

# Electronic Commerce for Agricultural Transactions: Role of Intermediaries and Accurate Pricing

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## Abstract

*This paper addresses the functional structure of agricultural electronic marketplaces, together with associated pricing mechanisms. The analysis of transaction costs suggests that electronic commerce with intermediaries provides more efficient trading environments than electronic marketplace without intermediaries. This indicates that existing intermediary institutions will remain important for agricultural transactions even after the adoption of electronic market systems. Compared to other industries or markets, agricultural markets are characterised as competitive markets and pricing is a key factor for efficient resource allocations. Pricing mechanisms being used by agricultural markets are contrasted with those of the Internet-based retail electronic commerce. This paper suggests that the current pricing in the Internet-based commerce is not efficient for agricultural electronic marketplaces, and that development of an alternative pricing mechanism is required to ensure efficient and accurate pricing for agricultural electronic commerce.*

## 1. Introduction

Electronic commerce has become increasingly popular as an alternative to traditional commerce as the costs of electronic communications fall and as the ability to convey complex information through networks expands. The popularity of the Internet, which has a potential to evolve into an interconnected marketplace for a wide variety of goods and services, has led many to regard electronic commerce as synonymous with Internet retailing. However, electronic commerce involves more than Internet retailing, which is only one type of electronic trading. This paper addresses an electronic

commerce system implemented for trading agricultural products at a wholesale level.

Many agricultural commodities are distributed through an industry value chain, which links producers and consumers through wholesalers (processors) and retailers. Wholesaling is a vital linkage in the marketing process of agricultural products. Wholesalers perform an important role in the value chain [14, 15, 16]. Agricultural wholesale markets have long been operated as intermediaries which bridge the gap between producers and consumers. Since many agricultural commodities are highly perishable and consumers purchase them in relatively small quantities at one time, retailers have to keep a rich assortment of commodities on their shelves at all times. Retailers (such as supermarket chains) prefer to purchase all the commodities which they want at a market where a wide variety of commodities are assembled. In addition, recent changes in consumers attitude towards high quality and healthy food consumption has resulted in a move away from mass standardized markets to small diverse customized niche markets [10]. This trend forces retailers to handle broader lines of commodities more efficiently.

All of these factors have encouraged agricultural market participants to implement efficient intermediary institutions to aggregate both demand and supply in order to more efficiently coordinate transactions. The agricultural value chain needs intermediary institutions through which farmers market their supplies and buyers purchase wide combination of agricultural products. The establishment of efficient intermediary institutions is a prior condition to the diffusion of electronic commerce in agricultural markets. An important issue addressed in this research is how to reconstruct the wholesale market system, i.e. the electronic intermediary institution, over electronic networks.

This paper suggests that market intermediaries will play an important role in electronic market systems for

agricultural products. Furthermore, wholesale electronic marketplaces for agricultural products need to incorporate pricing procedures into their systems in order to make systems more efficient. This paper is organized as follows. Section 2 discusses the functional structure of agricultural markets. This is followed by Section 3 suggesting that intermediary institutions are indispensable for agricultural markets from the transaction cost perspective. In Section 4, we point out that competitiveness is the most crucial factor for efficient markets and compare several pricing methods being used for agricultural trading. Finally, we discuss a pricing system in Internet-based commerce applications and suggest that new pricing systems need to be established for efficient electronic marketplaces for agricultural products.

## **2. Electronic Commerce for Agricultural Markets**

We differentiate electronic commerce for wholesale agricultural markets from consumer electronic shopping systems over the Internet. The tremendous growth of the Internet, and particularly the World Wide Web, has dramatically increased the number of new intermediaries such as Web Shop, Internet Mall, IndustryNet, and Internet Shopping Network, which interpose themselves between producers and customers in the industry value chain to take advantage of new types of economies of scale, scope and knowledge enabled by the Internet [19]. These intermediaries enable vendors to advertise their products to several millions of prospective consumers, while allowing customers to place purchasing orders electronically [8].

However, these new electronic intermediaries in the cyberspace do not include the function of discovering the market price of goods [11], although they have potential to influence retail prices by increasing competition among suppliers [2]. They usually employ posted-off pricing [20], where producers list ask prices and consumers decide how many items to buy at the posted price. In these systems, suppliers are price makers and on-line trading systems assist to determine quantities traded at relatively fixed prices.

