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Assessment on the Willingness to Use Food Cold Chain Logistics under the Applied Transformation

Taking Changle District Residents as an Example

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***Abstract*—Based on the Unified Theory of Acceptance and Use of Technology, UTAUT, this study is to discuss the public's acceptance and use willingness of food cold chain logistics, and to supervise the influence factors and level to food cold chain logistics use willingness, and also to supervise its actual use situation. The study finds that the influences factors of cold chain logistic use willingness, from large to small, are social influence, performance expectations, mental and physic efforts expectations, which means that under the public important participant support on the food cold chain logistics, the use willingness of the food cold chain logistics is relatively higher; on the contrary, it is relatively lower. Then, if the public can clearly understand the importance, convenience, benefits of the cold chain logistics, and when the public use the cold chain logistics, the user interface can be more friendly, the network speed can be fast enough, and the usage can be more smoothly and pleasantly, the use willingness of cold chain logistics also will become higher.**

Keywords—food cold chain logistics, UTAUT, use willingness

I. INTRODUCTION

Reviewing our country cold storage volume, during 2008-2014 year, its compound growth rate is 35%. In 2015 year, the cold chain market scale increased to 158.30 billion Yuan. We expect that the cold chain will increase to 347.9 billion market scales by 2020 year, and then the compound growth rate will reach to 17.1%. Presently among the cold chain, our food and agricultural products hold the major proportion, then the chemicals in minored proportion. And our cold chain level is still in the primary phase with a higher rot and damage ratio. Our level is still very low and without the complete system, so as to causing the higher rot and damage. The refrigerated transportation rate for our fruit and vegetables, meat products, aquatic products are about 30%, 50% and 65%, and their rot and damage rate are about 15%, 8% and 10%. So our rot and damage rate are still very higher than the developed countries, which is the 5% rot and damage rate.

So it is valuable to study and discuss on the higher attrition rate and the excessive transportation cost of the agricultural cold chain logistic products development during the transportation process. Besides, it is also valuable to discuss on the people's opinion about the cold chain logistics. Traditionally, due to the food spoilage and rot are widely happened by the unqualified condition of the cold chain logistics, so the public take it for granted that the food freshness and nutrition undoubtedly are changed and weakened by refrigeration and frost process. So presently people are reluctant to accept the gradually completing and regulating food cold chain industry. This really needs us to discuss and study and it is also the study motivation of this thesis.

Therein, the purpose of this study, which based on (Unified Theory of Acceptance and Use of Technology, UTAUT) , is to discuss the public acceptance and use situation of the cold chain logistics, meanwhile to analysis the influence factors of the public acceptance to cold logistic food, then to conclude and to make the practical suggestions.

II. LITERATURE REVIEW

A. The Study on Food Cold Chain Logistics by China and Other Countries

Hu Tianshi[3] In 2010, summarize three main features of cold chain logistics: complexity, coordination, high cost nature. The complexity is based on the 3T principles for cold chain logistics as: storage temperature, transportation time, and the product its storage tolerance. Because of the food perishability, the coordination is necessary for each step during the whole cold chain logistics. So it is well ensured for the whole cold chain logistics running stability. While the high cost nature is due to the complete low temperature equipment and advanced technologies have to be used for keeping food is under the low temperature all the time in each unit of the cold chain logistics.

