products e-commerce marketing model development and product quality glowing with a new round of vitality. 5G inherits and develops 4G, which is the newest generation of cellular mobile communication technology with high speed rate, large capacity and low latency and high reliability and other advantages [5-7]. The powerful image transmission capability and communication advantages of 5G technology can be combined with the very popular form of live broadcasting, allowing consumers to witness the whole process of farmers planting and picking crops, enhancing interaction and greatly helping farmers to market their products in order to expand the sales market [8-11]. In addition, 5G technology will realize the coordination and unification of the security system and the working system to provide a more secure network environment for agricultural e-commerce marketing, which can eliminate the worries and concerns of rural merchants and consumers participating in e-commerce transactions to a certain extent [12-15]. Its information transfer mode of using array antenna to complete the data directional transmission can greatly avoid the malicious attack of the intermediary, and more effectively guarantee the security of network transmission [16-18]. 5G technology effectively solves the security problems in the process of agricultural electronic heroes, ensures that the transaction can be carried out smoothly, and ensures that rural e-commerce can be benignly developed [19-20].

This paper first identifies the dimensional variables of the development of e-commerce marketing model and product quality improvement of agricultural products supported by 5G cybersecurity technology and develops the design of this study. The data collected from the questionnaire survey are analyzed by demographic characterization and descriptive statistics. Dependent and independent variables are set up to explore the relationship between the development of agricultural e-commerce marketing model and product quality improvement from the perspective of qualitative research using Pearson correlation coefficient, and the variables set up above are also detected to be used in quantitative regression analysis. Finally, based on the theory of multiple linear regression analysis, the mathematical quantitative relationship between the development of agricultural products e-commerce marketing mode and product quality improvement is investigated.

2. 5G network-based marketing model development and product quality improvement

2.1. Development of marketing models based on 5G networks

The advent of the 5G era accelerates the deep integration of traditional marketing communications and mobile Internet, bringing a full range of informatization systems to support the development of the rural economy [21]. The sinking of 5G network security technology breaks the time and space constraints of traditional business marketing, and the 5G network security promotes the birth of new technologies and new retail in the rural market, forming a brand-new new layout of the industrial Internet network short-video platforms as a new position for agricultural products. The new position of marketing has stimulated the vitality and creativity of the market main body. In the reality of the Internet of everything, "short video + agricultural products" market prospects. However, while observing the prosperity, it is still necessary to calmly examine the many problems that have emerged, and actively improve and cope with them. The development path of marketing mode based on 5g network is shown in Figure 1, and this subsection will illustrate the development of marketing mode based on 5g network from the three dimensions of strengthening brand awareness, expanding profit channels, and strengthening market management.

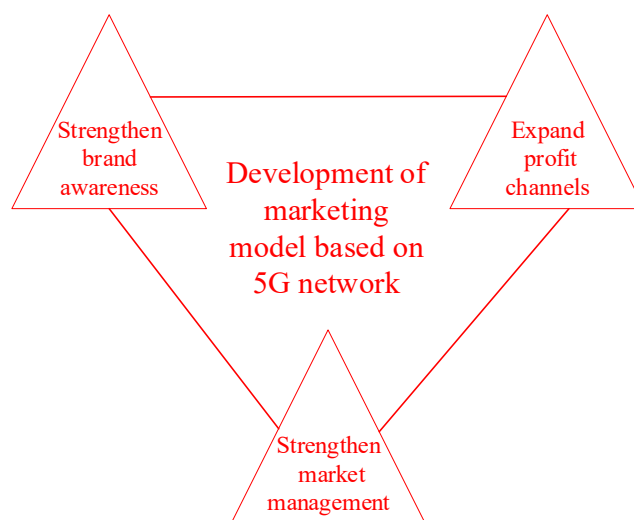


Fig. 1. Development path of marketing model based on 5g network

2.1.1. Strengthening brand awareness. 5G network security technology to support the “short video + agricultural products” will usher in explosive growth, a thousand and one “rural stories” and “netizens” will eventually exit the second half of the Internet! The stage of the second half of the Internet. Homogenized short video content is very easy to cause user aesthetic fatigue, to strengthen the vertical ploughing of marketing content, to avoid personalized recommendation algorithms under the same kind of video so that users are trapped in the information cocoon for a long time, the “short video + agricultural products” to lose the psychological expectations of the consumer motivation is difficult to form, resulting in the marketing of agricultural products encountered bottlenecks. It is necessary to inject fresh elements into the marketing strategy and boldly adopt the new technological means brought by the 5G era to revitalize the brand. On the one hand, segmentation of target users, the use of big data platform to fully analyze user consumption psychology, video content and style design to meet the audience's psychological expectations. On the other hand, relying on local advantageous resources to create a regional brand image, forming a differentiated and personalized video features of agricultural products, enhancing the accuracy of brand marketing and expanding market influence.

2.1.2. Expanding Profit Channels. At present, “short video + agricultural products” is mainly based on the passive operation mode of “submitting articles to the platform”, and the content producers mainly rely on personalized recommendations and e-commerce advertising to make profits. With the development of the industry, the three-dimensional media ecosystem in the 5G era will lead to more media combinations, and the “all-media” dissemination of information will greatly expand the profit channels of agricultural e-commerce marketing model. Short video as a communication medium will distribute high-quality content to e-commerce, social networking, education and other fields, diversified platforms, and make full use of all kinds of media to improve exposure and user awareness. With the product as the core, the video production process will link the content relationship products and derivative services, and establish an integrated online and offline agricultural content ecological chain. Change the marketing orientation from product promotion to service users, through the online “short video + agricultural products” to guide the provision of offline extended service products, such as farm picking, farming experience, food production and other marketing channels, to promote the depth of the integration of traditional marketing and network marketing, to maximize economic benefits.

