International Food and Agribusiness Management Review
Volume 15, Issue 4, 2012

The Relationship Between Information Exchange Benefits and Performance: The Mediating Effect of Supply Chain Compliance in the Chinese Poultry Chain

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Abstract

This paper aims to examine the relationships between information exchange benefits and company performance, and the mediating effect of supply chain compliance on this relationship. A sample of 165 buying companies and of 96 suppliers were analyzed by partial least square (PLS) path modeling. Five company characteristics, including company size, company age, company type, quality standard implemented, and administrative level of a location, were added as control variables in the model. The paper extends our understanding on the relationships between perceived communication benefits, supply chain compliance, performance and company characteristics. Managerial implications are generalized for buyers and suppliers respectively.

Keywords: Inter-organizational information exchange, perceived communication benefits, supply chain compliance, performance, company characteristics.

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Introduction

The theory of Supply Chain Management asserts that the way companies pursue their objectives is to seek cooperation through supply chains (SC) (Lee, Padmanabhan, and Whang 1997; Sahin and Robinson 2002). Supply chain cooperation can bring with substantial benefits and advantages for companies, and raise performance levels above those attainable in spot-market operations (Lambert, Cooper, and Pagh 1998; Mentzer, Foggin, and Golicic 2000).

A basic enabler for tight supply chain collaboration is inter-organizational information exchange (IOIE) (Fawcett et al. 2010). Moreover, information exchange is an essential determinant of the successful strategic positioning of firm networks (Jarillo 1988). Information exchange is fundamental to business as carbon is to physical life (Reinsch 2001). This stands true especially for the food sector because of agri-product market globalization and given the specific characteristics of perishable foods, such as shelf life constraints and food safety. However, only limited research has been conducted on supply chain information systems in the food sector (Stock and Boradus 2006; Storer 2006).

Although significant achievements have been made with the research on information exchange, it is still difficult to find out from existing literature how information exchange leads to improved performance (Storer 2005). In practice, although the competitive value of information is widely heralded, few companies have fully harnessed information's abilities to enhance their company and SC performance (Fawcett et al. 2007). To narrow the gap, this study intends to re-examine the relationship between information exchange and performance.

During literature study, we found that the literature often equated the value of information exchange with improved company performance, thus, often examined the value of information exchange by taking use of the constructs of performance. For example, Fawcett et al. (2007) identified and analyzed two distinct dimensions of information sharing – connectivity and willingness. And they examined the impact of both dimensions on operational performance and competitive performance. Paulraj et al. (2008) found empirical support for the notion of inter-organizational communication as a relational competency that enhances buyers' and suppliers' performance.

Differently, we assume company performance such as a firm's profitability and competitive performance might partly be an indirect result of information exchange. Comparatively, direct results might be issues such as cost reductions, problem resolution, as well as delivery and quality control. For example, it would be hard for a manager to answer a question such as "does the communication with your main customer/supplier help to improve profitability and sale growth rate of your company?" However, it would be less difficult for a manager to answer a question such as "does the communication with your main customer/supplier help you to solve problem and to control product quality?" Thus, we propose that the value of information exchange should be operationalized in a way to measure the direct benefits that a company obtains from information exchange. Therefore, we proposed a new construct "perceived communication benefits" and distinguished between perceived communication benefits and company performance.

Then, we ask what is the relationship between perceived communication benefits and performance, and how perceived communication benefits impact on performance? As we can imagine, there should be diverse ways that information exchange may lead to improved performance. This study focuses on checking the mediating role of supply chain compliance on this relationship.

Last but not the least, most prior studies focused on the perceptions of buying firms only or suppliers only, and did not reflect the perceptions of both sides. However, as we know, buying firms and suppliers have different functions and powers. There are questions concerning whether both buyers and suppliers benefit from information sharing and collaboration (Nyaga, Whipple, and Lynch 2010). And we further question whether the benefits obtained by a company from information exchange with its suppliers and with its customers contribute to its performance without difference. This paper is among the first attempt to reflect both sides of the 'coin' of information exchange by collecting data on the focal companies' relationships with their suppliers and with their customers respectively.

Thus, this paper intends to empirically test the relationship between perceived communication benefits and company performance, to explore the mediating role of supply chain compliance on this relationship, and to unfold how communication benefits help to improve company performance for food buyers and suppliers respectively.

The central research question is therefore: 'what is the relationship between communication benefits and company performance? how do communication benefits help to improve performance?' To answer this central research question and to achieve the desired research objective, the following specific research questions are formulated:

RQ1. What is the relationship between perceived communication benefits and supply chain compliance?

RQ2. What is the relationship between supply chain compliance and performance?

RQ3. With regarding to the answers to RQ1 and 2, what are the similarities or differences for buying firms and suppliers?