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S.J.James C. JamesJ. A.Evans（2006）propose that the purpose of the whole cold chain logistics system is not the refrigeration. Their purpose is to ensure the food quality and safety and ensure the continuous low temperature for food. E. Abad（2009）using the RFID wireless radio frequency identification to supervise the food during the whole cold chain process, to ensure the timely and accurate food situation inspection during the whole cold chain logistics. Wang Yuxia(2011) points out presently our country fresh agricultural products cold chain logistics circulation rate is lower in "The problem existing in our country agricultural products cold chain logistics and the solutions". In Europe, Japan, Canada and other developed country, the meat and poultry cold chain logistics are reaching to 100% circulation ratio, the vegetable and fruits category are also increasing above 95% circulation ration, however in our country, most of the fresh agricultural products are still transported under the normal house temperature. The cold chain circulation rate is overall lower. Zhang Xiaoshuan, Xing Shaohua, Fu Zetian, Tiandong(2011) when they study on the aquatic products cold chain logistics present situation and the developing trend, they point out the present aquatic products cold chain logistic already use the barcode scanning technology to ensure the information tracking during the whole transportation, but it lack of the timeliness, cannot effectively supervise the food temperature during the cold chain transportation. Lan Hongjie, Kang Biao(2010), in their "analysis on the main factors of the food cold chain logistics", point out the demands for food refrigeration and frost are increasing gradually, along with the tight modern life tempo and people's awareness on food safety. It improves the development of the food cold chain logistics. They propose the related enterprise should always focus on the consumer dietary habits and consumption orientation, and seize the opportunity to launch their own unique operating strategy. Yu Penglin(2015) , in his analysis of the Fujian province agricultural products cold chain logistics development, he points out that there exists the low level of logistic informatization in the present Fujian province agricultural cold chain logistics, the "chain broken" phenomena in cold chain process, cold chain logistics related enterprise development lag and other problems. As for these problems, the solution was to raised that to let the local government to promote the agricultural products cold chain logistics, asking the local government to select some cold chain logistics enterprises, which are rich, competitive, advanced in equipment and administration, to educate and carry out the advanced cold chain information technology and the complete cold chain logistics system.

B. Intention and the Influence Factors to Intention

Behavior intention is the subjective probability judgment towards some particular behavior by individual person; it is reflecting the people adopted intention on some particular behavior. This theory says that conduction intention is the direct decisive factor for people who would like to adopt some particular behavior or not, and considers that all possible factors that affect behavior are indirectly affecting the performance of behavior through the behavioral intention. Many studies have shown that under a given condition, the behavior intention is the best way to predict individual behavior, and a high correlation between behavioral intention and behavior (Ajzen, 1991). The intention of this thesis is the public's intention for using the cold chain logistic food.

Under UTAUT model, each dimension and the interference variables explanation are as bellow:

Performance Expectation: Personal cognitive on the food cold chain logistics use is helpful to their health, meanwhile this also can increase the individual food condition, freshness, safety and other conveniences. Using the cold chain logistics to meet the living satisfaction requirements and improve their personal healthy intention. And the performance expectation is also influenced by the interacting of sex and age for behavior intention. (Venkatesh &Morris, 2000).

Mental and physical efforts consumption expectation: The facility and convenience degree of using the food cold chain logistics is influenced by sex, age and experiences from the behavior intention. Venkatesh & Morris(2000), also point out that the woman have higher mental and physical consumption expectation than man.

Social Influence: Users perceive that the important person consideration of their usage of food cold chain logistics are influenced by sex, age, experience, and voluntary other interference variables. Venkatesh and Davis（2000）, point out the social influence is the decisive factor. He Weijia(2004), considers the most important and trustful way for cold chain logistics is the word of mouth. As for the aspects of sex, the female is inclined to listening to other people opinion, and the social influence effects will be decreased by the increasing of experience. (Venkatesh & Morris, 2000).

Environments Benefits: Users perceive that the related resource or technology supports degree is influences by age experience and other interference variables in the actual use of the environment benefits.

III. THE RESEARCH METHOD

A. The Researching Method and Framework

This study is in use the questionnaire survey method. The questionnaire includes four parts: demographic variables, acceptance (use the performance expectation, mental and physical efforts expectation, environment benefits and the social influence these four dimensions to measure), use willingness and the actual application. This study use the question answer method on internet, to select the Changle city residence as the main research objects, using SPSS For Windows 22.0 software to do the data analysis. Method is using the dimension and influence factors design scale as the tool for research in (Unified Theory of Acceptance and Use of Technology, UTAUT) and to conduct the residents questionnaire of Changle city. The research framework is as bellow figure.

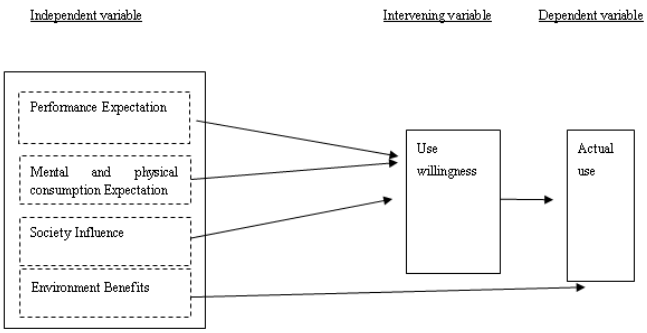

Fig. 1. Researching framework of the food cold chain logistics adoption

B. The Hypothesis

On the basis of the above research model, the hypothesis of this study is as bellow:

Hypothesis 1: the performance expectation, which is used by the republic, has a significant impact on the use willingness.

