

Sustainable Food Supply Networks in the Chinese Supermarket Sector

Chris J Backhouse and Chong Xu
School of Mechanical and Manufacturing Engineering
Loughborough University
Leicestershire LE11 3TU, UK

Norizah Mohamad
School of Electrical & Electronic Engineering
Universiti Sains Malaysia, Engineering Campus
14300 Nibong Tebal, Pulau Pinang, Malaysia

Reshpal Plaha
Crystal Quality UK Ltd
Royal Leamington Spa
Warwickshire CV31 1WQ UK

Abstract

This paper analyses the current status of Chinese supermarkets food supply network in terms of agricultural products and the ways supermarkets ensure food quality from different food sources. The local geographical context and *guanxi* network are also considered in this study. An improved supply mode (logistics) for agricultural food for the Chinese supermarket sector is proposed which aims to ensure supermarkets and their supply chain partners remain profitable whilst ensuring high quality, safe agricultural food products.

Keywords:

Agricultural Food, Chinese Supermarkets, Supply Network, Logistics.

1. Introduction

In recent years, with the rapid growth of supermarkets in China, food safety issues occurred frequently in Chinese food supply chain. In order to rebuild Chinese consumers' confidence in food safety and food quality from supermarkets, the Chinese government and supermarkets have taken a series of actions to ensure food quality by optimizing the food supply network. This is in parallel to supermarkets' ongoing objective to provide low price, sustainable and consistent delivery of a wide variety of products and high quality services to meet consumers need.

2. Literature review

With the development of supermarket in China, many practices in the spheres of social, political, economic and technological activities had emerged in recent years in order to satisfy customers' need and government requirements.

2.1 Food Safety

Food safety had been a big challenge faced by the Chinese supermarket. The 'tainted milk' scandal caused by *Sanlu* Company in 2008 and the abuse of food additives and even the illegal use of chemical additives had lowered the public trust in food safety standards in China (Kim, 2013; Wu, et al, 2013). In order to rebuild customers' confidence in Chinese food industry the Chinese Government adopted uniform national standard certification systems and requirements for advanced management system in the milk industry (Wang et al, 2008; Huang et al, 2012); Hazard Analysis Critical Control Point (HACCP) management to reduce the abuse of food additives (Wu et al, 2013); independence of food safety regulation system (Li et al, 2010); food traceability system (Wu et al, 2012; Zhang et al,

2012); the country of origin labeling (Chen et al, 2012); green, eco-labeled and environmentally friendly seafood (Xu et al, 2012).

2.2 Food Preference

With the rapidly increasing income of Chinese consumers and the urbanization of China, there has been a significant change in life style and eating styles (Fu, et al, 2012). Chinese customers are now much more likely, than in the past, to consume high-quality nutritious food, as evidenced in the increased consumption of animal products (Fu et al, 2012); organic and green food (Sheng et al, 2009); GM food (Ho et al, 2006). Meanwhile, the trend in fresh meat consumption by Chinese consumers has changed from hot-fresh meat to frozen meat and more recently to chilled fresh meat (Zhou et al, 2012). Similarly the consumption pattern of fresh vegetable and fruits had changed from purchasing loose products to simple-package products and then more recently to processed products (Rojas-Grau, 2009).

2.3 Logistic of the Fresh Fruit and Vegetable Supply

The vegetable supply chains of Chinese supermarkets faces the challenge of accessing large volumes of high quality fresh vegetables and fruits in a timely manner, combined with high costs of delivery (Stringer et al, 2008; Miyata et al, 2009). In order to solve those issues, supermarkets are more likely to cooperate with vegetable suppliers which have large scales of production; have short distances between themselves and processing plants and cities; support longer contracts with supermarkets and are certificated producers (Stringer et al, 2008). In these circumstances the supermarkets are much more likely to provide technical and financial assistance to producers (Miyata et al, 2009). As a result, the Chinese agro-food market had changed from a huge number of small farmers and traders to farmer led professional cooperatives (Jia et al, 2012; Deng et al, 2010).