This contrasts with wholesale agricultural markets, one of whose major functions is to determine the market price of goods. Suppliers who join the agricultural wholesale market (such as farmers in livestock auction) often have fixed quantities for supply without price tags: sellers are price takers and not price makers, although they may have reserve (minimum) prices. Electronic market systems in wholesale agricultural markets play an important role in determining a market price of goods

through either electronic auctions or electronic negotiations [12].

In addition, buyers who purchase agricultural products in wholesale markets are not end consumers but typically intermediaries who resell their purchased items to retail chains. Since qualities of offered products widely vary (even products from the same producer differ in qualities time to time), evaluations for product quality are essential to buyers who regularly join the market to purchase products at the wholesale level. Moreover, many agricultural commodities are highly perishable, thus they need to be promptly delivered to end consumers through the industry value chain. In contrast, products sold in electronic shopping systems over the Internet are mostly standardized and mass-produced (products from one supplier are identical). These systems typically target retail consumers who purchase goods based on price tags and brand names.

Intermediary trading takes place for a variety of reasons in agricultural markets. Changes in consumers' preferences for safe, high quality and healthy food have led to highly segmented agricultural markets, thus making matching product characteristics with demand more difficult without intermediary institutions such as wholesalers. The perishability of agricultural products (such as fresh meat) makes market transactions heavily rely on cooler and holding capacity more easily available in wholesalers. Sometimes, wholesaling is required by law for agricultural trading. For instance, regulations such as the 1920s Consent Decree prohibit some meat packers from retailing, and thus wholesaling is necessary for market transactions [18].

Suppliers of agricultural products consist of a large number of small farmers, who produce relatively small units: farmers do not produce large quantities enough to influence the market prices individually. On the other hand, agricultural commodities are consumed by a large number of consumers who are geographically dispersed in broad areas: buyers also cannot influence market prices individually. Both producers and consumers are considered as price takers, and a role of wholesale market for product pricing is very important for both producers and consumers.

Agricultural wholesale markets, typically established by market institutions, provide a variety of services for their members. The wholesale markets aggregate both demands and supplies to coordinate transactions of a variety of commodities efficiently. Their functions, which benefit both producers and consumers, include such services as assistance in search and pricing, needs assessment and product matching, risk reduction and product distribution.

Transaction costs consist of the costs of obtaining relevant information, the cost of bargaining and making decisions, and finally the costs of policing and enforcing contracts [6]. These transaction costs can be reduced if traders complete transactions in wholesale markets organized by market institutions as compared to fragmented, non-market exchange [9]. The costs of obtaining relevant information are reduced dramatically through the creation of an organized market, since wholesale market institutions help to publicize prices and other relevant information. The creation of regularized access to contacts within the market itself reduces costs by making it easier to discover preferable trading counterparts. Bargaining costs can also be reduced because the wholesale market institutions help establish procedures and conventions for reaching a bargain, and traders more easily establish expectations as to what kind of deal can be struck. Furthermore deals are likely to be conducted rapidly since options to transact with alternative buyers and sellers present in the market are clear to both parties.

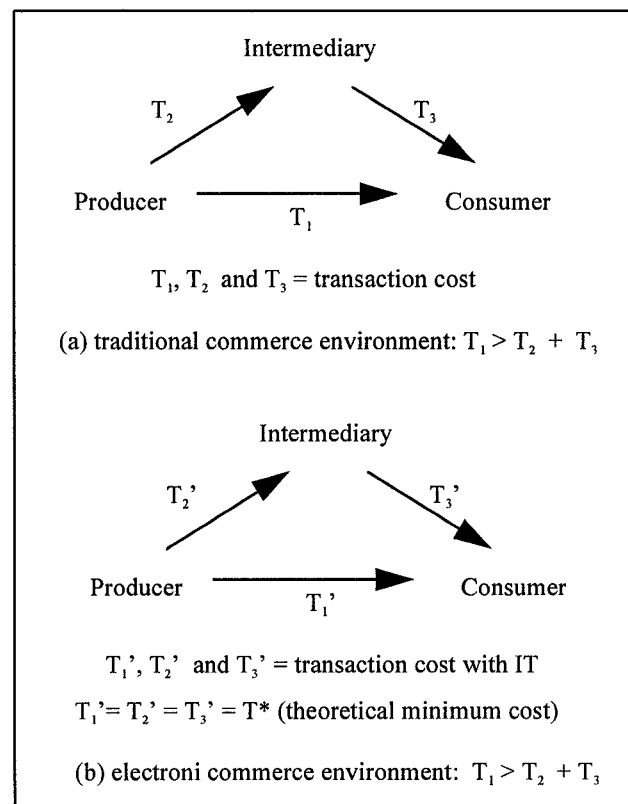
Policing and enforcement costs can be reduced because wholesale market institutions are typically equipped with norms of conduct and codes of practice among the buyers or sellers. The individual alone does not have to ensure that the contract is carried out because market institutions regulate in great detail all the transaction activities, such as the responsibilities of parties and the terms of settlements. The enforcement of the policies is possible because the opportunity to trade on the exchange itself is of great value: the withholding of permission to trade is a sanction sufficiently severe to ensure compliance for most member traders.

