Computers and Electronics in Agriculture 117 (2015) 81–90

Contents lists available at ScienceDirect

Computers and Electronics in Agriculture

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

Information empowers vegetable supply chain: A study of information needs and sharing strategies among farmers and vendors

Bu Zhong [a,*], Fan Yang [b], Yen-Lin Chen [c]

[a] 7 Carnegie, College of Communication, Pennsylvania State University, University Park, PA 16802, United States
[b] 115 Carnegie, College of Communication, Pennsylvania State University, University Park, PA 16802, United States
[c] Department of Agricultural Economics, Sociology, and Education, College of Agricultural Sciences, Pennsylvania State University, University Park, PA 16802, United States

ARTICLE INFO

Article history:
Received 25 March 2015
Received in revised form 4 July 2015
Accepted 10 July 2015

Keywords:
Information processing
Information need
Vegetable farmer
Vegetable vendor
Supply chain
Agriculture

ABSTRACT

Agricultural extension systems often fail due to inadequate knowledge of farmers' information needs and sharing strategies. This study aims to meet an urgent need of studying information needs and sharing strategies among vegetable farmers and vendors in Chengdu, China, whose results might be used in building a center of agricultural information disseminating vegetable production and marketing information. The findings disclose interesting differences between the farmers and vendors regarding their willingness to join such a center, information needs, sharing strategies and preferred information sources. Ample evidences justify the construction of the proposed center of agricultural information, which should not only empower the vegetable farmers and vendors but also enhance the efficiency of the existing vegetable supply chain and food security. Cross-discipline research involving both agriculture and communication scholars, like this, should shed more insights on working out strategies to cope with agricultural challenges.

1. Introduction

Market prices of perishable agricultural commodities like fresh vegetables are risky to farmers, vendors and other agents in the supply chain. This is particularly true to farmers and vendors who do not yet join contract farming in developing countries like China. Contract farming refers to agricultural production carried out by following an contract between a buyer and farmers that establishes conditions for the production and marketing of farm products (FAO, 2014). Contract farming could protect both growers against down-side risks, and processors or wholesalers against upper-side risks (Wang et al., 2011), but it has not been widely adopted by Chinese vegetable farmers. Without its protection, Chinese growers experienced severe price swings of several vegetables in past years, in which farmers were more vulnerable to price risks than other agents in the vegetable supply chain (Liu et al., 2004).

As the world's largest vegetable producer, China produced 700 million tons, or 1.4 trillion pounds, of vegetables in 2013, constituting over half of the world's annual vegetable production (Chen et al., 2014). For a comparison, China's vegetable output was five times more than that in India, the world's second largest vegetable producer, or nearly 16 times more than the United States, the world's third largest vegetable producer (Wu, 2014). In India, millions of farmers have benefited from the country's largest rural information system known as eChoupal, which was launched in 2000 to tackle India's unique agricultural challenges, including fragmented farms, weak infrastructure and numerous intermediaries (Rao, 2007). The Internet-based eChoupals not only provide information infrastructure but also enable efficiencies in the agricultural sector through greater information exchange and creation of an alternative market structure (Kumar, 2004). In developed countries like the Netherlands and the United States, information systems have long been employed to enhance the agri-food supply chain networks, focusing on implementation of information integration that takes both technical and organizational development into account (Wolferta et al., 2010), or climate forecast information system for managing agricultural risks in the United States (Fraisse et al., 2006).

As the top vegetable producer in the world, China faces a series of agricultural challenges ranging from making best use of natural resources, adopting new agricultural technologies, and managing risks in the agricultural supply chain. As a result, the risks involving vegetable production and trading could affect more farmers and vendors in China than any other countries in the world. Farming information has been a valuable resource in coping with

* Corresponding author. Tel.: +1 814 865 1023; fax: +1 814 863 8161.
E-mail addresses: zhongbu@psu.edu (B. Zhong), fuy106@psu.edu (F. Yang), ywc5239@psu.edu (Y.-L. Chen).

http://dx.doi.org/10.1016/j.compag.2015.07.009
0168-1699/

agricultural challenges (Ansari and Sunetha, 2014; Lee and Whang, 2000; Mahant et al., 2012; Morrow et al., 2002). Empowered by production and marketing information, farmers and vendors are capable of transforming traditional agriculture into a more profitable and sustainable business (Tologbonse et al., 2008). During the process, information systems serve as a prerequisite for developing a sustainable model of agriculture (Meitei and Devi, 2009). With limited access to information, Chinese farmers and vendors benefit little from information, resulting in less remunerative agriculture and food security concerns. Thus, both farmers and vendors have much to gain by shifting to more sustainable farming and trading practices, in which an information system should play a pivotal role. In fact, information has become the fourth critical factor of agricultural production in developed countries, next to land, labor and capital (Rao, 2007).

These years the benefits of constructing an information system become convincing to other industries in China. Research shows that, for instance, building an information system should enhance China's health management and healthcare delivery system (Eggleston et al., 2008), and help integrate diverse traffic data for better sharing traffic information between applications in the country's transportation information system (Song et al., 2014). With some initial progress being made, the information systems in these industries leave room for improvement in the areas of accessibility, productivity, cost efficiency, and standards of data gathering and sharing.