3. Evaluation of Sustainable Food Networks

In order to study the supply chain management of Chinese supermarket, as well as their ways to ensure food quality, three different types of supermarkets in Chengdu, Sichuan province, have been chose as object of study. Supermarket #1 (SM1) is part of a global supermarket chain formed as a joint venture to enter the Chinese food market. Supermarket #2 (SM2) is a highly successful large domestic supermarket; it has more than 10 chain stores in Chengdu. Supermarket #3 (SM3) is a small domestic supermarket which only operates in Sichuan province. All three supermarket chains operate more than 5 stores in Chengdu.

3.1 Ways to Ensure the Quality of Food

Each supermarket chain has a different food supply chain management systems to ensure the quality of fresh vegetable and fruit (FFV) and processed food. Clearly, the main purpose of retailers in this supply chain remains as profit maximization which includes minimising unnecessary capital investment in all areas including quality assurance, transportation and inspection. Fig 1 shows how the three supermarket chains ensure quality of fresh vegetable and processed food.

Supermarkets	SM1	SM2	SM3	Supermarkets	SM1	SM2	SM3
Ways to ensure quality				Ways to ensure quality			
Own labelling	Apple(etc)	Carrot(etc)	0	Termination of cooperation if Farmer Continue to provide Substandard products	1	1	0
Integrated chain(own produce, process and logistics)	Own logistics	Own farmland and distribution center	0	Leasing land and own producing	0	1	0
Cooperate with other Supermarket (share logistic, products, quality inspection)	0	Local small supermarkets	Hualian, Lianhua	Random inspection the products	1	1	1
Traceable food	Pork (etc)	0	0	When buying from farmers directly			
Alliance with multinational Logistics firms	Xinbang logistic firm	Ant logistic company	0	Specialized input provision for farmers(tech ,finance and right and interests assistant)	0	1	0
Different goods providing and quality standard according to different area and culture	A	A	B	Cooperate and contract with local wholesalers	1	1	1
Reposition to special food	Zongzi(etc)	Mooncake (etc)	0	Inspect products sample when buying from wholesalers	1	0	0
Main local procurement systems	Buy from FPCs or distribution center	Buy form FPCs or wholesalers	Buy from local farmers	Inspect products sample when buying from famous /unknown processors	1/1	0/1	0/0
Provide region characteristic products	Hot pot favored vegetables	Barbecue suitable vegetables	Watermelon	Specialized packaging and processed ways to processors	1	0	0
Private standard and sample inspection	Additive inspection	0	0				
Green/organic/non-hazardous food purchasing	Green labeling	Organic labeling	0				
Total	10	9	4	Total	6	6	3

Figure 1: The ways supermarkets ensure the quality of fresh vegetables, fruit and processed foods

3.2 Purchase Channel of Each Supermarket

All three supermarket chains have their own purchase channel for agricultural products. They also have strong financial reserves to a) purchase products which have higher quality assurance, and b) develop a more efficient supply chain management mode from upstream to downstream in the whole supply chain.

Guanxi network strategically decide a relationship with its suppliers, domestic supermarkets are more likely to sustain a long relationship with dedicated wholesalers who continuously provide high quality and fresh products, even though it has risk of providing low quality and non-fresh products and increases transaction cost. In processor sector, domestic supermarkets usually purchase products from domestic processing companies, because they can obtain financial subsidies from the government if they support the domestic processed industry. Fig 2 shows their main purchase channel.

3.3 Development of Three Supermarkets in Their Fresh Fruit and Wholesalers System

In terms of the FFV wholesalers system shown in Fig 3, it could be summarized as comprising dedicated specialized wholesalers; traditional wholesalers; local distribution centre; road market. For large supermarket, they would like to choose more reliable quality wholesalers who continuously provide a large quantity of fresh high quality and nutritious products even though they will pay a premium for those products. On the other hand for the small supermarket most of their products are from road markets which lack significant quality assurance.