2.1.3. Strengthening market management. A good short video marketing ecosystem requires government supervision and guidance, the establishment of a long-term management mechanism for

Internet platforms, and the standardization of the market business order, in order to correctly guide the healthy development of e-commerce marketing of agricultural products in the 5G era. Increase the injection of funds, improve the financing system, through relevant policies to strengthen the farmers in the mobile Internet “short video + agricultural products” entrepreneurial risk protection, enhance the risk-resistant ability of entrepreneurs, stimulate the enthusiasm of the content producers, and build a positive, healthy and upward network marketing environment.

2.2. Product quality improvement based on 5g network

5g network security technology can bring merchants and farmers closer together, while at the same time promoting the gradual standardization of the production and sale of local agricultural products. Furthermore, the use of cloud data and other information technologies can assist managers in establishing a credit system for the quality and safety of agricultural products at farmers' markets. Utilizing the Internet of Things (IoT) technology and integrating advanced sensor IoT devices into the production of agricultural products will help establish a quality traceability information system. Utilizing comprehensive analysis technology to obtain various indicators of agricultural production and establish a risk early warning and assessment information system to guarantee the quality and safety of agricultural products.

2.2.1. Standardization of production, supply and marketing of agricultural products. In the standardization of agricultural production, supply and marketing, information technology is applied in all aspects. Firstly, at the source, in the agricultural production environment, new types of sensors and fast data transmission networks are applied, so as to carry out standardized control and management of the agricultural ecological environment. Secondly, in the production process of agricultural products, the use of information markers to mark products, and in the future circulation, sales and other links, the use of information technology, such as Internet of Things, the process of the whole process of information perception, transmission and fusion of control, to achieve standardized production of agricultural products and intelligent, scientific control for the quality and safety of agricultural products escort.

2.2.2. Credit building for quality and safety of agricultural products. In the construction of the credit system, information technology is used, data docking is done, and credit information is shared in a timely manner. And arrange a special person in charge to update the credit information on agricultural product quality and safety in a timely manner and realize dynamic management. Do a good job of saving and updating data. At the same time, set up a reward and punishment linkage mechanism, further improve the convergence mechanism of supervision and law enforcement, continue to implement the system of origin access and market access, and actively promote the construction of the credit system, and construct an environment of honest production and operation.

2.2.3. Quality traceability of agricultural products. In establishing the agricultural product quality traceability platform, attention should be paid to the following aspects: First, a reasonable traceability software system should be screened, which should be reasonable, practical, convenient and easy to operate. Second, we should determine the pilot of agricultural product quality and safety traceability and carefully screen it. Third, to accelerate the promotion and application of advanced and practical technology and scientific and technological achievements, to promote the process of standardized production and improve the quality and safety of agricultural products. Fourth, to enterprises to implement the access access system, access to agricultural products into the market, the primary processing and packaging of agricultural products sold after the implementation of access to the regulatory and operational mechanisms with a traceable bar code. Fifth, the full implementation of agricultural product quality sampling system pilot, the establishment of quality monitoring points. Sixth, in the traceability information system is basically built in pilot villages, pilot cooperatives are all

equipped with computers and traceability bar code special printer, to ensure the normal operation of the traceability software.

2.2.4. Early warning of quality and safety risks. Agricultural product quality and safety risk warning mainly includes the following aspects: first, agricultural product quality and safety monitoring and warning, second, agricultural product quality and safety risk potential, third, agricultural product quality and safety risk analysis and judgment, and fourth, agricultural product quality and safety risk control. The use of information technology, the quality and safety of agricultural products for the initial identification of events, the use of its occurrence of the event characteristics, to determine the level, and at the same time with the help of previous events training mode of the event caused by the loss of the prediction, and put forward the corresponding plan to enhance the ability to cope with emergencies.

3. Study design

The previous chapter defined the marketing model development and product quality improvement based on 5g network, and did not give the connection between the two, in this regard, this chapter in order to explore the mechanism of marketing model development and product quality improvement between the two, the use of questionnaires and mathematical and statistical theories of in-depth analysis. The detailed description is as follows:

3.1. Study population and questionnaire design

3.1.1. Subject of the study. A city is located in the Loess Plateau, Tibetan Plateau, Mengxin Plateau intersection zone, and the two major deserts of Tengger and Badanjilin adjacent to the dry climate, precipitation is low, belonging to the typical desert oasis-type areas. Wuwei City has taken advantage of the special climate and geographical conditions to promote the modernization of agriculture, and the agricultural production and management system has been improved. As of 2020, a city has cultivated 153 leading enterprises of agricultural industrialization above the municipal level, including 8 at the national level and 36 at the provincial level. Professional cooperatives 8550, built 34 national demonstration societies, provincial demonstration societies 88, cold storage reserve capacity reached 287,000 tons. A city is not only a large city of meat sheep industry to the northwest, but also formed a relatively complete industrial chain and constructed a meat sheep industry system with modern features. To a certain extent, this study is a continuation of the research related to the major scientific and technological special project of the Science and Technology Department of a certain city, "Demonstration of the creation of characteristic product brand and leading enterprise driving mode" (referred to as "major special project"), and the choice of a certain city's meat and sheep industry as the object of the study is intended to utilize the research accumulated in the previous research of the project to develop a modernized meat and sheep industry system. The purpose of choosing a city's meat sheep industry as the research object is to utilize the research results and experience accumulated in the previous research of the project and the rich information obtained from the field survey. In summary, the selection of a city's meat sheep industry as a case for empirical research is highly representative.