2. Literature review

Research discloses that agricultural extension systems often fail due to inadequate knowledge of farmers' information needs and sharing strategies (Babu et al., 2012). The present study seeks to investigate information needs and sharing strategies among vegetable farmers and vendors in a vegetable supply chain, whose findings should help identify and reduce production and marketing risks. Management of agricultural risks and challenges is an important measure for the effectiveness and sustainability of agricultural extension (see Zarmai et al., 2014). The findings will then be used to justify the construction of an information center, which should enhance the efficiency of the existing vegetable supply chain. A thorough knowledge of information needs, sharing and sources among Chengdu farmers and vendors should also help manage vegetable supply chains in other Chinese cities, which often face similar agricultural challenges.

Research has identified six major risks in China's agricultural production and marketing: output risk, price risk, break risk, technique risk, system risk, and global risk (Cui, 2010). Among the risks, price and output risks are the leading concerns in agricultural production, in which the price risk is defined as the uncertainty of price fluctuation due to market or seasonal changes, and the output risk refers to the uncertainty involving the output of agricultural products due to changing natural conditions (e.g., weather, pests) (2010). Cui (2010) notes that these risks, however, could be significantly reduced by contract farming and access to information. In China, contract farming is still an innovative supply chain structure (Wang et al., 2011), requiring farmers to provide agreed quantities of agricultural products meeting agreed quality standards, and the buyers commit to purchase the products at an agreed price and time.

Most Chengdu growers had not joined contract farming. To them, access to agricultural information becomes particularly beneficial in managing risks in production and marketing. Information has long been recognized as a powerful tool fighting risks in an agricultural supply chain, but it, however, could not fall upon farmers or vendors automatically. The first step is to build an information center that disseminates reliable, timely, and relevant production and marketing information. The need to investigate the target group's perceived information needs and sharing is pertinent to local officials and the agents in the supply chain.

2.1. Chengdu's vegetable supply chain

Chengdu, the capital of Southwest China's Sichuan Province, is one of China's top 10 cities with a population of 14 million. Each day, over 70% of Chengdu families went to buy fresh vegetables at one of over 200 vegetable markets in Chengdu's urban districts. In the suburbs, vegetable was the most important cash crop, and vegetable farming provides employment for about 70% of the population in the production areas. Each year, 5.3 million tons of vegetable was produced in Chengdu, most of which was locally consumed, and one fifth of it, or over 1 million tons, was sold outside Chengdu (Zhang, 2014).

The existing vegetable supply chain in Chengdu has remained largely unchanged for over 30 years. In the traditional model, vegetable farmers first sold their produce to suburb dealers who collected the vegetables on farms. The dealers then transported the vegetables by trucks to various wholesale markets in the suburbs of Chengdu, where most of the vegetables were transported to wholesale markets close to Chengdu's residential areas. Each morning, thousands of local vendors would buy the vegetables from the near-city wholesalers, and transport them by tricycles to vegetable markets in the city, where they sold the vegetables to consumers. A typical vegetable market in Chengdu has 300–400 individual vendors, each vendor having a stand of three square meters, selling around 250 kg of produce per day. Many vendors worked seven days a week, who went to buy vegetables from wholesalers very early in the morning, and sell them at a vegetable market until evening.

The current supply chain has five major deficiencies: (1) High price – The vegetable prices are comparatively high mainly due to the five layers of intermediary between vegetable farmers and consumers; (2) High transportation cost – The produce was transported to various wholesale markets before they eventually reached the vegetable markets in town; (3) Quality of instability – The vendors had little control on the quality of vegetables from wholesalers, and the long transportation time also contributed to the deficiency of instable quality; (4) Intractability of produce – The vegetables in Chengdu's markets were intractable, causing food safety concerns, especially when food emergency (e.g., food poison) occurs; (5) Disorganized market – The vegetable market could be disorganized from time to time due to the lack of production and marketing information in the supply chain. Without the information, farmers had difficulty in planning production and vendors faced challenges in setting up proper prices.

Thus a new model of vegetable supply chain was proposed by the Chengdu government. Based on the model, 20 new vegetable markets (hereafter called "Yimin market") had been built in Chengdu since 2010, which are managed by the government-owned Yimin Vegetable Market Management Co. Ltd. (hereafter called "Yimin"). Most of the vegetable stands at Yimin markets were procured through open tender. Unlike a traditional market housing 300 individual vegetable vendors, a typical Yimin market has three to five vegetable firms as the vendors, each selling 5–7 tons of vegetables per day. Most of the vegetable firms sell vegetables at multiple Yimin markets. The large sales volume gives the firms an opportunity of buying produce directly from vegetable farmers who preferred to sell a large volume of products at one time. Farmers tend to sell their produce to these firms as they often pay more than suburb dealers due to less intermediaries involved.

Yimin is much like Amazon.com, focusing more on managing a platform for its clients (vendors) than engaging in trading itself. As