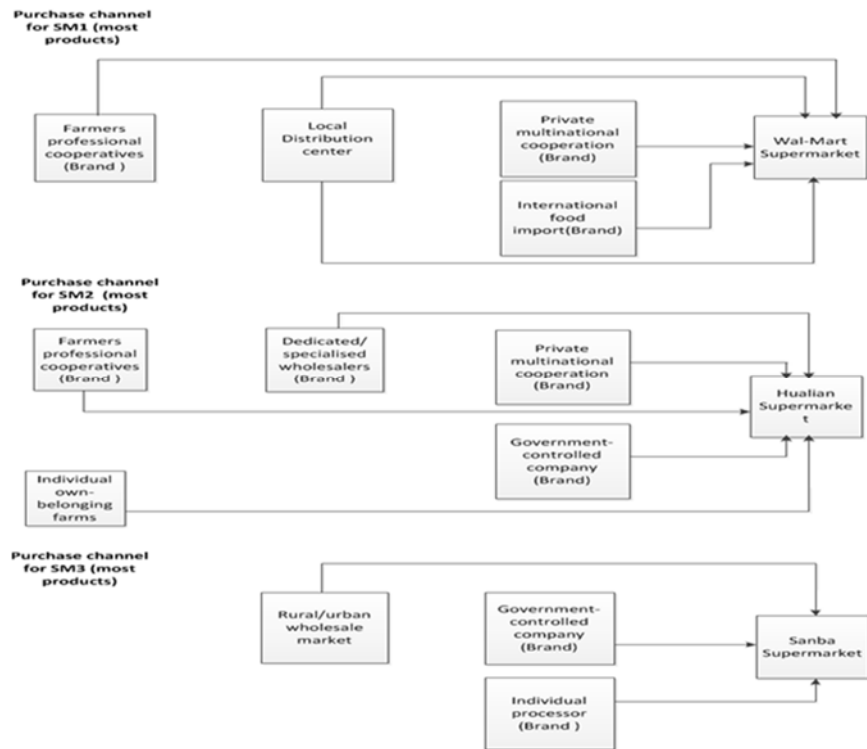


Figure 2: The main purchase channel for three different supermarkets

supermarkets	FFV wholesaler system
SM1	Most of dedicated/specialized wholesalers Some volume items procured from local distribution centre International food bought from foreign country directly
SM2	Traditional wholesalers provide small volume products Most of products buy from Dedicated/specialized wholesaler Some volume items procured from local distribution centre
SM3	Most of products procured from informal road market Few products bought from traditional wholesalers

Figure 3 FFV wholesalers system for three different supermarkets

4. Development of the Analytical Framework

4.1 The Supply Network for Chinese Supermarkets

The supply network of Chinese supermarket is very complex due to the wholesalers' position in this supply chain. A variety of producers exists and will exist for a long time in the future. Fig 4 illustrates the whole supply network for Chinese supermarkets.