### 3. Transaction Costs and Wholesale Agricultural Markets

The Internet has brought significant changes in the economics of marketing channels and the organizational structure of distribution, which will lead to a redefinition of value system in many industries. The increasing popularity of the Internet has led many to predict that one of its effects will be the bypassing of intermediaries in electronic markets [3]. This proposition is based on the assumption that intermediaries add significant costs to the value chain, which are reflected in a higher final price of products or services. The essential argument is that the Internet allows manufacturers to internalize activities that have been traditionally performed by intermediaries. If parts of savings resulting from this bypass are transferable to consumers in the form of price reduction, direct search markets on the Internet may more than compensate for the costs of searching and matching, and

could become a preferred alternative to existing middleman markets.

The recent proliferation of producers' virtual storefronts, where consumers can directly buy goods over Internet, supports the proposition that the Internet enables vendors and customers to leap over existing intermediaries. This finding is also consistent with the new trend in the financial exchanges. Electronic Share Information Ltd. started an Internet-based exchange system that allows sellers to post stocks at a certain price on a public order and investors to buy the shares directly without having to call a broker [1]. Sprint Street Brewing Co., New York-based microbrewer, lets investors buy and sell the company stock through its Web home page with no commission charges and without a broker [13]. More than 70 of the estimated 650 mutual fund sponsors have set up electronic storefronts on the Web to sell shares directly to investors [22].



**Figure 1: Threatened Intermediary Hypothesis (source: [19])**

According to this "threatened intermediary hypothesis," intermediary will be eliminated from industry value chain. In Figure 1,  $T_1$ ,  $T_2$  and  $T_3$  denote the transaction cost from a producer to a consumer, from a producer to an intermediary and from an intermediary to a consumer respectively. In a traditional commerce

environment, intermediaries provide efficient marketing services, thus as for the relation of each transaction cost we recognize:  $T_1 > T_2 + T_3$ . In the “threatened intermediary hypothesis”,  $T_1$ ,  $T_2$  and  $T_3$  are supposed to be significantly reduced to  $T_1'$ ,  $T_2'$  and  $T_3'$  as a result of electronic market adoptions. With electronic commerce systems, they all reach  $T^*$  which is the theoretical minimum level of transaction costs involved. As a result, the relation of each transaction cost is now:

$$T_1'(T^*) < T_2'(T^*) + T_3'(T^*) = 2T^*$$

In this context, proponents of the hypothesis suggest that the direct link from a producer to a consumer become advantageous, thus eliminating existing market intermediaries.

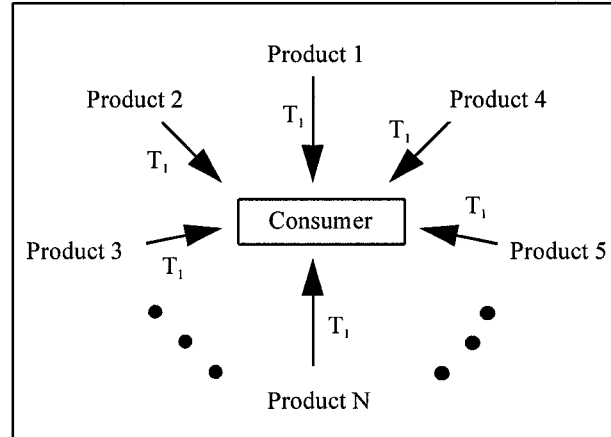
The central claim of this paper is that intermediaries, such as wholesalers, are vital for agricultural market transactions and that it is thus unlikely for wholesalers to be eliminated in the value chain even after introduction of electronic market systems. Both sellers and buyers in agricultural markets deal with many kinds of commodities, such as vegetables, fruits and so on. Moreover, each kind has a wide variety: for example, vegetables consist of carrots, potatoes, onions, celery, and so on. For each these products, there are multiple varieties, e.g. 4 types of onions, 5 varieties of potatoes, etc.

