

An Empirical Analysis on Vegetables Wholesalers' Quality and Safety Traceability Behaviors

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Abstract: Currently, traceability is viewed as the most effective way to improve the vegetables quality and safety control, and vegetables wholesalers play vital role in the construction of vegetables quality and safety traceability system in China. Based on the Theory of Planned Behavior, this paper makes an empirical analysis on vegetables wholesalers' quality and safety traceability behaviors by investigating the supply level of quality and safety traceability system of some vegetables wholesalers and influence factors in Shandong province. The results show that the subjective elements related to behavior attitude and subjective norm, the objective elements related to Perceived Behavioral Control, such as culture level, business scale, income percentage and training have positive influences to the supply level, but age has a negative to the supply level. In the intensity, the subjective elements related to behavior attitude are the most, while the objective elements related to Perceived Behavioral Control are the least.

Keywords: vegetables, wholesalers, quality and safety traceability system

I. Introduction

Vegetables are the basic consuming products in daily life. In recent years, many food safety accidents have occurred one after another, more and more people have begun to concentrate on vegetables' quality and safety.

The current circulation about vegetables is mainly to realize by transferring from producers to wholesale markets, agricultural trade markets or supermarkets, and to consumers at last. From the aspect of logistics, wholesale markets are the key nodes for vegetables' collecting and distributing, which are also gathering places for products flow and information flow. In general, wholesale markets include many benefit bodies, such as wholesalers, buyers, management departments in markets, related governmental departments [1]. Among them, the wholesalers play the most important role, which take on the functions of products and information transferring, and which are the center of wholesale markets operation.

Quality and safety traceability system is an effective method to avoid risk and improve the food safety, whose principle is to realize the supervisions of recording, communicating and sharing quality and safety information in all processes from the production to circulation. Many countries in the food

circulation field have established the quality and safety traceability system to guarantee the supply for safe food. In Chinese vegetables circulation system, the quality and safety traceability system undoubtedly can improve supervision the safety status of vegetables. The vegetables wholesalers are the hinge of products and information in the circulation system, who can effectively realize the collecting, spreading and tracing, which should be the main body to the construction of the quality and safety traceability system.

II. Related Theories and Literature Reviews

literature reviews in foreign and domestic

The developed countries have had earlier researches on quality and safety traceability system, whose current researches are mainly focusing on the theoretic and empirical studies for behavior, cost and efficiency and so on. Hobbs (2004) processed the information tracing for the pre-traceability and post-traceability by models, who though the pre-traceability could reduce the cost to acquire the quality and safety information and improve consumers' recognizing ability to products, who also though the post-traceability could effectively separate polluted food when some food safety accidents happened, and could confirm the responsible attributions to food safety accidents [2]. For the researches on the quality and safety traceability behaviors for micro bodies, many foreign scholars have done many jobs from different aspects. Buhr (2003) used an analysis paradigm of transaction cost to get the following conclusions: the motivations of establishing the traceability system for the farmers, processing enterprises and retailers in food supply chain are to reduce information asymmetry, moral risks and opportunism behaviors [3]; Monteiro and Caswell (2009) constructed a two-stage econometrics model for the quality and safety traceability behaviors to farmers, who were also the first time to construct the model at the aspect of farm, the traceability system implemented by the farmers were mainly affected by the following elements: target markets, members in production organizations, farm's productivity, protection for old farm and farmers' age and so on [4]. In the analysis for the traceability behaviors, the foreign scholars mainly think that the market implementing with the quality and safety traceability characteristics is an important element to affect body's behaviors, who have done many good jobs on them. Pouliot and Sumner (2008), Loureiro and Umberger (2007), Dickinson and

Bailey (2002) respectively used Selection Test, Discrete Choice Model and other methods to do empirical studies on consumers' WTP to traceability behaviors for different countries and environments, the result showed the consumers were willing to pay higher prices for food including traceability character [5][6][7].

Compared to the developed countries, Chinese researches on the quality and safety traceability system started relatively late, most of researches still stay on the level of technology, for example, Zhang Bing et al. (2007), Yang Xinting et al. (2008) imported the information technology and enterprise resource planning, based on the dot net technology platform, to construct a perfect information traceability system, to satisfy the current demands of food safety management [8][9]. However, the researches in economics and management field are quite few, Zhou Yingheng (2002) analyzed the application of quality and safety traceability system for the European Union and Japanese food economics systems, and proposed some suggestions according to foreign experiences in the advanced traceability system for food safety [10]. Zhou Deyi (2005) researched the effects of knowledge management, community structures and supply chain modes and other aspects in the traceability system according to the traceability system of Thailand agri-products [11]. Zhou Jiehong (2007) constructed the logit model for the traceability system of farmers' desires and behaviors, who thought that the industrialization degree, planting scale, governmental policy had important effects for farmers' desires and behaviors for the construction of the traceability system [12].