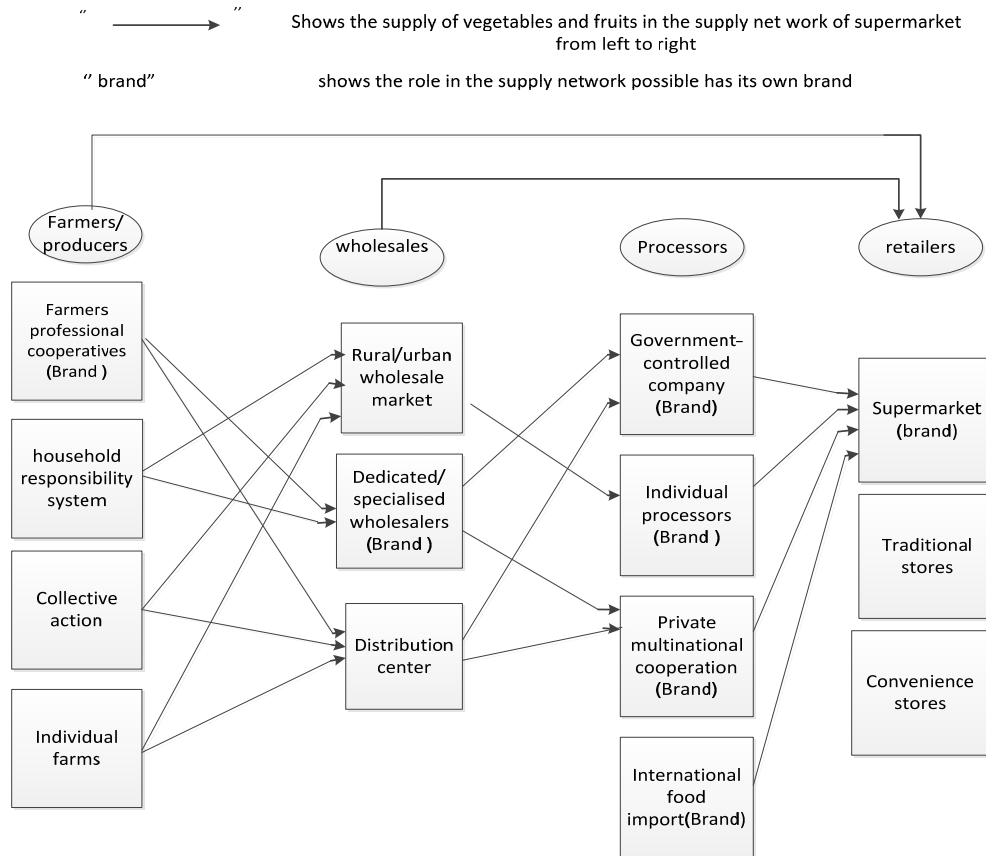


Figure 4 Supply chain network of Chinese supermarkets

4.2 Preferred Supply Chain Roles

Farmers' Professional Cooperatives

Farmers' professional cooperatives are developing strongly and are based on collective action. They are typically a company with mature supply chain management and structure management producing large quantities of high quality FFV to dedicated wholesalers or retailers. Farmers' professional cooperatives usually have their own brand and package to attract the wholesalers and supermarkets. Meanwhile Farmers' professional cooperatives can receive financial support, technology and planting material support as well as special policy support from the Chinese government.

Distribution Centre

Distribution refers to delivering the goods which are processed, packed and delivered on time to a designated location determined by the customer' need. As the development of supply chain of Chinese supermarket, there is a shift from per-store procurement system to a distribution centre-based system that serves many stores in the same region for some leading supermarkets. In this way, substantial cost savings by reducing cost for sustaining

relationship with suppliers, food quality monitoring and risk management while increasing cost of food transportation and keeping products fresh

Minimally Processed-Fresh-Cut

Processors appear to make more profit by focussing on the characteristics of colour, flavour and texture of products rather than on quality and freshness. However, in terms of Fresh fruit and vegetable, consumers don't like to pay a premium for their products and resist high-cost package, unhealthy food additives and non-nutritious processed food.

4.3 Chinese Characteristic: Significant Effects on FFV Quality and Supply Chain

Government policy

In the supply chain management of Chinese supermarkets, the Chinese government play an important role in protecting farmers' benefits. Local government provides technology and financial supports while central government encourages them to join the supply chain as participants and form farmer's cooperatives For the sake of increasing the domestic processed industry and supermarkets development, government departments like the State Administration for Industry and Commerce and Quality Inspection Administration provide farmers with food inspection and testing services at a lower price than the joint venture companies and provide subsidy support if they procure products from farmers directly with contracts

Regional difference and culture

China is a large country with vast territory and many ethnicities, so Chinese consumers have a range of eating habits and differing degrees of concerns about food safety. In addition traditional festival and the production of food crops local to a specific geographic area have impacts on regional differences.

Guanxi network

The *Guanxi* network significantly affect the Chinese supermarkets supply chain in both upstream (producers, processors and retailers) and downstream (consumers), as well as daily social business life. On the upstream side, *Guanxi* network is an interpersonal trust and a kind of transaction-specific investment which aims to improve the profit for both buyers and sellers, and make the supply chain more efficient. On the consumers' side, *Guanxi* network determines purchasing behaviour.

5. Conclusions for Improving Food Sustainability

The overall objective of this paper was to show the current status of Chinese supermarkets supply chain in planted food sector from producers to supermarkets. It highlights the existing ways which supermarkets used to ensure the quality and freshness of products as well as the nature of Chinese characteristics like government policy, regional difference, culture and *Guanxi* network all of which have significant effects in promoting the form of the current supply chain and the development of future supply chain.

For the sake of sustainable development of planted food, every part in this supply chain needs to make efforts to improve. Fig 5 shows the existing ways to ensure food quality for three local supermarkets in Chengdu.