3.1.2. Questionnaire design. According to the needs of the research content, the research team designed the "Questionnaire on the Development of E-commerce Marketing Mode and Product Quality Improvement of Agricultural Products Based on G-Network Security". As a matter of fact, the questionnaire was used in an on-site randomized survey targeting smallholder farmers in agricultural trading markets when the survey was conducted in one of the cities in December 2022, and a total of 500 valid questionnaires were obtained in this survey. The questionnaire used in this study was based

on the experience of the pre-survey in December 2022, and on the basis of retaining some of the valid questions and modifying the low validity questions, some new questions were added to make the questionnaire have excellent reliability performance. The questionnaire consists of 3 main parts with 89 questions. Its main contents include:

Part 1: Basic information of farm households. The questions in this part mainly cover the basic information of the respondents mainly including four contents of gender, age, marriage, and education level, with 4 questions in total and 1 question for each dimension.

Part 2: Development of marketing model based on 5G network security. This part is subdivided into three dimensions: strengthening brand awareness, expanding profit channels and strengthening market management, with a total of 36 questions and 6 questions per dimension.

Part 3: Product quality improvement based on 5G network security. This part is subdivided into four dimensions: standardization of supply and marketing of agricultural products, credit construction of agricultural product quality and safety, traceability of agricultural product quality, and early warning of agricultural product risks, containing 70 questions and 10 questions per dimension.

3.2. Theoretical knowledge of mathematical statistics

3.2.1. Pearson's correlation coefficient. Pearson's correlation coefficient, also known as Pearson's product-moment correlation coefficient, simple correlation coefficient, which describes the degree of closeness of the link between two fixed-distance variables, used to measure the correlation (linear correlation) between two variables X and Y with values between -1 and 1 with values between -1 and 1, generally denoted by r . $Corr(X, Y)$, the formula for the calculation is:

$$Corr(X, Y) = \frac{n \sum xy - \sum x \sum y}{\sqrt{n \sum x^2 - (\sum x)^2} \sqrt{n \sum y^2 - (\sum y)^2}} \quad (1)$$

where, n is the sample size, X and Y are the quantitative values of the questionnaire test for the 2 variables respectively.

If $r > 0$, it indicates that the 2 variables are positively correlated, i.e., the larger the value of one variable, the larger the value of the other variable will be [22-23]. If $r < 0$, it indicates that the two variables are negatively correlated, i.e., the larger the value of one variable, the smaller the value of the other variable will be. The larger the absolute value of r , the stronger the correlation, and the degree of correlation is shown in Table 1.

Table 1. Correlation degree of Pearson product moment correlation coefficients

Range of r	Degree of correlation
$0.0 \leq r \leq 0.2$	Very weak correlation or no correlation
$0.2 \leq r \leq 0.4$	Weak correlation
$0.4 \leq r \leq 0.6$	Moderate correlation
$0.6 \leq r \leq 0.8$	Strong correlation
$0.8 \leq r \leq 1.0$	Most strong correlation

3.2.2. Multiple linear regression. Multiple regression analysis refers to the use of regression equations to quantitatively explain the linear dependence between the dependent variable and two or more independent variables. The basic idea is to try to find the mathematical expression that best represents the relationship between the independent and dependent variables [24-25].

In multiple regression analysis, when the dependent variable y is interfered by external influencing factors, these influencing factors are defined as independent variable x_i . If there is a certain correlation between y and x_i , a multiple regression model can be established based on the dependent variable y and each influencing factor x_i , and the mathematical expression of the model is as follows:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_p x_{ip} + \varepsilon_i \quad (2)$$

1) Establishment of multiple linear regression equation. The multiple linear regression model is given in the following equation, which is represented by a matrix:

$$y = x\beta + \varepsilon \quad (3)$$

The valuation $\hat{\beta}$ of β can be found from the least squares principle as:

$$\hat{\beta} = (x^T x)^{-1} x^T y \quad (4)$$

2) Regression equation significance test. In many practical problems, the relationship between dependent variable y and independent variable x^i is not obvious, and it needs to be tested and verified by certain significance test to finally determine whether there is a good and significant relationship between the two, if they do not have a good significance between them, then it means that there is not a relevant connection between y and x^i , therefore, the process of testing the significance is also very important.

To test the significance of the regression equation, the statistic F is generally quoted as the constraint of the model, and the expression of the statistic F is:

$$F = \frac{S_{\text{Back}} / p}{S_{\text{Remain}} / (n - p - 1)} \quad (5)$$

In the above equation, S_{Back} is the regression sum of squares, S_{Remain} is the residual sum of squares, and the statistic F should obey a $F(p, n - p - 1)$ distribution, i.e., obey the level of significance α , α can be determined by the following expression:

$$P\{|F| \geq F_{1-\alpha, p, n-p-1} | H_0\} = \alpha \quad (6)$$

The above formula is the expression of significance test, if it satisfies $|F| \geq F_{1-\alpha, p, n-p-1}$, it means that there is a good significance relationship between y and x_i at α significant level, and the constructed model is significant and good.

3) Significance test of regression coefficient. In the method of multiple regression analysis, the regression equation obviously does not represent that every independent variable is obvious to the dependent variable, at this time, the significance of the independent variables should be studied, the independent variables with high significance will be saved, and the independent variables with low significance will be excluded, so that the significance of the model can be effectively suppressed the impact of significance. After eliminating the irrelevant influences, the parameters of the independent variables of the constructed model can also be optimized, so that the intrinsic connection between y and x_i can be studied more accurately, and the deformation of the dependent variable can be analyzed better at the same time.

If the role and effect of a particular variable x_i on the dependent variable y is not very significant, the value of the coefficient β_j of the multiple regression model should be zero, and the test of whether the dependent variable x_i is significant or not is often can be verified by the following expression:

$$\frac{\beta_j^2 / C_{jj}}{S_{\text{Remain}} / (n - p - 1)} \sim F(1, n - p - 1) \quad (7)$$

In the above equation, if independent variable x_i is significant for dependent variable y , it obeys a $F(1, n - p - 1)$ distribution.

