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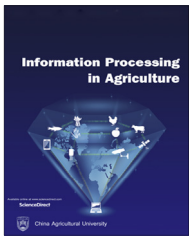
INFORMATION PROCESSING IN AGRICULTURE XXX (2018) XXX–XXX

journal homepage: www.elsevier.com/locate/inpa




# Quality control of the agricultural products supply chain based on "Internet +" ☆

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ARTICLE INFO

*Article history:*
Received 17 January 2018
Received in revised form
17 May 2018
Accepted 19 May 2018
Available online xxxx

*Keywords:*
"Internet +"
Agricultural products supply chain
Quality control
Reputation loss

ABSTRACT

This paper describes a quality-control supply-chain model using the "Internet +" paradigm. The model is based on principal-agent theory, which considers the reputational loss due to inferior products and external responsibility identification. After model analysis and simulation verification, the results show that the optimal quality-control level and market price of agricultural products can be achieved in the agricultural supply chain based on "Internet +" if and only if the information platform's claim to the agricultural producer is less than the agricultural producer's claim to the delivery service provider. Also, a rise in consumers' claims or the agricultural producer's reputational loss due to inferior products will motivate the quality control of an agricultural procedure. Meanwhile, the market price of agricultural products will also increase with enhanced quality control procedures. The quality-control level of a delivery service provider is inversely proportional to the information platform or its own reputational loss. Thus, the key to promoting quality control along the supply chain is to strengthen the responsibility confirmation of an inferior product between the agricultural producer and the delivery service provider.



## 1. Introduction

The quality and safety supervision system of agricultural products along the path from farm to table will be established in the future, as put forward in "The 13th Five-Year Plan" in China. With the continuous development of Internet-related technology and its application in the production, transportation, inventory, sales, and information management of products, "Internet + agricultural products" will become an important model and development trend in agricultural production, sales, and consumption in China [1]. E-commerce companies such as Jingdong Fresh, TooToo, and Fruit Day, have become important circulation channels and consumption modes for agricultural products in the city. However, endless consumer disputes have emerged due to the one-off transfer of ownership and multi-agent circulation during product consumption, as this which may induce a quality problem. Consumers' claims to problem products not only induce the reputation loss of the e-commerce platform and

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☆ This work is partially supported by the Beijing social science fund project (No. 16GLC061) and Beijing new rural construction research project (No. KF2016052).
Peer review under responsibility of China Agricultural University.
https://doi.org/10.1016/j.inpa.2018.05.005

the production loss of agricultural producers, but also affect the development of e-commerce platforms and reduce consumer confidence.

Due to the risks from online payments, distribution and information services, and other aspects [1,2] that differ from the traditional agricultural products supply chain, quality control in an e-commerce supply chain has its own characteristics, such as quality information, controlling unit, or area [3]. It may be necessary to adopt different quality supervision strategies at different stages or links in this process [4]; furthermore, the control methods are different compared to those in traditional product quality control across a supply chain [5].

## 2. Literature review

Quality control is one of the most important aspects of supply chain management [6]. Many scholars have suggested methods to improve the quality-control level of products along the agricultural products supply chain in an e-commerce environment that are based on the advantages of information technology in an electric business environment. These advantages include the ability to build a traceability system for agricultural products quality [7–10], a tracing system for the circulation area [11,12], a quality and safety supervision platform for agricultural products based on quality traceability [9,10], agricultural product quality information monitoring platforms [8,13,14], and an e-commerce quality management system [4,13]. Some scholars have designed quality-control contracts based on the platform for the suppliers' products that encourage suppliers to provide a quality product [8,15]. In fact, domestic and international scholars have not only built a basic framework for supply chain quality management, but also conducted research into the relationship between supply chain quality [16–18], supply chain quality improvement [19], and quality management decisions [4,20]. Many theoretical methods and techniques, such as principal-agent theory [21], game theory [22,23], supply chain optimization [18,24], and optimal control theory [3,19,25], have been introduced into supply chain quality control research to model the game relationship and individual demands of the supply chain participants. Different types of quality contracts that coordinate the behaviors of different participants have been designed based on those theories.

Currently, research into the quality control of a supply chain based on "Internet +" is mainly focused on the construction of a quality-control system from a macroscopic perspective, including quality supervision, product traceability, etc. More specific issues have received less attention. Especially, research into supply chain product quality control has mainly focused on traditional methods. As far as we know, supply chain operation based on "Internet +" has not been considered. In this paper, we study quality control in the context of "Internet +" by considering the mode and characteristics of the "Internet + agricultural products" supply chain.

## 3. The model framework

### 3.1. Model description

We constructed a product quality control model for the agricultural products supply chain that is based on "Internet +".

As shown in Fig. 1, we assume a model that consists of one agricultural producer, one information platform, one delivery service provider, and many consumers. The agricultural producer is the supplier, and the producer entrusts the information platform to release the price, quality, and other related product information to the customers via the Internet. The consumers buy products according to the information that is released by the information platform. The order or demand information will be sent to the agricultural producers by an information platform based on "cloud" computing technology. The agricultural producer entrusts the delivery service provider to deliver the product to the consumer according to the order information.

Any decrease in consumers' confidence will induce a crisis of trust among the consumers, the delivery service provider, the information platform, and agricultural producers, whether the quality problem is caused by production or distribution. Therefore, a loss of reputation will affect the agricultural producer, information service platform, and delivery service provider. Also, the consumers' claims to the agricultural producer will use the information service platform, and the information platform will punish the agricultural producer according to the value of the agricultural product if the consumers request compensation because of inferior products. Of course, the agricultural producer may also punish the delivery service provider according to its responsibility when there are claims by the consumers.

### 3.2. Symbol definition

$p_m$: Market price of per unit of the agricultural product.

$\alpha$: The proportion of the market price that represents information release costs. $0 < \alpha < 1$, which means the information platform will get $\alpha p_m$ for the information release from per unit sold of agricultural products.

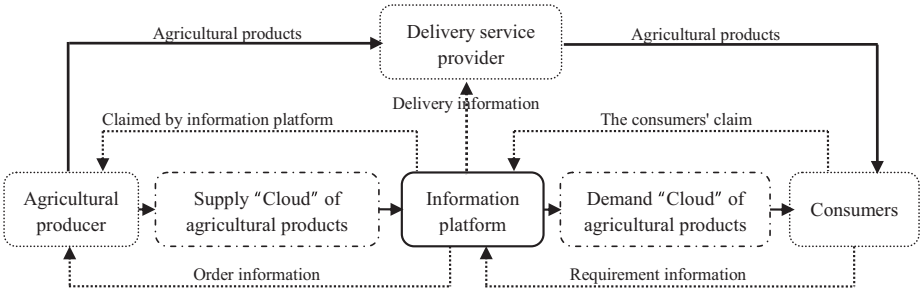


**Fig. 1 – Conceptual model of the agricultural supply chain based on "Internet +".**

Please cite this article in press as: Shen Q et al. Quality control of the agricultural products supply chain based on "Internet +". Info Proc Agri (2018), https://doi.org/10.1016/j.inpa.2018.05.005