Related theory background

Theory of Planned Behavior (TPB) thinks the behavior intention will decide behavior directly under enough practical control conditions. Behavior intention means that the action tendency that the individual wants to take a special behavior, which is a result affected by Attitude towards the Behavior, Subjective Norm and Perceived Behavioral Control. Attitude towards the Behavior is a pre-assuming stand, which is affected by behavior belief. Subjective Norm means the cognizance that the individual gets from the social pressure when he or she takes a special action. Perceived Behavioral Control means the controllable degree pre-felt by the individual after the individual takes an action, which includes inner control elements, such as the individual's disadvantage, technology, abilities or emotion and so on (Notani, 1998). The individual's Attitude towards the Behavior is more strong, whose Subjective Norm is more positive, who will be felt more strong control power, whose desire to perform one behavior is more strong, who will more possibly to perform one behavior. The Theory of Planned Behavior can use the following model to denote, which is shown in figure 1.

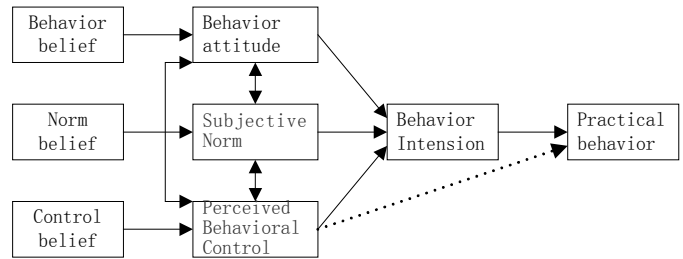


Figure 1 The structure model of Theory of Planned Behavior [13]

Comments on the current theories and Literature Reviews

The developed countries have used economics methods to research on quality and safety traceability system, which have formed a research system on theoretical and empirical studies. Many research objects are oriented to all kinds of organizations in supply chain, which can explore a general development law for quality and safety traceability system under market economy. The foreign researches mainly focus on the livestock and poultry products, further more, the vegetables mainly rely on the import, so the constructions of traceability system are rare, the researches on traceability system are quite few and the researches on the wholesale markets are absent.

Based on the explaining abilities of TPB and the research status, this paper uses a research method of econometrics based on the investigation, to construct vegetables wholesalers' quality and safety traceability system supply behavior model, aiming to provide a theory reference to improve the whole food safety and management level of Chinese vegetables.

III .An Empirical Analysis on Vegetables Wholesalers' Quality and Safety Traceability Behaviors Based on TPB

The supply of quality and safety traceability system is a planned behavior, so this paper uses the TPB theory and the past researches, and combing with the data getting from the field investigations to develop an empirical analysis, to explore the influence elements and influence degree.

Data source and samples characteristics

All data are from the field investigations for the supply behaviors of vegetables wholesalers' quality and safety traceability system from the vegetables wholesale markets in Shandong province, the investigating time was from May, 2009 to October, 2009. We sent 100 questionnaires and received 75 questionnaires. The wholesalers characteristics are as follows:

(1) The wholesalers in the received questionnaires, most of them are middle-aged persons. In the all wholesalers, whose age is less than 30, the percentage is 9.3%; whose age is between 30 and 60, the percentage is 86.6%; whose age is

more than 60, the percentage is 4.1%.

(2)The wholesalers' sale years are short, whose range is less than 5 years, the percentage is 40%; whose sale years are between 5 and 10, the percentage is 18.7%; whose sale years are between 10 and 15, the percentage is 26.7%; whose sale years are more than 15, the percentage is 14.6%;

(3)Vegetables' incomes are an important source to their family incomes. The sale incomes of 74.7% wholesalers are more 50% than their whole family incomes.