Suppliers generally specialize in one or two types of agricultural products to take advantage of economies of scale by cultivating a few products on a large scale. On the other hand, retail chains (such as supermarket chains) need to purchase a wide range of agricultural products from several farmers and bundle them into packages for end consumers. Thus, direct exchanges between farmers and consumers are very difficult to be realized in agricultural products even with electronic market systems. Intermediaries are necessary who provide a service of commodity grouping for efficient marketing, and thus electronic market systems can strengthen the role of market intermediaries, rather than threatening them. Intermediaries can take advantage of electronic market systems through economies of scale for the search and transactions.

If a consumer would like to buy all of these agricultural products directly from suppliers, his/her search costs will be enormous and be very difficult to be economically justified. In this case, transaction cost  $T_1'$  from producers to a consumer is multiplied by the number of product types which he/she wants to purchase, that is (see Figure 2):

$$\sum_n T_1' \quad (n=1, \dots, N),$$

where  $N$  is a number of agricultural commodity types which the consumer purchases. Suppose  $T_1'$  reaches  $T^*$ , then the transaction cost from producers to the consumer becomes  $NT^*$ .



**Figure 2: Transaction Cost without Intermediary**

If consumers use intermediaries such as wholesalers or retailers (see Figure 3) for market transactions, the transaction cost from producers to a consumer becomes:

$$\frac{\sum T_2'}{C} + T_3' \quad (n=1, \dots, N),$$

where  $C$  denotes a number of consumers. Here we assume that the transaction cost is all paid by consumers consequently, and the cost from producers to the intermediary ( $T_2'$ ) is to be shared by all consumers.

If  $T_2'$  and  $T_3'$  reach  $T^*$ , then the transaction cost from producers to the consumer is:

$$\frac{NT^*}{C} + T^* = \left(\frac{N}{C} + 1\right) T^*.$$

Obviously a number of consumers is greater than the types of agricultural products which each consumer purchases, that is,  $N \ll C$ . Thus,

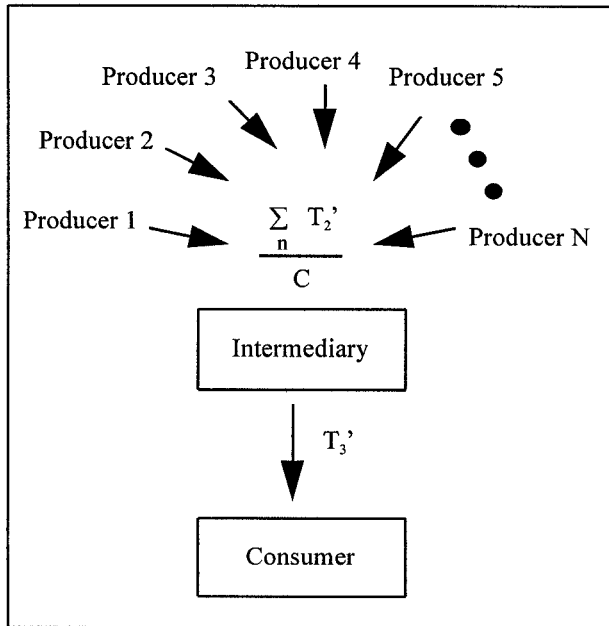
$$\frac{N}{C} \cong 0.$$

To compare these two costs between direct exchanges and transactions with intermediaries, we calculate:

$$NT^* - \left(\frac{N}{C} + 1\right) T^* = \left(N - \frac{N}{C} + 1\right) T^* > 0.$$