If $|F| \geq F_{1-\alpha, p, n-p-1}$, the regression coefficient β_j is considered significant at the confidence interval of $1 - \alpha$.

Note that the regression model should be rebuilt for each deleted variable and each coefficient should be tested until all regression coefficients are significant.

4) Multicollinearity. The sufficient condition to be fulfilled to build a multiple linear regression model is the rank $\text{rank}(X) = k + 1$ of the design matrix X , which means that the column vectors of the sample matrix X are linearly independent of each other. However, in economic analysis, such as the study of economic problems, several factors need to be considered. However, due to the complexity of things, there is some correlation between most factors. Generally, the case of weak correlation between independent variables is regarded as meeting the modeling requirements of the regression model; however, when there is a strong correlation between the independent variables, the regression model is considered to be inconsistent with the basic assumptions and is said to suffer from the problem of multicollinearity.

In the actual analysis process, it is more common that the linear relationship is approximately established, i.e., there exists a set of constants $c_0, c_1, c_2, \dots, c_k$ not all zero, making:

$$c_0 + c_1 x_{i1} + c_2 x_{i2} + \dots + c_k x_{ik} \approx 0, i = 1, 2, \dots, n \quad (8)$$

When the relationship shown in equation (8) exists for independent variable $x_1, x_2, \dots, x_k$, multicollinearity is said to exist between independent variables $x_1, x_2, \dots, x_k$.

Three types of relationships can usually be initially determined by using simple correlation coefficients to attribute the existence of three relationships between the modeled independent variables:

- 1) $r_{x_i x_j} = 0$, i.e., x_i has no linear relationship with x_j .
- 2) $r_{x_i x_j} = 1$, where x_i is perfectly covariant with x_j .
- 3) $0 < |r_{x_i x_j}| < 1$, where there is some degree of linearity between the independent variables.

The independent variables are made dimensionless so that $(X^*)^T X^* = (r_{ij})$ is the correlation array of the independent variables. Notation:

$$C = (c_{ij}) = (X^{*T} X^*)^{-1} \quad (9)$$

Call the main diagonal element $VIF = c_{jj}$ the variance expansion factor of the independent variable x_j . This is obtained through Eq. $D(\hat{\beta}) = \sigma^2 (X^T X)^{-1}$:

$$Var(\hat{\beta}_j) = C_{jj} \sigma^2 / L_{jj}, j = 1, 2, \dots, k \quad (10)$$

where L_{jj} is the sum of squared deviations of x_j . Let R_j^2 be the complex coefficient of determination of the independent variable x_j with respect to the other variables, and note that

$$c_{jj} = \frac{1}{1 - R_j^2} \text{ is the definition of } VIF_j.$$

We usually use R_j^2 to measure the degree of linear correlation between the independent variables, $R_j^2 \rightarrow 1$ when VIF_j is greater. From this perspective, we can use the value of VIF_j to reflect the degree of multicollinearity between the independent variables. Typically, $VIF_j \geq 10$ this indicates that there is a strong problem of covariance between the respective variables in the least squares estimation, and it can have a large impact on the LS estimates.

4. Exploring the relationship between marketing model development and product quality improvement

4.1. Demographic Characterization and Descriptive Statistical Analysis

4.1.1. Demographic characterization. Through the first part of the questionnaire (the basic situation of farmers) questions test, access to the quantitative value of the demographic characteristics of the research object, in order to more intuitively show the distribution of the quantitative value of the demographic characteristics, accordingly the use of Mulberry diagrams to describe the demographic characteristics of the (can be clearly seen in each type of quantitative value of the indicators under the size of the ranking of the situation), demographic characteristics of the results of the analysis as shown in Figure 2. According to the labeled data in the figure, it can be seen that in the gender type, the number of boys and girls are 281 (56.20%) and 219 (43.80%) respectively, and the number of boys is 62 more than the number of girls, and other age, marital status, and literacy level are described in the same way.

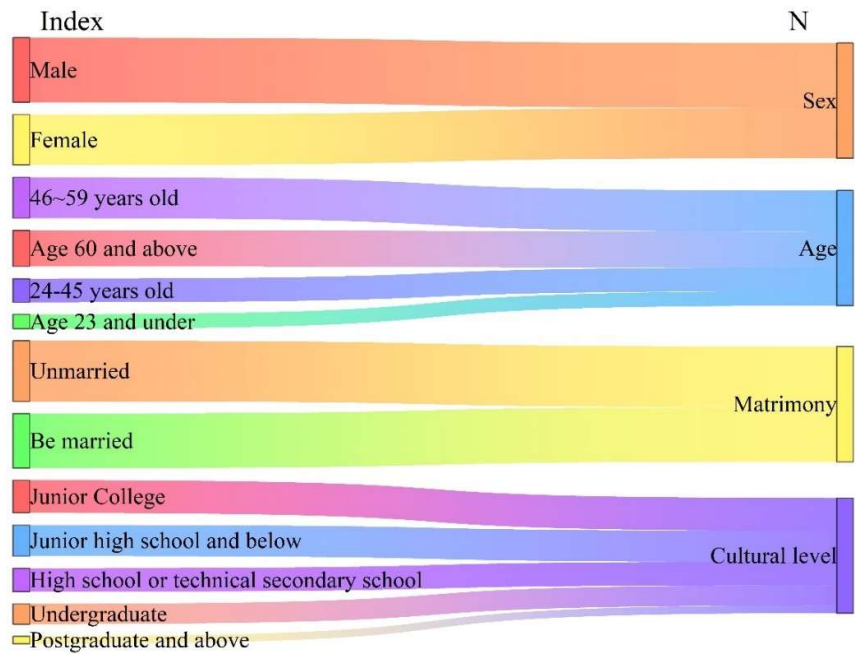


Fig. 2. Demographic characteristics analysis results

4.1.2. Descriptive statistical analysis. Based on the test results of the second and third parts of the questionnaire, descriptive statistical analysis of the dimensions (strengthening brand awareness B1, expanding profit channels B2, strengthening market management B3, standardization of supply and marketing of agricultural products B4, credit construction of agricultural product quality and safety B5, agricultural product quality traceability B6, and agricultural product risk early warning B7) was carried out, and the results of the descriptive statistical analysis are shown in Figure 3. The labeled data in the figure indicate the mean value of each dimension, and it is summarized that $B4 (2.976) < B3 (3.082) < B2 (3.173) < B6 (3.187) < B7 (3.195) < B5 (3.354) < B1 (3.421)$, which not only reveals the distribution of quantitative values of the dimensions, but also provides the data support for the following research work.

