Research Article
On the Working Mechanism of Cold Chain Logistics in Food Industry based on O2P Theory

[1]Yanni Li, [2]Jiayin Li, [3]Wenxuan Zhao and [3]Fuguang Zhao
[1]School of Foreign Languages, Changchun Institute of Technology,
[2]School of Communication, Jilin Animation Institute, Jilin 130012,
[3]School of Life Science, Jilin Agricultural University, Jilin 130118, China

Abstract: In recent years food safety has been concerned by people, especially the whole process of cold chain logistics. This study tries to illustrate online order and offline experience as the guide for food consumption and put forward cold chain logistic pattern under O2P theory. The supervision from the very beginning of the order to the experience at the community stores will help to set up a transparent mechanism of cold chain logistics, which will stimulate the consumption of food industry.

Keywords: O2P, Cold chain logistics, database, EPC, food industry

INTRODUCTION

The rapid economic development and rising level of household consumption in China enhances people's needs for agricultural products, especially meat and vegetables. Under the influence of healthy economy, people are more aware of their food especially for its intrinsic quality and safety, so how to keep the freshness of their food, especially meat, has motivated the research on cold chain logistics.

On June 20, 2014, the panel of the specification of food cold chain logistics services (industry standard) was held in Beijing. This standard specifies the main evaluation index of food cold chain logistics services on the basic condition, service quality, temperature control, packaging, storage, loading and unloading, handling, transportation, delivery and transfer, which is suitable for management in the process of circulation of food material. According to the research, the integrated cold chain flow rate of China is only 19%, while the cold chain circulation rate of United States, Japan and other developed countries is above 85%. With the boost of consumption upgrade and the propulsion of urbanization, as an area where exists high barriers and huge market share, the cold-chain logistics has become the "dessert" of E- business enterprises and the logistics.

Around the world, there are some researchers focusing on this field. Salin and Nayga (2003) had the research on export food and they put forward the method to set up cold chain network according to the cases from APTA. Van der Vorst et al. (2005) tried to distinguish the supply chain and processing chain of fresh agricultural products. James and Evans (2006) gave the index reference for cold chain transportation and he mentioned temperature and quality should be put in the first place in cold chain logistics, but not refrigeration. Marvin et al. (2009) studied the risk evaluation of food safety and introduced HACCP into food cold chain. Rediers et al. (2009) had a research on the management of cold chain about fresh-cut endive. Kuo and Chen (2010) co-built a model of joint distribution with multi-temperature control. But they only focused on the process and theory of cold chain and weren't familiar with the E-business requirement and the current development of cold chain market in China.

Based on E-business theory ---O2P (online to partner), this study tries to emphasize the importance of technical researches on cold chain logistics in China now, because it is really a new concern to many enterprises. For public health's sake, it also puts forward some suggestions to enhance the supervision process of agricultural food industry and its online transactions pattern under the internet of things.

MATERIALS AND METHODS

While as it is pointed out that pollution of raw materials and willful frauds are the key words in food security issues (Caswell et al., 1998). So how to supervise the feeding, processing, storage, transportation, sales, to the consumption of meat in the whole link has become a technical issue, because it involves farmers, E-business enterprises and inspection departments to take their responsibilities to set up a sound chain, which can guarantee the circulation of meat products. Under such a high-tech world, internet
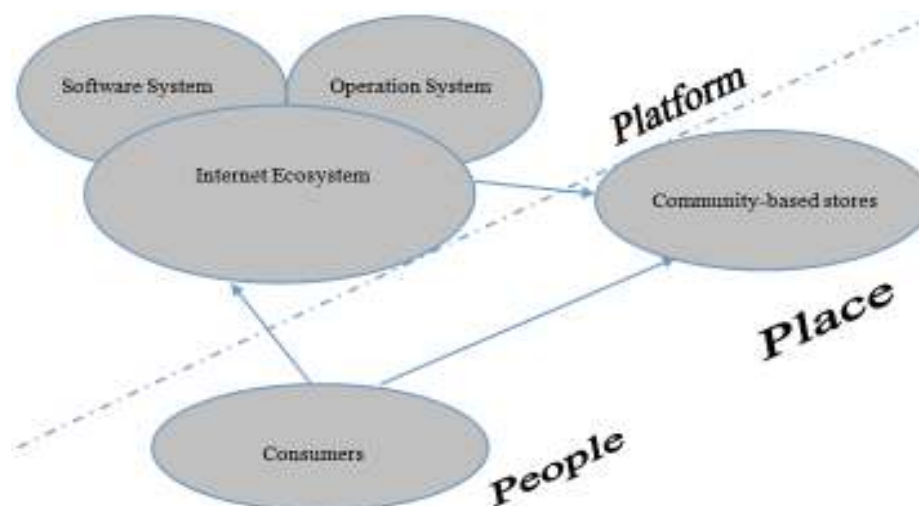
Fig. 1: Relationship among 3Ps under the internet of things