Hypothesis 2: the mental and force efforts consumption expectation, which is used by the republic, has a significant impact on the use willingness.

Hypothesis 3: the society influence, which is used by the republic, has a significant impact on the use willingness.

Hypothesis 4: The environment benefit, which is used by the republic, has a significant impact on the actual use.

IV. RESEARCH RESULTS

The research results are divided into descriptive statistics, related analysis, multiple regressions and logic regressions for the hypotheses verification.

A. Descriptive Statistics

500 copies questionnaire are delivered out on internet, 409 copies are recycled, and 391 copies are effective. The effective recovery rate is 97.1%. According to questionnaire recycling results and SPSS 22.0 version analysis researching sample, the population variable distribution: 138 boys, their sampling proportion are 34.76%; 259 girls, their sampling proportion are 65.24%; 212 person have college education background, the sampling proportion is 53.4%, next 133 person have high school education background, sampling proportion is as 33.5%, employee of enterprise in total 189 person, sampling proportion is 47.61%, then the stuff of manufacturing industry in total are 98 person, their proportion is 24.69%, the minority are partial from agricultural, fishery, animal husbandry industry and other vocations. There are 209 person monthly average salary mainly between 3000yuan and 5000yuan , sampling proportion is as 52.64%, then the salary bellow 3000yuan, totally have 131 person, their sampling proportion are 33%, next the people whose salary are from 5000yuan to 8000yuan section, and few interviewed people have salary above 8000yuan for each month.

The reliability of each dimension is between 0.8 and 0.9 (above 0.7), indicating that these five dimensions are reliable.

The general acceptance dimension of Fuzhou Changle residents for cold chain logistics (M=3.92, SD=1.08) is closing to the median. Among the acceptance intention influence factors, the largest is environment benefits as(M=3.97, SD=.96), next is the society influence dimension as (M=3.72, SD=.86), the performance expectation dimension (M=3.65, SD=.85), the last is the mental and physical efforts expectation dimension (M=3.64, SD=.79).

B. Related Analysis

Pearson Correlation Analysis, he found that these four dimensions are related to the use willingness. The relation degree, from large to small, are mental and physical efforts consumption expectation(r=.852), social influence (r=.823), environment benefits(r=.809), performance expectation(r=.669) the relative factors**. When the outstanding level reaches to 0.01(double ends), it is relatively remarkable.

C. Multiple Regression Analysis

The multiple regression analyze the [use willingness] dimensions influence degree of performance expectation, mental and physical consumption expectation and society influence, the results is as bellow table.

TABLE I. MULTIPLE REGRESSION ANALYSIS

Independent Variable	R	R2	Adjust R2	R2 variation	F Value	original regression factors	standardized regression factors	P
Constant						397		.000
Society influence	.79	.62	.62	.62	654.47	.88	.70	.00
Mental and physical efforts consumption expectation	.79	.63	.63	.01	332.76	.15	.11	.03

Dependent Variable: Use willingness

Above chart β value show us that both the social influence (β=0.88, p=.00), mental and physical efforts consumption expectation (β=.15, P=0.03) have positive influence on the use willingness. The β value of social influence is the biggest that means the [society influence] has the biggest influential power on the use willingness of navigation system. The social influence and the mental and physical efforts consumption expectation R2 of [use willingness] is 0.62, that is to say,

these two dimensions can explain the cold chain logistics food use willingness 62.0% variation amount. However, the performance expectation is not selected into the regression model, that is to say, the performance expectation has no significant influence on the use willingness, so hypothesis verify results: hypothesis 1 is not set up, while the hypothesis 2 and hypothesis 3 are set up.

D. Logic Regression Analysis

Logic regress analysis results tell us the Wald index of environment benefits and use willingness are 65.266 and 96.208，their significance are reaching to the standards, so the environments benefits and use willingness can be regarded as the effective prediction on the Changle residents' actual usage of cold chain logistics, H4 hypothesis verification is set up, refer to bellow table.