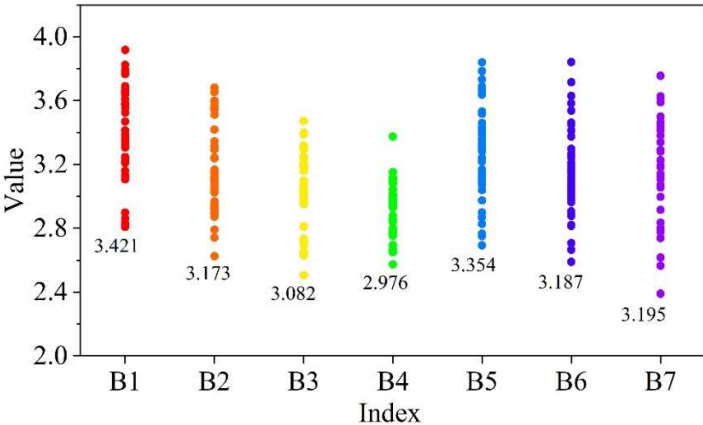


Fig. 3. Descriptive statistical analysis results

4.2. Correlation analysis

The dimension of marketing mode development based on 5G network (strengthening brand awareness B1, expanding profit channels B2, and strengthening market management B3) was set as the dependent variable, while the dimension of product quality improvement based on 5G network (agricultural supply and marketing standardization B4, agricultural quality and safety credit

construction B5, agricultural quality traceability B6, and agricultural risk early warning B7) was set as the independent variable, and, from the qualitative point of view, the relationship between them was investigated by using the above-mentioned mentioned Peel's selection correlation coefficient to explore the relationship between the two.

4.2.1. Strengthening brand awareness (B1). Pearson's selected correlation coefficient was applied to explore the dimensions of enhanced brand awareness (B1) and product quality improvement based on 5G network (agricultural supply and marketing standardization B4, agricultural quality and safety credit construction B5, agricultural quality traceability B6, and agricultural risk warning B7), and the results of the correlation analysis are shown in Figure 4. It can be clearly seen that the Pearson correlation coefficients of strengthening brand awareness (B1) and agricultural product supply and marketing standardization (B4), agricultural product quality and safety credit construction (B5), agricultural product quality traceability (B6), and agricultural product risk early warning (B7) are 0.423, 0.781, 0.454, and 0.536, respectively, which indicates that there is a significant positive correlation between them.

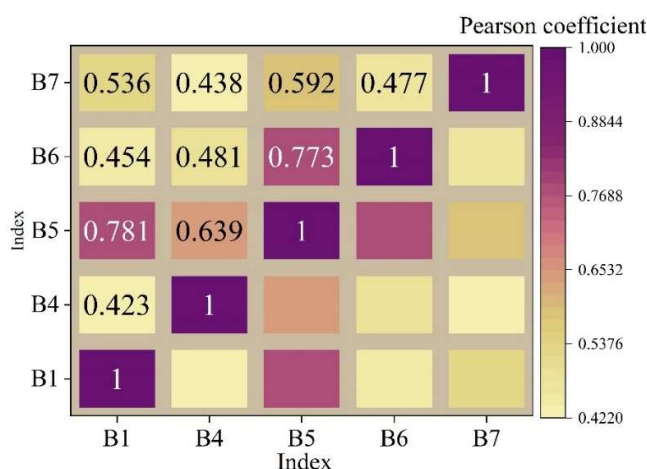


Fig. 4. Correlation analysis result

4.2.2. Expanding profit channels (B2). Adopting the same method as above, we discuss the interaction relationship between expanding profit channels (B2) and the standardization of agricultural product supply and marketing (B4), credit construction of agricultural product quality and safety (B5), agricultural product quality traceability (B6), and agricultural product risk early warning (B7), and the results of the correlation analysis between the two are shown in Fig. 5. The results show that the Peel's Choice correlation coefficients of B2 with B4, B5, B6, and B7 are 0.411, 0.746, 0.427, and 0.519, which proves the significant relationship between B2 and B4, B5, B6, and B7, and can be used for regression analysis.

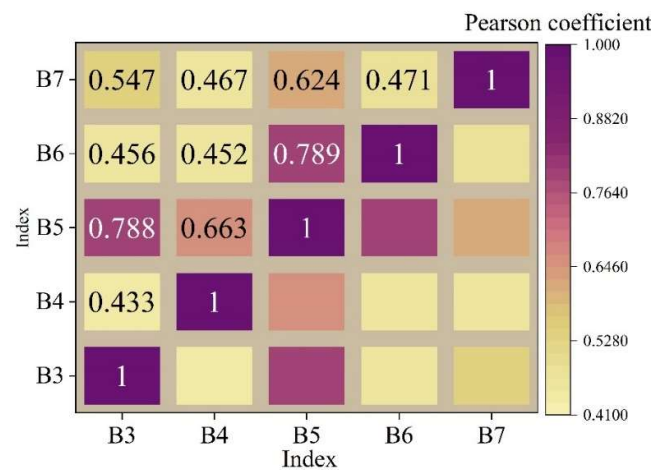


Fig. 5. Results of correlation analysis between the two

4.2.3. Strengthening market governance (B3). Finally, we interpret the mutual influence relationship between strengthening market management (B3) and the standardization of supply and marketing of agricultural products (B4), the credit construction of agricultural product quality and safety (B5), the traceability of agricultural product quality (B6), and the risk early warning of agricultural products (B7), and the results of the analysis of the mutual influence mechanism are shown in Fig. 6. The data in the figure show that the correlation coefficient values of B3 and B4, B5, B6 and B7 are 0.433, 0.788, 0.456 and 0.547, among which the Pearson correlation coefficient of B3 and B5 is the largest, which verifies that the set variables can be used in the multiple linear regression model.