From this relation, we can easily conclude that the transaction cost of direct exchanges is higher than that through intermediaries. If we extend this cost to whole consumers, the total transaction cost will be:

$$\sum_c \sum_n T_1' \quad (n=1, \dots, N, c=1, \dots, C).$$



**Figure 3: Transaction Cost with Intermediary**

If the transaction cost reaches a theoretical minimum, then this will be equivalent to  $NCT^*$ . With the use of the intermediary, the total transaction cost is:

$$\sum_n T_2' + \sum_c T_3',$$

which will be identical to  $(N+C)T^*$  with the transaction cost reached to  $T^*$ . To compare the costs associated with two alternative transactions (with and without intermediaries), we calculate:

$$NCT^* - (N+C)T^* = (NC-N-C)T^* = \{(N-1)C-N\}T^* > 0.$$

If the number of consumers is bigger than the number of commodity types exchanged, this result clearly becomes positive, indicating that the total cost without intermediary is higher than that with intermediary. If we include the effect of economies of scales for transacting and delivery of goods (transportation), the difference

between the two costs might be wider, and the advantage of using intermediary services will be more clear. Therefore, we can conclude that use of intermediaries for agricultural transaction will be more economical even in an electronic commerce environment. Intermediary institutions are indispensable for agricultural markets and it is unlikely for intermediary functions to disappear in the value chain of the agricultural industry.

#### 4. Wholesale Market and Competition

In economic theory, a market is often defined as an institutional mechanism by which buyers and sellers interact to determine the transaction price and quantity of goods or services. Price discovery is an essential function of market institutions, and is a key economic activity. In a competitive economy, the price plays an important role to guide and regulate production, consumption, and marketing decisions - that is, the price serves as a signal for coordinating production and marketing decisions. Market efficiency should be judged by how effectively the market mechanisms discover prices of goods while effectively matching supply and demand.

Traditionally, the term "market" refers to a physical site where buyers and sellers negotiate trading conditions, including prices. We use the term "market" to describe a pricing institution and the term "marketplace" to refer to the physical market site to distinguish between the two concepts. Market structure is a crucial factor when we discuss market efficiency. Under freely competitive conditions, a market enables trading parties to discover equilibrium price. Of course, an equilibrium price is merely a theoretical concept and it is difficult to tell which price is an equilibrium one in real markets. Thus, we use the term "accurate price" instead to express a price closer to the equilibrium price discovered in real markets. Pricing accuracy is defined as how the price reflect the overall market conditions (for example, supply and demand conditions) - in other words, how close the discovered price is to a competitive equilibrium price.

Markets facilitate competition between many traders, sellers and buyers. Market structures can be classified based on the degree of competition between market participants [21]. One extreme type is a pure competition and the other extreme is a monopoly. A pure competitive market is characterized by the following conditions:

- a. The number of buyers and sellers is sufficiently large so that no individual can purposely influence the market price.
- b. The products are sufficiently homogenous.
- c. There are no artificial restriction on demand, supply, or prices.

#### d. Mobility of resources and products.

Under these competitive conditions, we can discover the equilibrium price and reach an optimal resource allocation. A competitive market is more favorable for resource allocation. Agricultural markets have been recognized to be close to the theoretical competitive conditions, because of a large number of sellers (producers) and buyers (retailers, consumers) participating in the marketplace. Agricultural markets facilitate competition among buyers and sellers and performs market coordination functions by discovering competitive prices. Agricultural commodities are less asset-specific than non-agricultural commodities, thus buyers can easily locate alternative trading partners. Barriers to enter or exit from the industry are also low. Except the last condition (mobility of resources), agricultural markets satisfy all conditions to be purely competitive markets, so that we can recognize that agricultural markets are very close to theoretical purely competitive markets. We conclude that agricultural (wholesale) markets perform well from the viewpoint of pricing accuracy and resource allocation.

### **5. Pricing Mechanism in Agricultural Market**

Different pricing mechanisms have different impacts on market behavior and performance even in the same market structures [7]. Current agricultural markets and associated electronic commerce applications show four different pricing mechanisms: (1) auction; (2) private treaty; (3) administered pricing; and (4) formula pricing [14]. These pricing mechanisms tend to be associated with particular commodities.

Auction markets provide centralized procedures for the exposure of purchase and sale orders to all market participants simultaneously. By doing so, they virtually eliminate the need for middlemen to locate compatible partners and to bargain for a favorable deal. However, pricing in an auction market depends upon the extent of participation in the market as well as the price discovery mechanisms used. Several different auction mechanisms are being used by auction markets, including English or ascending bid auction, Dutch or descending bid auction, sealed bid auction, and double or convergent auction [4].