Role in food supply chain	Existing ways to ensure food quality
Producers	<ol style="list-style-type: none"> 1. Promote the development of special farmers' cooperatives like farmers' professional cooperatives 2. Supports from central government like legislation and documents and from local government like financial and technology support and seeds and fertilizers 3. Supermarkets provide long-term contracts with producers who high quality and nutrition of products continuously 4. Establish a brand for its products and join in the supply chain as participates
Wholesalers	<ol style="list-style-type: none"> 1. Reduce the numbers of wholesalers when products procuring from producers and selling to supermarkets directly 2. Supermarkets collaborate with dedicated wholesalers who provide large quantities of high quality and fresh products continuously 3. Supermarkets procure products from high quality distribution centre directly
Processors	<ol style="list-style-type: none"> 1. Government increase supervision of raw materials procuring and the use of food additives 2. Government punish processors if provided non-compliance products 3. Processed factory optimise food processing by using high pressure and high temperature process 4. Supermarkets randomly inspect processed products buying from processors or processed company
Supermarkets	<ol style="list-style-type: none"> 1. Provide support for every part in this supply chain and ensure the development of food supply chain in a preferred condition 2. Own standard which is providing traceable food, green and organic labelling food 3. Integrate chain for some vegetable and fruit , and prefer local procurement system

Figure 5: Exiting ways to ensure food quality for three local supermarkets

Role in food supply chain	Recommendations to ensure food quality
Government	<ol style="list-style-type: none"> 1. Transfer from farmer support only, to processor inspection 2. Strengthen the legal penalties for processors if provide harmful food intentionally 3. Accelerate supermarkets' development in the township and small city to form a broader industry chain 4. Agriculture rebuilt: from a variety of modes of production to the uniform producing pattern---FPCs 5. Join in food supply chain as a supporter, without intervention in market economy 6. Strengthen basic knowledge of education about food quality to public and provide legal aid when consumers involved in food incident
Producers	<ol style="list-style-type: none"> 1. Supermarkets inform producers the logistic of their products and the consumers they face 2. Add new purchasing channel for fresh vegetable and fruit which consumers can buy FFV from supermarkets-belonging or authorization on production base directly 3. Planting non-original vegetables and fruits but local favour which could form a new food supply for local region
Wholesalers	<ol style="list-style-type: none"> 1. No longer have wholesalers exist in the future 2. Standardized distribution center pattern for future fresh food logistics
Processors	<ol style="list-style-type: none"> 1. Supermarkets should cooperative with dedicated processors with simply process to fresh food 2. Randomly inspect processed food by public consumers

Figure 6: Recommendations for Chinese supermarkets to ensure food quality in the future.

6. Recommendations for Improving Food Sustainability for Future Work

The Chinese government and supermarkets make many efforts to ensure food quality and freshness including financial and technology support; legislation support from government; higher procuring price from farmers if they provide large quantities of high quality food continuously to supermarkets; supermarkets which have their own standard and inspection. However, food contaminations still happen in today's food markets, as a result, more steps should be taken to ensure food quality and continuously improve the development of food supply chain. Considering the Chinese characteristics and current Chinese food supply chain, more attention should be paid to the transformation of government policies; transformation of producer's mode; change of wholesaler's activity in supply chain and improvement for processed food. Fig 6 provides a final summary of the overall set of recommendations.