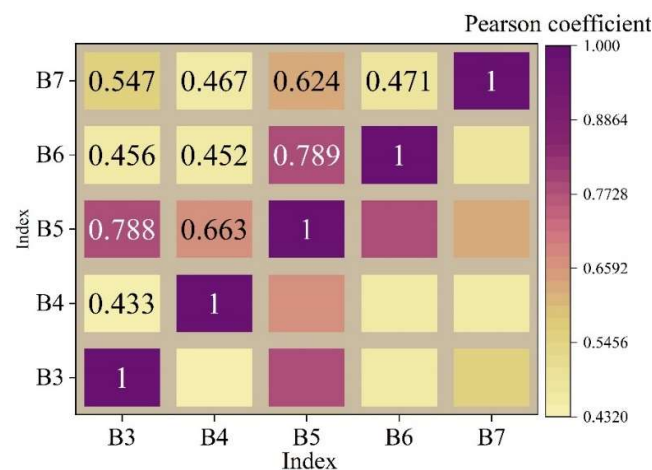


Fig. 6. Analysis results of interaction mechanism

4.3. Regression analysis

4.3.1. Regression analysis of strengthening brand awareness on product quality. Firstly, the standardization of supply and marketing of agricultural products (B4), the credit construction of agricultural products quality and safety (B5), the quality traceability of agricultural products (B6), and the risk early warning of agricultural products (B7) in product quality enhancement are taken as independent variables, while the strengthened brand awareness (B1) in the e-commerce marketing mode is taken as the dependent variable, and by inputting the above data into the analytical software, we get the regression analysis of the strengthened brand awareness on product quality. As a result, the regression analysis results are shown in Figure 7, where (a)~(d) denote B4~B7, respectively. From the VIF value, it can be seen that there is no problem of multiple covariance between the variables.

($VIF < 10$), in addition to the regression equation of strengthened brand awareness on product quality can be derived as $B1 = 0.511 + 0.439*B4 + 0.653*B5 + 0.327*B6 + 0.297*B7$, to mathematically quantify the interpretation of product quality enhancement on the e-commerce marketing model to strengthen brand awareness (B1) impact, only in-depth implementation of the standardization of agricultural supply and marketing, agricultural product quality traceability, agricultural product risk early warning, agricultural product quality and safety credit construction, is more conducive to enhance the user's attention to the degree of brand of agricultural products, which in turn promotes the development of agricultural products e-commerce marketing model.