TABLE II. ENVIRONMENT BENEFITS, USE WILLINGNESS INFLUENCE ON THE FOOD COLD CHAIN LOGISTICS

Variable Name	β	S.E.	Wald	Variance（df）	significance	Exp(B)
Environment benefits	-1.297	.161	65.266	1	.000	.273
Acceptance Intention	-1.980	.202	96.208	1	.000	.138

Dependent variable：actual use

Independent variable: environment benefits, use willingness

V. RESEARCH DISCOVERY AND SUGGESTIONS

The discussion for research purpose and problem is as bellow:

A. The Acceptance and Actual Use Situation for Cold Chain Logistics

Among the 397 copies questionnaires, we find that presently the Fuzhou Changle residents acceptance average value on cold chain logistics is 3.65; there have 52.14% interviewed people can accept the cold chain logistics food. But the actual user for cold chain logistic food is only 154 people in this area, 38.79% proportion, so we can notice that the cold chain logistics food actual users are less than its acceptance proportion. This result indicates that some of the potential customer who can accept but still never use the cold chain logistics food, that means the cold chain logistics enterprises still have promotion space.

B. The Population Variables Influence on the Cold Chain Logistics Food

Firstly from the sex respects, the female acceptance intention is higher than the male, because most of the female are connected with the diets in home. So the female are more sensible than male for the food safety, freshness and varieties. Secondly, the most of young people acceptance are higher, whose age is from 20 to 39 and education background above college, because this group age from 20 to 39 years old are young people, they have higher education background, strong judgment ability, good learning ability and strong acceptance ability, so they can more easily to understand the food cold chain logistics. However, the people, whose age are above 40years old, have lower education background as middle school or even bellow middle school, they have lower acceptance of the food cold chain logistics. This group people whose ages are above 40years old, they consider the food after refrigeration will lose it's the original nutrition. The people whose education background bellow middle school, they have less acknowledge on the food cold chain logistics, so they cannot have a correct judgment and opinion on the food cold chain logistics. Thirdly , the group whose vacation is enterprise employees and office stuff , have the higher acceptance of food cold chain logistics, while the people whose vacation is in agricultural, fishery, poultry industries, have lower acceptance for food cold chain logistics. Because of the enterprise employee and office stuff don't need to buy food in the vegetable market, so they are inclined to use the food cold chain distribution and the refrigeration area food in super markets, so they have the higher acceptance rate. However, the people who work in the agricultural, fishery, poultry industries, can directly contact with the food, they have enough time and consumption habits to go to the vegetable market. So their acceptance of cold chain logistics is lower. The people whose monthly average salary is between 3000 and 5000yuan, can easily accept the food cold chain logistics, just because this group people are the enterprise employee and office stuff, they have higher acceptance rate for the food cold chain logistics due to the working time. In conclusions, the above results can support the Venkatesh and Davis（2000）research. They realize the use willingness is influenced by the sex, age, experience, voluntary and other related interference variables.

C. The Actual Use Influence Factors of Food Cold Chain Logistics Use Willingness

Through multiple regression analysis that we know the mental and physical efforts consumption expectation and the society influence beta coefficient are positive. That means these two variables use willingness are positive for food cold chain logistics, namely, social influence, mental and physical consumption expectation will affects the food cold chain logistics use willingness, the social influence of food cold chain logistics acceptance highest (beta =. 88), the influence of explain variance is also the biggest (R2 = 62); Means that the society influence can explain 62.0% variance of food cold chain logistics acceptance. Users perceive that if the important people consider that they should use the food cold chain logistics, then the use willingness is higher. That means they are more willing to accept food cold chain logistics. This result can support Venkatesh and Davis (2000) study. They point out that the social influence is the decisive factor of willingness. At the same time also confirm He Weijia (2004) remarks, Mr He thinks the word of mouth is the most important and trustful information resource for food cold chain logistics. Through the logic regression analysis, we know the environment benefits and the use willingness of the Wald index are 65.266 and 65.266, which are reaching to the significant standards, the environment benefits and use willingness can effectively predict the Changle residents practical use in food cold chain logistics. That is to say among the people who have strong

desire of food cold chain logistic, the actual user are increased more. And the environment benefits are more perfect. That means if the country food cold chain logistics policy can be perfect, food cold chain logistics related equipment will be advanced and the food freshness will be guaranteed. If the logistics personnel quality is higher, the guarantee of no pollution on food is higher. Then people are more willing to use the food cold chain logistics. So the hypothesis 2, 3, 4 are set up in results.