of things has been put into uses in human's life. The network, just like in the chain of meat industry has been highly valued for its accuracy and wide coverage (Motarjemi and Adams, 2006), especially when it is integrated with O2P business model under big data age.

The technical research on O2P business pattern: In 2013, O2P business model is performed by Daoees Company, an electric vehicle dealer in China. O2P model is essentially derived from O2O (online to offline). The key to O2P is that it finds consumers online and brings them into real-world stores, in where they can experience the products being sold. It is a combination of payment model and foot traffic generator for merchants that create offline purchases. It is inherently measurable, since every transaction happens online. Although O2P model is a new kind of E-commerce model in recent years, the paper highly assures that it will be widely used in the whole link of meat industry because of the connotation of 3Ps in this model. They are platform, place and people.

O2Platform actually is a general name for internet software platform, operation system platform and internet ecosystem platform. What all of these sites have in common is their use of the Internet to appeal to consumers via an online connection and the leverage of that connection to persuade the consumer to purchase online, while experience in person offline; O2Place stands for the localization of channel partners. Community-based retail stores can cut the budget of rent and other costs, besides they are the best connection between online orders and offline experience performed by consumers; O2People is where the product or service finally goes to and they are also the spotlights in the whole chain. Their relationship can be sketched in Fig. 1.

The research on food cold chain logistics: On June 20, 2014, the panel of The Specification of Food Cold Chain Logistics Services (industry standard) was held in Beijing. This standard specifies the main evaluation index of food cold chain logistics services on the basic condition, service quality, temperature control, packaging, storage, loading and unloading, handling, transportation, delivery and transfer, which is suitable for the third party cold chain logistics services and management in the process of circulation of food material (Carol, 2007). The integrated cold chain flow rate of China is only 19%, while the cold chain circulation rate of United States, Japan and other developed countries is above 85%. With the boost of consumption upgrade and the propulsion of urbanization, as an area where exists high barriers and huge market space, the cold-chain logistics has become the "sweet pastry" of electric business enterprises and the logistics. The cold chain services mainly concentrated on the food cold chain service and consumption of agricultural products. Standard marked the landing of cold-chain logistics macro policies and the expanding and upgrading the cold chain service eventually fall to warehousing, transportation and other logistics links. The standards' coming on stage is conducive to standardize the cold-chain logistics environment, stimulate the market demand and avail for the development of large and medium-sized cold-chain logistics enterprise (Qinggang, 2011).

Chinese E-business enterprises have been actively taking part in the cold chain logistics competition. Currently the enterprises that rival cold chain are mainly the E-commerce companies. The rookie cold-chain service has covered 210 cities all over the country; Jingdong is intended to sink the whole logistics system into the township level through owning logistics network and developing the cold chain logistics; SF-best takes the cold chain logistics as a breakthrough point, by transferring the "offline logistics" to "online transactions" and now fruit, meat,

aquatic products and other fresh products account for 50% of the sales in SF-best.

The time for developing E-cold-chain-logistics has come. The cold chain logistics can not only satisfy people's demands for fresh food, can also minimize losses and waste in transportation. But the problems of low public awareness, poor original equipment, etc. have seriously restricted its development and it is mainly because of lacking of a complete independent system of cold chain logistics; inadequate cold chain facilities, constructions and low level of technology; low level of marketization of cold chain; lack of 3rd party companies' involvement; inconsistent supporting facilities and unreasonable layout.

RESULTS AND DISCUSSION

The refrigerated logistics in China is still at an early stage, which is featured with the small market scale, strong regional features and lack of influential, nationwide 3rd party logistics leaders.

In terms of technology, cold chain logistics generally follow the principle of 3T, which the ultimate quality of product depends on the storage in the chain, time of circulation, temperature and the tolerance of the product. Because of the particularity of the goods, cold chain logistics system demands highly for the collection and delivery of information, time-control and temperature-control. Then how to integrate all of the links and efficiently monitor the time and temperature of the whole process of logistics? This is where technologies and equipment should work in the construction of logistics system.