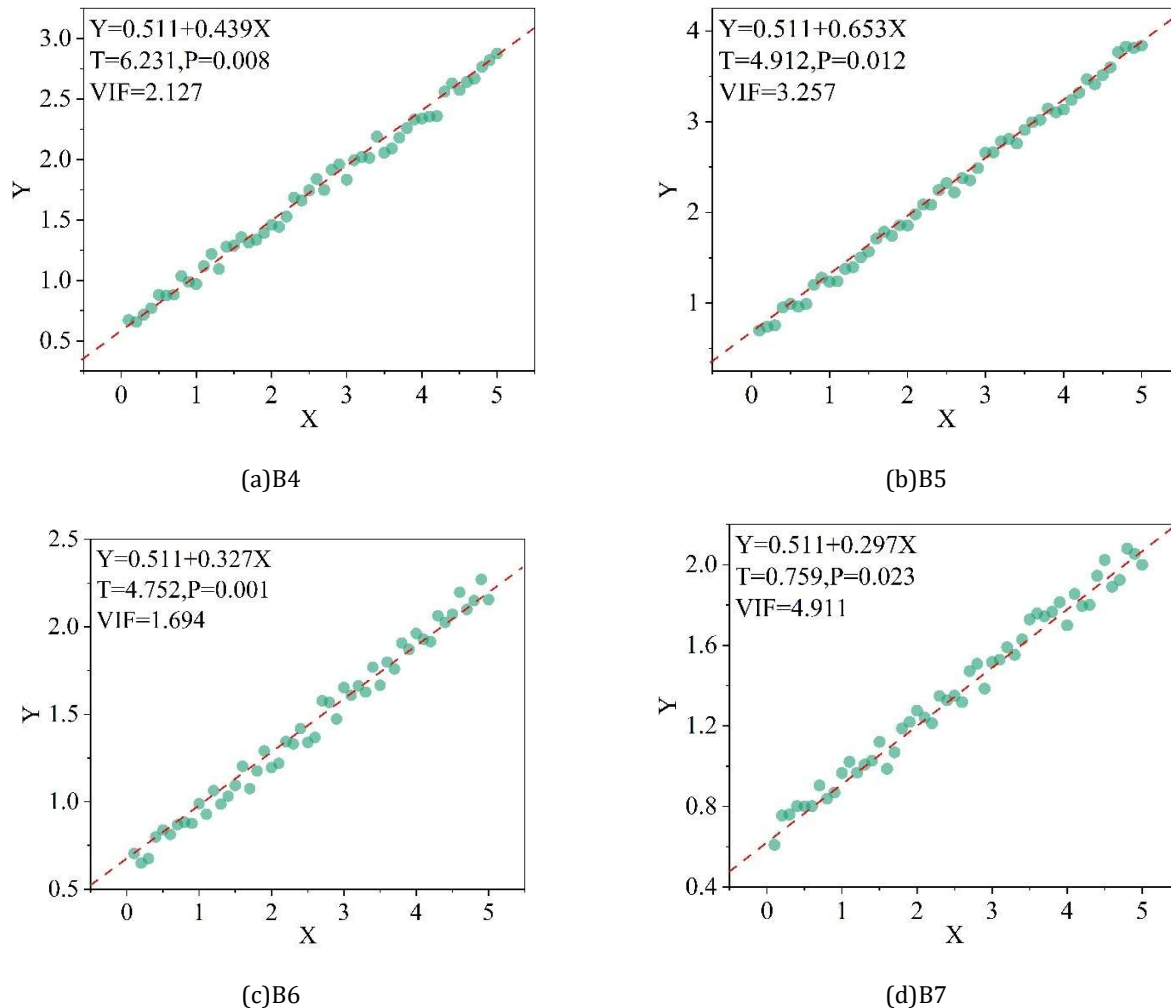


Fig. 7. Regression analysis result

4.3.2. Regression analysis of expanding profit channels on product quality. Then the dependent variable is replaced with expanding profit channels (B2), while the independent variable remains unchanged, also with the help of data analysis software, the results of the regression analysis of expanding profit channels on product quality, variable regression analysis results are shown in Figure 8. The data show that the regression coefficients of B4~B7 are 0.527, 0.466, 0.483, 0.367, and the constant is 0.638, which together form the regression equation of expanding profit channels on product quality: $B2 = 0.638 + 0.527*B4 + 0.466*B5 + 0.483*B6 + 0.367*B7$, and there is no multicollinearity, only Continuously strengthening the standardization of agricultural supply and marketing (B4), agricultural quality and safety credit construction (B5), agricultural quality traceability (B6), agricultural risk early warning construction, not only the profitability channels of

agricultural products have been further expanded, but also the level of development of the agricultural e-commerce marketing model has been improved.