VI. CONCLUSION

In conclusion, the author raises some suggestions for governmental office, enterprise and the academic study people reference. Explanations are as bellow:

A. The Governmental Office Should Completely Regulate the Policy and Standards for Cold Chain Logistics

To establish the related consulting platform for the republic browsing, and to widely broadcast and promote the cold chain logistics food policy, building up the public's confidence on government for food cold chain logistics. Secondly, to give support to the food cold chain logistics enterprise by plans and improve their general level by the aspects as fund, equipment, procedure and the personnel cultivation, and to supply the public the fast, safe and fresh cold chain logistics food. In this way, the cold chain logistic food can be widely accepted by the public. The education organization also can broadcast the food cold chain logistics knowledge among the middle school and primary school, letting students build up their correct acknowledge and study on the food cold chain logistics.

B. The Food Cold Chain Logistics Enterprises and Practitioner Should Update and Complete the Freezing and Refrigeration Equipment:

To guarantee the food freshness, safety and nutrition during the storage and transportation, to let the public are well-ensured to use the cold chain logistics food. Secondly to strengthen the logistics information system and make the whole logistics course transparent and traceable. Then the public can be well-ensured that they can freely know the food logistics dynamic conditions. So the food cold chains logistic use frequency will be improved. To pay more attentions to improve the cold chain logistics service quality, the familiar and good service attitude and quality can make the public are comfortable, well-ensured and more willing to use the food cold chain logistics.

REFERENCES

[1] GB/T 18354-2006. Logistics Terms. Beijing: National Bureau of Technical Supervision. 2006

[2] Wan Yanfang, Li Xuegong. Standardization and Reference of Developed Countries Cold Chain Logistics Experience [J].AO Agricultural Outlook，2014（4）：77

[3] Wang Yuxia, The Problem and Solution of Our Agricultural Products Cold Chain Logistics [J]. Logistics Engineering and Management, 2011（3）:81-82.

[4] Lan Hongjie, Kang Biao.The Analysis for Food Cold Chain Logistics Main Factors [J].Logistics Technology，2010（21）:17-18

[5] Shi Jiangxin, Sun Ruoying. The ANP Based Fresh Food E-commerce Cold Chain Logistics Performance Assessment [J]. Journal of Beijing University Information science and Technology，2015（30）:48-52

[6] Ju Xiaomin. The Study of Fresh Products Cold Chain Logistics Potential Development and Problems [J]. Sci-Tech Information Development & Economy，2010（22）：138

[7] Yu Penglin. Analysis of Fujian Agricultural Produts Cold Chain Logistics Development and Solutions[J]. Logistics Engineering and Management，2015（37）：195-196

[8] Zhang Xiaoshuan, Xing Shaohua, Fu Zetian, Tiandong, The Study of Aquatic Products Cold Chain Logistics Technology Situation and Developing Trends and Solutions. [J]. Fishery Modernization，2011（38）：47-48

[9] Zhang Yingxin. The Food Cold Chain Logistics Research [J]. Logistics Technology，2004,23（12）：32-34

[10] Hu Qiuling, Sun Quan,2011, About the Integration of Technology Acceptance Model for Consumers to Use Mobile Payment Use Intention , Statistics and Decision.2008/06

[11] Ajzen, I. & Fishbein, M., (1980). Understanding Attitudes and Predicting Social Behavior. Prentice-Hall, Englewood Cliffs, NJ.

[12] Davis, F. D.（1989）. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. MIS Quarterly13 (3), pp. 319-339.

[13] Davis, F. D., Bagozzi, R. P., and Warshaw, P. R.（1989）.User Acceptance of Computer Technology： A Comparison of Two Theoretical Models. Management Science, 35(8), pp. 982-1002.

[14] S.J.James， C.JamesJ. A.Evans.Modeling of food transportation systems a review. International Journal of Refrigeration.2006（29）：947-957.

[15] Venkatesh, V., and Davis, F. D.（2000）. A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. Management Science, 45（2）, pp. 186-204.

[16] Venkatesh, V., M.G., Morris, G. B. Davis and F. D. Davis.（2003）. User Acceptance of Information Technology: Toward A Unified View. MIS Quarterly, 27, 4 pp.425-478.