References

- CHEN, M. Consumer Trust in Food Safety- A Multidisciplinary Approach and Empirical Evidence from Taiwan. *Risk Analysis*, 2008, **28**(6), pp. 1553-1569.
- DENG, H., and HUANG, J. Policy support and emerging farmer professional cooperatives in rural China, *China Economic Review*, 2010, **21**, pp. 495-507
- FU, W., and GANDHI, P. V., and CAO, L. Rising Consumption of Animal Products in China and India: National and Global Implications. *China & World Economy*, 2012, **20**(3), pp. 88-106.
- HUANG, J., WU, Y. and YANG, Z. Marketing China's milk: A case study of the sales activity of dairy farmers in greater Beijing. *China Economic Review*, 2012, **23**(3), pp. 675-689.
- HO, P., and VERMEER, B. E., and ZHAO, H. J. Biotechnology and Food Safety in China: Consumers 'Acceptance or Resistance? *Development and Change*, 2006, **37**(1), pp. 227-253.
- JIA, X., and HUANG, J. Marketing of farmer professional cooperatives in the wave of transformed agrofood market in China. *China Economic Review* 2012, **23**, pp. 665-674.
- KIM, R. A Perspective challenges of Chinese food risk management system in globalizing food supply chain. *International Food Research Journal*, 2013, **20**(1), pp. 515-517.
- LI, Y., and QI, R. Designing Independent Regulatory System of Food Safety in China. *Agriculture and Agricultural Science*, 2010, *Procedia*(1), pp. 288-295.
- MIYATA, S., and MINOT, N., and HU, D. Impact of Contract Farming on Income: Linking Small Farmers, Packers, and Supermarkets in China. *World Development*, 2009, **37**(11), pp. 1781- 1790.
- Rojas-Grau, A., Oms-Oliu, G., and Soliva-Fortuny, R. The use of packaging techniques to maintain freshness in fresh-cut fruits and vegetables: a review. *International Journal of Food Science and Technology*, 2009, **44**, pp. 875-889
- SHENG, J., and SHEN, L., and QIAO, Y. Market trends and accreditation systems for organic food in China. *Food Science & Technology*, 2009, **20**, pp. 396-401.
- STRINGER, R., and SANG, N. Producers, Processors, and Procurement Decisions: The Case of Vegetable Supply Chains in China. *World development*, 2009, **37**(11), pp. 1773-1780
- WANG, H. M., and QIAO, J., and Ning, Y. L. Influential factors on consumers' willingness to purchase safe food e a study on consumption of urban consumers to green certificated pork of in Beijing. *Chinese Journal of Animal Science*, 2012, **48**(6), pp. 48-52.
- WU, L., and ZHANG, Q., and SHAN, L. Identifying critical factors influencing the use of additives by food enterprises in China. *Food Control*, 2013, **31**(2), pp. 425-432.
- WU, L., and XU, L., and ZHU, D. Factors Affecting Consumer Willingness to Pay for Certified Traceable Food in Jiangsu Province of China. *Canadian Journal of Agricultural Economics*, 2012, **60**, pp. 317-333.
- XU, P., and ZENG, Y., and LONE, T. Chinese consumers' willingness to pay for green- and eco-labeled seafood. *Food Control*, 2012, **28**(1), pp. 74-82.
- ZHANG, C., and BAI, J. Consumers' willingness to pay for traceable pork, milk, and cooking oil in Nanjing, China. *Food Control*, 2012, **27**(1), pp. 21-28.
- ZHOU, G., and ZHANG, W., and XU, X. China's meat industry revolution: Challenges and opportunities for the future. *Meat Science*, 2012, **92**(3), pp. 188-196

Biography

Chris J Backhouse has been an academic at Loughborough University since 1990 and Professor of Product Innovation since 1999. Prior to that he had a successful career in industry including several years as a design engineer in consumer goods manufacture (Unilever) and in heavy industry (Morris Mechanical Handling). He was

Head of Dept of Manufacturing Engineering and then Dean of the Faculty of Engineering. For two years he was Vice President, British University in Egypt. He has published extensively in areas related to lean, servitization and organisation management; has received 4 best paper awards, and been investigator of approx 20 UK Government funded research projects.

Chong Xu completed his Masters in Advanced Manufacturing Engineering and Management at Loughborough University in 2013. Prior to that he obtained his BEng in Manufacturing Engineering from Southwest Jiaotong University, China.

Norizah Mohamed is a senior lecturer at the School of Electrical & Electronic Engineering, Universiti Sains Malaysia. She graduated from Loughborough University of Technology (Electronic, Computer and Systems Engineering). She pursues her MSc (Technology Management) from Liverpool John Moores and then her EngD (Engineering Management) from Universiti Teknologi Malaysia. She completed her thesis in product development and supply chain within the automotive industry. She has since been interested in product development in the halal food industry during her 9 months sabbatical leave at Loughborough University in the year 2012. She is currently teaching Engineering Mathematics and Engineering Management courses at her institution.

Reshpal Plaha is Managing Director of Crystal Quality UK Ltd. She is a quality systems consultant, management systems auditor and trainer. Her background is as a food technologist having been quality systems manager in major UK multinational food producers. She undertakes business improvement projects based on ISO9000 Quality Management Standards and Excellence Model for UK regional local authorities, construction; UK Ministry of Defence; motor industry and major food producers. She is an active member of the UK Asian Business Community and has represented UK interests on UK Trade and Investment Mission to India.