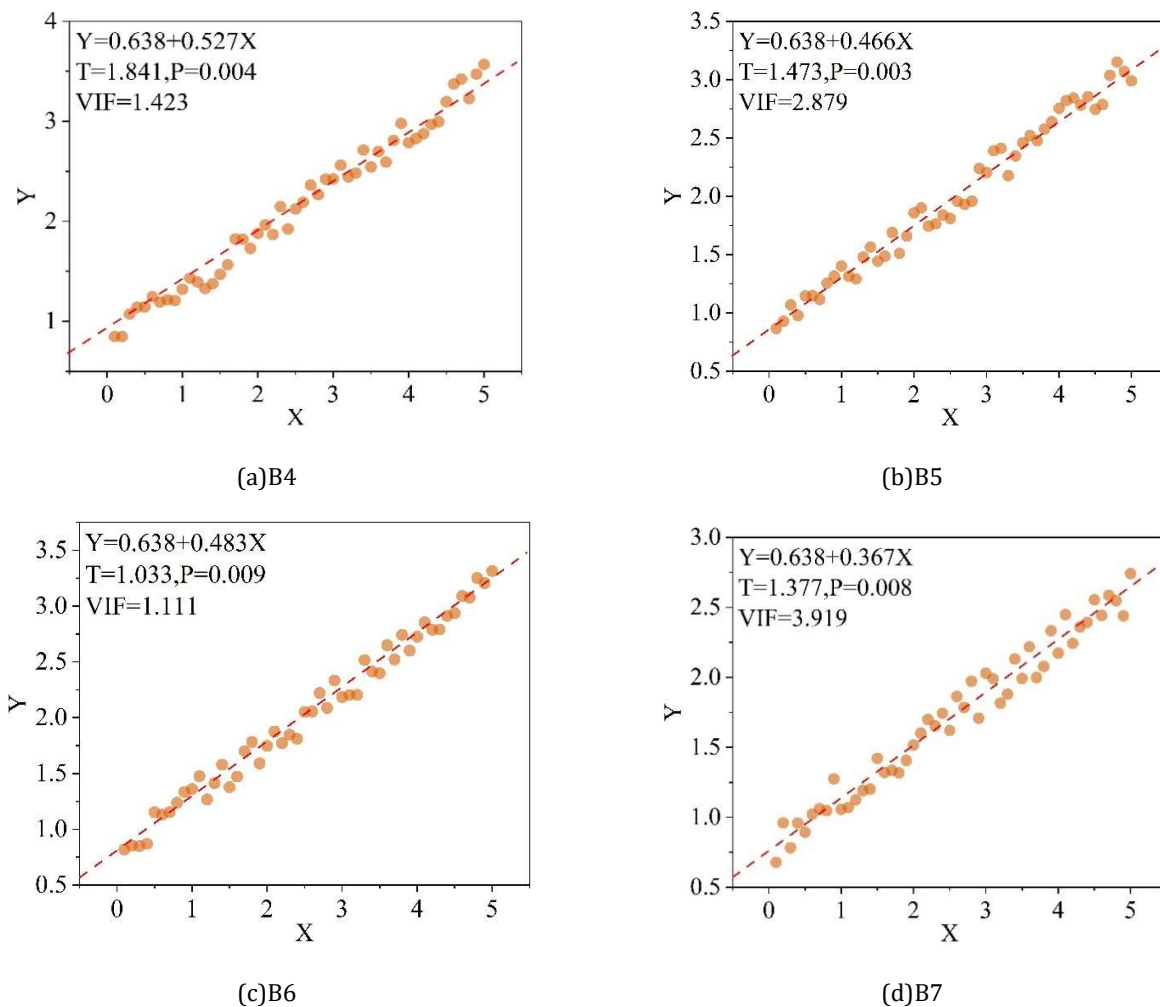


Fig. 8. Variable regression analysis results

4.3.3. Regression analysis of strengthening market management on product quality. Finally, strengthening market management (B3) in the e-commerce marketing model is taken as the dependent variable in this research, and the same independent variable is kept unchanged, and the regression analysis of strengthening market management on product quality is studied in depth according to the multiple linear regression theory mentioned above, and the regression effect relationship between the two is demonstrated in Figure 9. Combined with Figure 9 (a) ~ (d) can be concluded that the regression equation is $B3 = 0.498 + 0.384 * B4 + 0.642 * B5 + 0.469 * B6 + 0.544 * B7$, the P-value of each variable is less than 0.05, which indicates that the equation has a significance, and explains the relationship between strengthening the market management and product quality enhancement well. Agricultural products e-commerce marketing model and product quality have an interdependent relationship, a reasonable grasp of the balance between the two, in order to make the 5G network security better promote the synergistic development of the two.

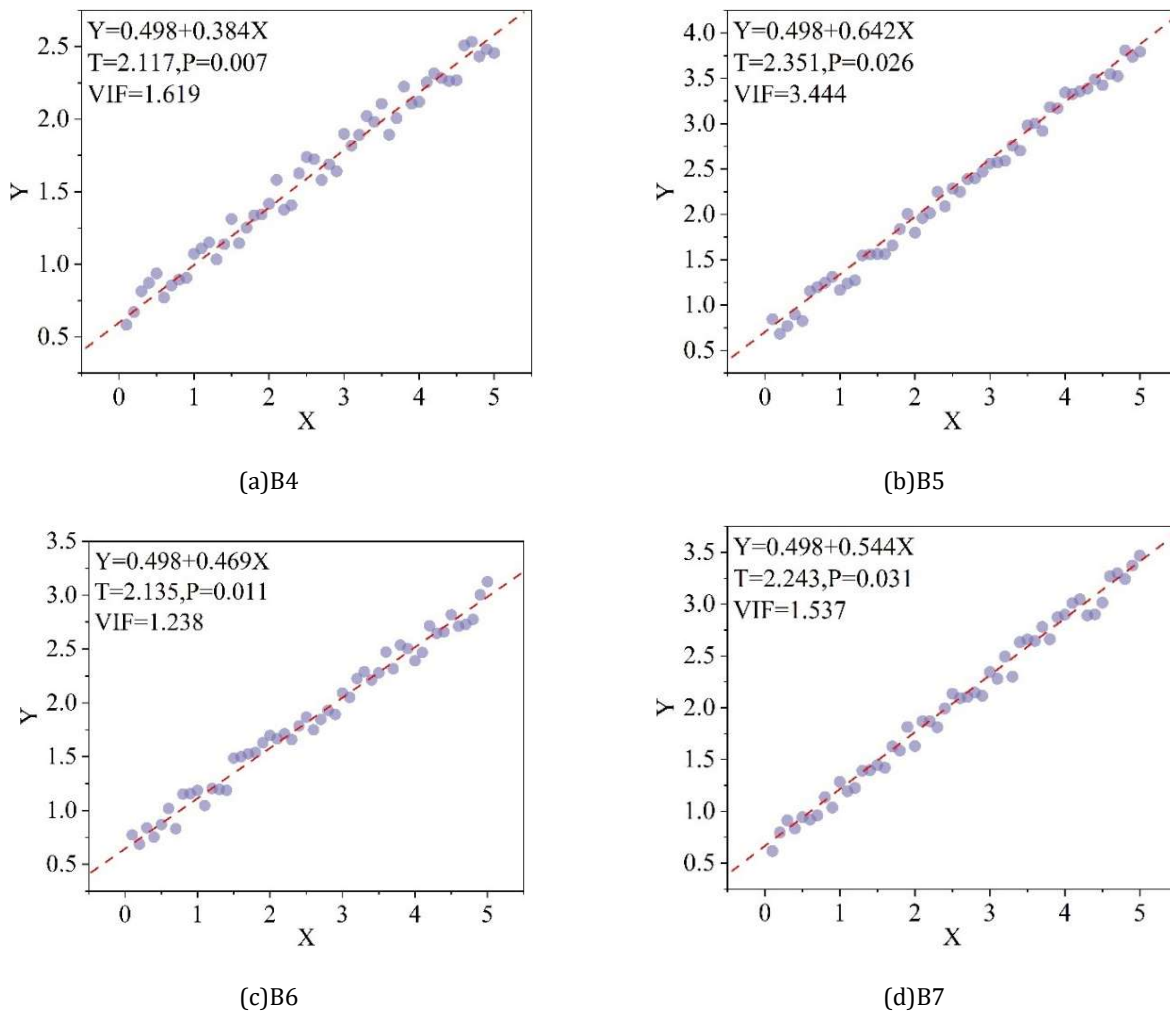


Fig. 9. The regression effect relationship between the two

5. Conclusion

This project determines the dimensional variables of agricultural e-commerce marketing model and product quality improvement with the technical support of 5G network security. Select the research variables of this study, take the questionnaire data as the source of research data, set the independent variables and dependent variables, and use the knowledge of mathematical statistics to deeply explore the relationship between the development of marketing mode and product quality improvement. The regression equation of expanding profit channels on product quality improvement is obtained: $B2=0.638+0.527*B4+0.466*B5+0.483*B6+0.367*B7$, which not only has the regression coefficient of significance, but also exists the problem of multiple non-collinearity, which reveals the mathematical relationship between the product quality improvement and the expansion of profit channels, and the study has an important theoretical guidance for the development of synergistic development of the marketing mode of agricultural products e-commerce and product quality. This study has important theoretical guidance value for the synergistic development of product quality.

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