Nowadays, the introduction of GPS to the construction of cold chain logistics brought us a marvelous tool to supervise the 3T. Having been utilized for decades, this technology is pretty popular. The strongest feature of GPS may be its compatibility,

which has multiple external interfaces to connect with the barcode scanners, POS, PDA and many other machines to improve the work efficiency and to collect the statistics data of vehicle to enhance its management. During the period, inspection supervision departments can also make sure the standard operation of the enterprise as well as the quality of the products through regular or random checking (Frewer *et al.*, 2002).

To guarantee the operational standardization of this logistics transport, recording and tracking the temperature, controlling the temperature equipment and inspecting the product acceptance, the RFID technology was applied to the cold chain logistics, which is a non-contact automatic identification technology. Through radio waves, it can automatically identify the target and access to the relevant data without any manual intervention. And it can work in various harsh environments. The most important thing is that it can work beyond your sight and identification distance is farther than optical systems. Its radio frequency identification card can read and write, which is capable of carrying a large amount of data, which is very convenient for information collection in the era of big data.

The technical architecture and workflow of EPC Internet of Things in this study adopt 3 tier architectures (Wu, 2011): perception layer, network layer and application layer. Perception layer collects the original information and data of markers by QR code, RFID systems and various sensors. Network layer transmits and manages information taking use of sensing network and internet. Application layer processes massive data by mining and analysis and intelligent computing, intelligently controls things and provides support for decision making and other application services with the help of various supporting platforms, cloud computing and pattern recognition. Among Internet of Things consisted in EPC label,
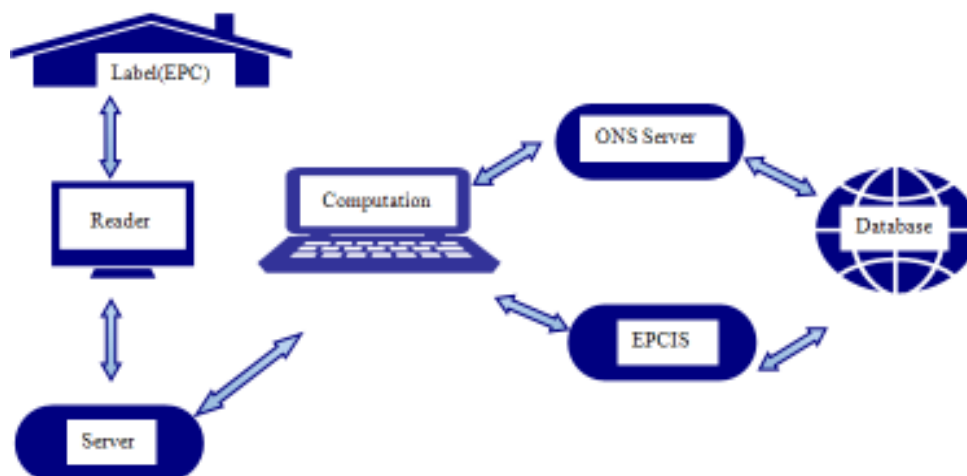

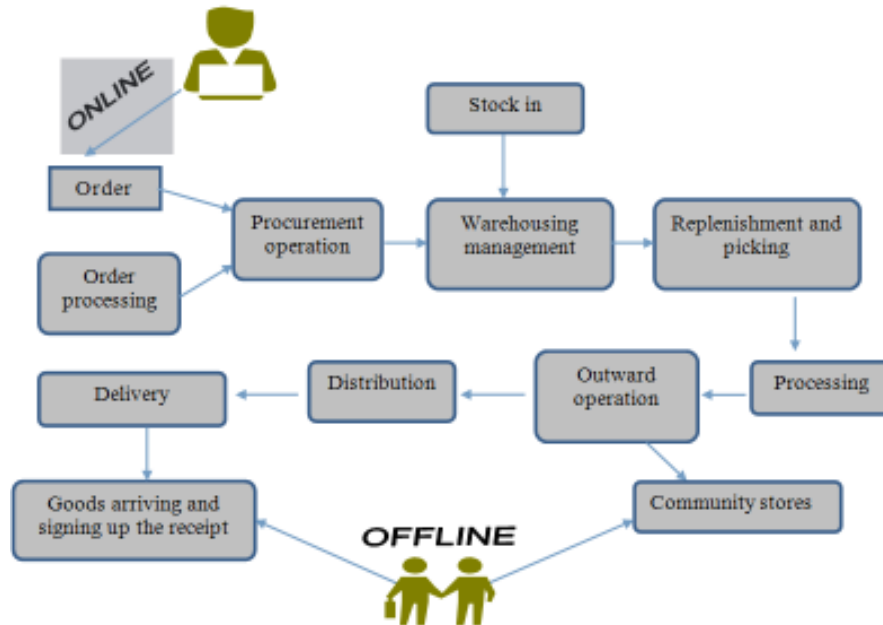Fig. 2: Working flow of EPC and RFID in cloud computation