(4)The wholesalers' culture degree is low. In the all wholesalers, whose educated degree is not more than the level of elementary school, the percentage is 33.3%; whose educated degree is at the level of junior high school, the percentage is 28%; whose educated degree is at the level of senior high school or technical secondary school, the percentage is 20%; whose educated degree is more than junior college, the percentage is 18.7%;

(5)The business scales are still low. In the all wholesalers, 24% suppliers' business scales are very low, 36% suppliers' business scales are comparatively low, 12% wholesalers' business scales are at the middle level, 18.7% wholesalers' business scales are comparatively high, 9.3% wholesalers' business scales are very high.

(6)The vegetables are mainly from self-production and upstream wholesale markets. In the all wholesalers, 31.1% vegetables products are from self-production, 45.9% vegetables products are from upstream wholesale markets, 23.0% vegetables products are from buying at the producing places.

(7)The sale objects are very complex. The sale objects mainly included the individuals, schools, enterprises and institutions, business persons in the farm product market and downstream wholesalers.

(8)The products' authentication degrees are low. The wholesalers who got the non-harmful authentication were the most, the subsequent places are green authentication and organic authentication. There are still about 40% suppliers who sold their products without any quality and safety authentications.

The description to wholesalers' quality and safety traceability behaviors

The supply level to wholesalers' quality and safety traceability system: The wholesalers' supply behaviors to quality and safety traceability system include registering the sources and production information in the purchasing part, registering the bargaining information and preserving information in the bargaining part and so on. By investigating the wholesalers' behaviors combining with questionnaires, the paper uses three dimensions (precision, broadness, deepness) in the traceability system behaviors proposed by Golan (2004)^[14], and designed a basic reference system, to quantitatively evaluate the suppliers' supply behavior level to quality and safety traceability system, the result shows that 37.3% wholesalers only finished less than 20% traceability requirements, 21.3% wholesalers finished

20%-40%, 9.3% wholesalers finished 40%-60%, 22.7% wholesalers finished 60%-80%, 9.4% wholesalers finished more than 80%. It can be seen that most of the wholesalers could not establish comparatively entire quality and safety traceability system, which shows that the quality and safety traceability system implementing in the Chinese vegetable circulation field incompletely.

The perceptibility to the outside traceability requirements of wholesalers: The investigation shows that wholesalers thought that the requirements about quality and safety traceability related to governmental departments had positive influences to wholesalers' business, the percentage is 73.3%, the percentage with non-influences is 26.7%; the wholesalers thought that the requirements about quality and safety traceability related to markets' management departments had positive influences to suppliers' business, the percentage is 64%, the percentage with non-influences is 36%; the wholesalers thought that the requirements about quality and safety traceability related to consumers had positive influences to wholesalers' businesses, the percentage is 66.7%, the percentage with non-influences is 33.3%. So the wholesalers' perceptibility to government is the strongest, but the suppliers' perceptibility to consumers is the weakest, which shows that the Chinese food safety depending on governmental supervising, food's Credence Property and many gambling behaviors in the production and circulation process keep close to the current status.

The wholesalers' cognition to the quality and safety traceability system: The investigation shows that on the perceiving for the quality and safety traceability system, 18.6% wholesalers thought they understand "very much" for it, 24% wholesalers thought they understand "in a general way" for it, 26.7% wholesalers thought they understand "a litter" for it, 30.7% wholesalers thought they understand "nothing" for it. In general, the wholesalers had a low-degree cognition to the quality and safety traceability system.

The wholesalers' benefit expectations provided by the quality and safety traceability system: The investigation shows that 16% wholesalers thought that the construction of the quality and safety traceability system would reduce their income very possible, 29.3% wholesalers thought that it would reduce their income possibly, 21.3% wholesalers thought that it would not have an effect to their income, 25.3% wholesalers thought that it would be avail to improve their incomes, only 8% wholesalers thought it would be very avail to their incomes. According to the above analysis, this paper thinks that the wholesalers have pessimistic expectations to benefit expectations for the quality and safety traceability system.

The wholesalers' trainings to quality and safety: The investigation shows that in resent three years, 40% wholesalers had not gotten any quality and safety trainings, 21.3% wholesalers only got one to two times trainings, 20% wholesalers had gotten three to four times trainings, 18.7% wholesalers had gotten five times or more than five times

trainings. So the wholesalers’ trainings to quality and safety are still insufficient, many wholesalers were still lack of food safety management consciousness. The wholesalers’ attitudes to wholesale Market entry certification system implemented by the government: The wholesale market entry certification system is an important part to the construction of quality and safety traceability system, so the attitudes to wholesale market entry certification system could directly reflect the vegetables wholesalers’ attitudes to quality and safety traceability system. The investigation shows that 33.3% wholesalers did not approve it, 22.7% wholesalers thought it did not matter, 28% wholesalers thought they approved it, 16% wholesalers thought they approve it very much. It can be seen that most of wholesalers had inimical or wait-and-see attitudes from their subjective intentions to the quality and safety traceability system, it is possible to relate with many elements, such as wholesalers’ low perceiving, cost increasing and government’s bad performing.