A private treaty pricing system is a mechanism where buyers travel to properties of farmers and negotiate contracts with producers on-site. The negotiation process is not governed by any structural rules. Although the private treaty pricing offers convenience to the producer, it does not necessarily result in a competitive price. Overall, the private treaty prices appear to be less

efficient (in terms of converging on the competitive equilibrium level) compared to auction prices. An administered pricing system refers to a mechanism where sellers announce the sale in advance with non-negotiable selling prices and buyers decide how many to purchase at fixed prices. The administered pricing typically appears in markets with monopolistic suppliers. Prices administered by a monopoly seller converge rapidly on the monopoly equilibrium. Monopoly is well known as one of market failures. Thus the administered pricing system is the least efficient one.

Formula pricing differs from the private treaty pricing in that the transaction price is determined based on prices published by a market reporting service on the day prior to shipping. The formula pricing is widely used for wholesale meat trading and accounts 80% of all meat trading in US. However, the formula pricing has been subject to question on two specific charges: market price manipulation and adequacy of market information. Formula prices are based upon prices that are reported voluntarily, and the reporting mechanism involves personal discretion on the part of the market information services. Thus, large firms could use market reporting services to affect prices in manners advantageous to themselves and detrimental to the other market participants, including consumers and farm producers. Another problem can be the adequacy of market information. A large percentage of negotiated transactions are not reported to market reporting services, thus creating a "thin market" phenomenon. It is estimated that sales data on less than 2 percent of US federally inspected slaughter is reported to market reporting services [18]. When a considerable portion of the market is insulated from use as a source of price information, this further increases the potential of market price manipulation by large firms.

### **6. Pricing Mechanism in Electronic Commerce**

Electronic commerce opens up new opportunities and has many effects on a commerce environment. Internet-based commerce is just one form of electronic commerce. Our primary interest is in the pricing scheme of the Internet-based commerce. Does a pricing mechanism in Internet-based commerce ensure a pricing accuracy, or do prices discovered in Internet-based commerce work as a signal to coordinate production and consumption? In an electronic commerce environment, how do sellers seek would-be buyers, and how do buyers find the would-be sellers? Even if they are fortunate enough to find partners, how do they discover prices and settle the trade,

and who will ensure that the price they discovered is accurate in the given market conditions?

In the Internet-based electronic commerce, sellers and buyers seek trading partners by accessing "directories." These directories are databases of goods and services which provide information of offered products, including both prices and product characteristics [5]. Potential customers access the directories and search for preferred vendors. Once they locate appropriate vendors, they can purchase and pay for the goods electronically. Consumers can access the directory or virtual storefronts of would-be sellers and then consider whether to accept the posted price or to initiate negotiations for the price. If consumers fail to locate an appropriate storefront or supplier, they surf around the Internet until they find one.

As for the pricing system, Internet-based pricing is similar to the administered pricing or the private treaty pricing in agricultural markets. The former one refers to the pricing where suppliers post their selling prices and consumers decide how many items to purchase at the posted price. The latter one allows consumers to negotiate with vendors to adjust the price and other contract terms. Both of these pricing methods, however, are not the best one for pricing accuracy, especially in competitive markets such as markets for agricultural products.

In a competitive market, both parties should be enabled to discover the equilibrium price, or the accurate price. The structure of competition in Internet-based electronic commerce is far from that of agricultural markets. Current Internet-based commerce is less competitive than in agricultural markets because transactions over the Internet are disbanded into multiple and separate negotiations. Even with the directory available in the Internet, one question still remains - who will ensure that the directory provides the best information about commodities and trade partners? Segmented and small markets do not show better performance than a big centralized market when the pricing accuracy is a major concern. The current pricing mechanism of the Internet-based commerce is not efficient for agricultural commodities. The electronic commerce for agricultural products needs to develop pricing schemes that fit in the competitive conditions and result in the accurate prices.

## 7. Conclusion

An agricultural marketing system needs wholesale markets as an intermediary institution even in an electronic commerce environment. Electronic commerce without an intermediary function is not sufficient for

agricultural marketing, since buyers prefer large assortments of products. Electronic commerce for agricultural markets should handle many commodities with a broader line of quality. An assortment of commodities is one of the benefits of using intermediaries for electronic commerce of agricultural products.

In agricultural markets, competition is an effective way of ensuring accurate pricing and optimal resource allocation. The administered pricing, which is the most common pricing mechanism in the Internet-based retail commerce, does not guarantee accurate prices, the most important factor for effective agricultural transactions. For the optimal resource allocation, a more efficient pricing mechanism is required for electronic commerce in the agricultural industry.

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