Fig. 3: Flowchart of cold chain logistics based on O2P theory

reader-writer, Savant server, ONS server, Internet, EPCIS and many database, radio frequency technology automatic inducts and recognizes the EPC label attached to the goods, then the reader reads EPC just as a piece of information reference and according to it, find out the IP address from the internet and obtain information of related items stored in it and specific realization is taking advantages of Savant software system and EPCIS. Savant system processes and manages a string of EPC information which is read by reader and if the computer wants to gain other information matching uniquely identified EPC; it will need ONS to provide automated network database service. Savant delivers EPC to ONS and then ONS indicates Savant to a PML server in which is saved a product document to search and this document can be copied by Savant, therefore, the product information in the document can be delivered to the product supply chain. The specific flow of work is as shown in Fig. 2.

The users need to input an EPC code, find the IP of EPCIS in EPC code through ONS Internet checking and make collection with every node of PML server to gain circulation information of the product and combine with the geography information that is intuitively reflected in GPS. So according to O2P theory, as shown in Fig. 3, consumers can contact the enterprises or company by their online platform and then track the product from the very beginning to logistic transportation, at last they can receive the product they ordered. At the same time, based on the trust from the chain, they would like to experience or taste their product in the community stores, especially when there are some new products launched on the market. It saves the time of buyers and cut the cost for the sellers, generally speaking, it will be a win-win policy for both sides.

CONCLUSION

From the analysis above it is rather clear that with the help of EPC under the big data age, achievements on improving cold supply chain of logistics can be realized in the near future. Logistic enterprises should plan ahead of the requirement from the market, then they can grasp the golden chances under the new normal economic environment. But there is still a long way to go, because the security of food supply needs the joint effort of every concerned member in the food chain, they are the authorities, enterprises, customers and the high-tech services from some R and D organizations.

ACKNOWLEDGMENT

REFERENCES

Carol, C., 2007. Safety starts with temperature control. Int. J. Control, 12: 178-182.

Caswell, J.A., M.E. Brudahl and N.H. Hooker, 1998. How quality management metasystems are affecting the food industry [J]. Rev. Agr. Econ., 20: 547-557.

Frewer, L.J., S. Miles and R. Marsh, 2002. The media and genetically modified foods: Evidence in support of social amplification of risk. Risk Anal., 22(4): 701-711.

James, S.J. and J.A. Evans, 2006. Modeling of food transportation systems a review. Int. J. Refrig., 29: 947-957.

Kuo, J.C. and M.C. Chen, 2010. Developing an advanced multi-temperature joint distribution system for the food cold chain. Food Control, 21(4): 559-566.

Marvin, H.J.P., G.A. Kleter, L.J. Frewer, S. Cope, M.T.A. Wentholt and G. Rowe, 2009. A Working procedure for identifying emerging food safety issues at an early stage: Implications for European and international risk management practices. Food Control, 20(4): 345-356.

Motarjemi, Y. and M. Adams, 2006. Emerging Foodborne Pathogens. Wood Head Publishing, Cambridge, pp: 656.

Qinggang, W., 2011. Study on the current situation of Chinese cold chain logistics and its strategies. Chinese Circ. Econ., 25(2): 24-28.

Rediers, H., M. Claes, L. Peeters and K. Willems, 2009. Evaluation of the cold chain of fresh-cut endive from farmer to plate [J]. Postharvest Biol. Tec., 51(2): 257-262.

Salin, V. and R.M Nayga, 2003. A cold chain network for food exports to developing countries. Int. J. Phys. Distribut. Logist. Manage., 33(10): 918-933.

Van der Vorst, J.G.A.J., S. Tromp and D. van der Zee, 2005. A simulation environment for the redesign of food supply chain networks: Modeling quality controlled logistics. Proceeding of the Winter Simulation Conference.

Wu, J., 2011. Application of the internet technique on improving the security of food. Comput. Knowl. Technol., 7: 4207-4208.