The empirical model and result analysis

Under the TPB framework, the cognition to traceability system, the expectation benefits, the attitudes to market entry certification system, the governmental requirement perceiving, the markets’ requirement perceiving, the consumers’ requirement perceiving, other suppliers’ related behaviors perceiving, age, culture degree, sale years, business scale, income percentage and trainings, all of them are possible to produce influences to the supply behavior level of wholesalers’ traceability system. Because the supply behavior level of wholesalers’ quality and safety traceability system and other elements are of continuity, the paper uses multivariable linear regression model to analyze the supply behaviors to wholesalers’ quality and safety traceability system, the theory model can be denoted as:

$$\pi = \beta_0 + \beta_1x_1 + \cdots + \beta_nx_n + \mu_i$$

In the model:

π is denoted as the supply level of wholesalers’ quality and safety traceability system.

$x_1 \sim x_n$ is denoted as the influence elements to the supply behaviors of wholesalers’ quality and safety traceability system.

$\beta_1 \sim \beta_n$ is denoted as the coefficient of the influence elements.

β_0 is denoted as the constant.

μ_i is denoted as the stochastic error.

In order to simplify the above model and get rid of the multicollinearity, before constructing a empirical model, it is very necessary to simplify the subjective perceiving variables by the principal component factor analysis. The paper uses some spss16.0 to do a principal component factor analysis for the cognition to traceability (U_T), the expectation benefits (E_B), the attitudes to access system (A_A), the governmental requirement perceiving (G_P), the

markets’ requirement perceiving (M_P), the consumers’ requirement perceiving (C_P), other wholesalers’ related behaviors perceiving (O_S), the result is shown in table 1.

Table 1. The rotated component matrix of factors

Variables name	Variables	
	1	2
M_P	0.8420	0.1350
O_S	0.7140	0.4110
G_P	0.6290	0.0100
C_P	0.6140	0.5240
E_B	0.2310	0.8910
U_T	-0.0050	0.8840
A_A	0.2230	0.8560

The rotated component matrix of factors shows the factor 1 explains the main contents of M_P, O_S, G_P and C_P, depicts the wholesalers’ perceiving to outer pressure, which conforms to the meaning of subjective norm in TPB, so, which is named as “subjective norm”. The factor 2 explains the main contents of E_B, U_T and A_A, reflects the attitudes owned by wholesalers, which conforms to the meaning of behavior attitude in TPB, which is named as “behavior attitude”.

According to assignment value to the factor 1 and factor 2 after the principal component factor analysis, adding some objective variables related to Perceived Behavioral Control in TPB, such as age, culture degree, sale years, business scale, income percentage and training, They will be denoted as independent variables, and the supply level of suppliers’ quality and safety traceability system is denoted as dependent variable. Before doing a multivariable linear regression analysis, the paper does a correlation analysis, by getting rid of the element “sale years” with low significance, related trainings (R_T), income percentage (I_P), culture degree (C_D), business scale (B_S), age (A), factor 1 and factor 2 will be imported into the regression equation. The result is shown in table 2.

Table 2 The regression result of the supply level of wholesalers’ quality and safety traceability system

	coefficient	S.E	T statistic value
	(B)		
constant	1.1070	0.4930	2.0640**
R_T	0.2640	0.1040	2.5370**
I_P	0.0070	0.0030	2.5520**
C_D	0.2790	0.1200	2.3320**
B_S	0.1770	0.0810	2.1730**
A	-0.0160	0.0080	-2.0420**
Factor 1	0.3130	0.0740	4.2060***
(Subjective norm)			
Factor 2	0.3220	0.0800	4.0090***
(Behavior attitude)			
Adjusted R ²	0.9070		
F Value	104.5550*		

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(Note:**, * represent that testing has been passed under 1%, 5% and 10% level)

It can be seen that the regression equation's goodness of fit is very good, which is of good explanatory power. The regression shows:

1. The factor 1 (Subjective norm) has the most positive influence to supply level, the possible reasons are that the traceability systems in the field of vegetables' processing and circulation are not compulsory, the supplies of the traceability systems mainly rely on bodies' perceiving and attitudes.
2. The factor 2 (Behavior attitude) has a positive influence to supply level, but the influence degree is the second, lower than the factor 1 (Subjective norm) ..
3. The objective variables related to perceived control behavior have the different influences to supply level. The concrete influences are as follow: (1)The culture degree has a positive influence to supply level, the main reason is that the culture degree is more high, the food safety management consciousness is more strong, the supply level is more high. (2)If the wholesalers get more training, then they will be more understandable to the traceability system, the supply level will be higher. (3)The business scales are bigger, the supply levels are higher, the main reason is that the construction of traceability system is of economies of scale, the wholesalers with larger business scale will have lower cost in the construction, which have been proved by the past researches, another reason is that the suppliers with larger scale will be confronted with higher quality and safety risks, so the supply of high-level traceability system will reduce the business risk. (4)The income percentage is higher, suppliers are more possible to reduce risks by traceability system and get continual benefits. (5)The age has a negative influence to the supply level, that is to say, the age are bigger, the supply level is lower, the possible reasons are that most of the wholesalers were engaging in individual and familial business, with the increasing of age, wholesalers from intelligence and strength could not satisfy the requirements implemented in the process, which will cause the reducing of the supply level.
- 4.The constant in the regression result is positive and more than zero, which shows that the suppliers will have some traceability functional activities in the products' purchasing and selling even if there did not have the traceability system.

IV. Conclusion and Suggestions for Governments

Firstly, Chinese vegetable wholesalers business scales are relatively small, the wholesalers had gotten the education degree are relatively low and their business years are short,

products are mainly from self-production and higher-grade wholesale markets, the authentication degrees of products are low and whose selling objects are very complex.

Secondly, the wholesalers in vegetables wholesale markets have a very strong perceiving for the governments' and markets' and consumers' requirements, but they are insufficient to the perceiving for the traceability system, the related trainings are relatively scarce, so the supply level of wholesalers' quality and safety traceability system is low.

Thirdly, The subjective elements related to subjective norm and behavior attitude have positive influences to the supply level of the wholesalers' quality and safety traceability system, the objective elements related to perceived behavioral control have positive and negative influences to the supply level. For the influence strength, the behavioral attitude is the highest, the objective elements related to perceived behavioral control are the lowest.

Fourthly, in the all objective elements related to perceived behavioral control, the culture degree has the most positive influence, the descending sequences of influence degree are related training, business scale and income percentage. Age has a negative influence to the supply level, the age is bigger, the supply level is lower.

According to the above conclusions, the suggestions to improve the supply level of quality and safety traceability system for the wholesalers in Chinese vegetables wholesale markets are as follow:

Firstly, governments should increase some training on the food safety management for vegetables wholesalers, to improve the cognition and expectation for the traceability system. By establishing the test organizations in markets, releasing quality and safety information and reducing information asymmetry to realize products' good quality and good prices, wholesalers can produce positive attitude and perceiving for quality and safety traceability system and promote the increasing of supply level.

Secondly, the governments and wholesale markets should establish typical quality and safety traceability systems, and spread products in consumers and construct good credits, and get better benefits, to drive the supply level's improvement on other wholesalers' quality and safety traceability system in wholesale markets.

Thirdly, based on the economies of scale, the governments and markets should positively encourage wholesalers to cooperate, so as to improve organizational nature, and enlarge the scales. At the same time, in the construction of traceability system, the governments and markets should provide some supports on capital and technology for suppliers. The governments and markets should encourage young, well educated and large-scale vegetables suppliers to develop as agricultural top integrated production-supply-marketing enterprises, who import modern enterprise management system to improve the supply quality and level of quality and safety traceability system.

Fourthly, The governments should strengthen the

propagandas and educations for products' quality and safety oriented to terminal consumers, and make them improve the consciousness of consuming safety food, and increase the revealing of agricultural products' quality and safety, so as to let consumers bring the demands and paying intentions for products' quality and safety traceability systems, and by the markets' ways to promote the supply level's improvement of quality and safety traceability system oriented to vegetables wholesalers.

Fifthly, The governments should increase the standardization construction of agricultural products and the development of agricultural information technology, and promote the food labeling system and market access system, which can lay a foundation for the construction of quality and safety traceability system. Many governmental departments should strength the cooperation in the supervisions in the agricultural products' quality and safety.

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