As companies through a food supply chain from farm to fork often have diverse characteristics, we have added five company characteristics as control variables in the structural model in order to avoid potential bias and to examine the potential influence of company characteristics on the interrelationships between perceived communication benefits, supply chain compliance and performance. These company characteristics are: company size, company age, company type, quality standard implemented, and administrative level of a location.

This paper focuses on the poultry supply chain in China. In the last 26 years from 1985, the share of poultry has gradually increased in the total output of livestock products in China (Table 1). Correspondingly, per capital possession of poultry has gradually increased also during the last two decades (Table 2). Notably different from the highly integrated poultry chains in the West, fragmentation and integration coexist in the Chinese poultry supply chain. Table 3 shows that

small-scale, medium-sized, and large-scale poultry farms coexist. Thus, the Chinese poultry chain provides a new and meaningful context for the study and arouses our research interest.

Table 1. The output of poultry and other meat in selected years in China (10,000 tonnes).

	1985		1995		2005		2008	
	Output	*%*	*Output*	*%*	*Output*	*%*	*Output*	*%*
Poultry	160.2	8.3	724.3	17.8	1,344.2	19.4	1,533.7	21.1
Pork	1,654.7	85.9	2,853.5	71.0	4,555.3	65.6	4,620.5	63.5
Other meat	111.6	5.8	496.6	12.2	1,039.4	15.0	1,124.5	15.4
Total meat	1,926.5	100.0	4,074.4	1000.0	6,938.9	100.0	7,278.7	100.0

Source. China Statistical Yearbook of Animal Husbandry 2009

Table 2. Per capita possession of poultry and other meat in selected years in China (kilograms).

	1990	1995	2000	2005	2008
Poultry	2.8	6.1	9.4	11.2	11.5
Pork	20.0	24.2	31.4	38.3	34.8
Total meat	25.1	34.5	47.8	59.2	54.8

Source. Chinese Yearbook of Meat 2008

Table 3. Poultry production scale for 2008 in China

Poultry production scale (Number of poultry / year)	Number of poultry at the end of the year (10,000 heads)	Percentage of the total poultry
Below 2000	144,668.9	18.4
2000 ~ 49,999	440,699.0	55.9
50,000 ~ 499,999	132,208.7	16.8
500,000 ~ 999,999	21,804.3	2.8
More than 1,000,000	48,640.8	6.2
Total	788,022.6	100.0

Source. China Statistical Yearbook of Animal Husbandry 2009.

In the sections to follow, this paper presents our hypotheses and the research framework. Then, based on empirical data analysis, a review of the findings is described. Afterwards, elaboration on the conclusions and discussions follows in the penultimate section. Finally, this paper ends with managerial and policy implications, research limitation, and future research.

Perceived Communication Benefits, Supply Chain Compliance and Performance

Perceived Communication Benefits and Supply Chain Compliance

A way companies pursue their objectives is to seek cooperation through supply chains (SC), and a basic enabler for tight supply chain collaboration is inter-organizational information exchange (IOIE). IOIE is looked as imperative glue that holds supply chain partners together (Mohr and Nevin 1990, 36), is the heart (Lamming 1996), lifeblood (Stuart and McCutcheon 1996), nerve center (Chopra and Meindl 2007), essential ingredient (Min et al. 2005), key requirement (Sheu, Yen, and Chae 2006), and foundation (Lee and Whang 2001) of chain collaboration. It is a critical factor in promoting SC compliance among firms, and is also a generic cure for SC ailments (Lee, Padmanabhan, and Whang 1997; Sahin and Robinson 2002). Effective and efficient

communication is vital to on-going channel relationships and successful inter-firm exchange (Paulraj, Lado, and Chen 2008). Correspondingly, communication difficulties are a prime cause of collaboration failures. Miscommunication could cause conflicts and misunderstanding among SC partners (Paulraj, Lado, and Chen 2008; Cao et al. 2010). Thus, to examine the influence of information exchange benefits on supply chain compliance, we herein propose the following hypotheses:

H_1: The level of perceived communication benefits is positively associated with the level of supply chain compliance.

'Perceived communication benefits' here refers to the extent to which a company perceives benefits directly from information exchange with its suppliers and customers. And 'supply chain compliance' here refers to the extent to which a company complies with its customers' requirements for logistics activities and quality control.

Supply Chain Compliance and Performance

Previous studies have revealed that customers and suppliers that comply with business partners' requirements, for example, in the area of logistics and quality, are likely to perform better. However, some of the findings are different or even conflicting in recent studies in the Chinese context. Lu (2007) studied the Chinese vegetable chain, and found that vegetable companies' compliance with buyers' delivery requirements had positive effects on quality and price satisfaction, on profitability, but not on efficiency, whereas companies' compliance with quality requirements had no significant effect on any of these aspects of performance. Adversely, Han (2009) found that the association between integrated logistics management and performance was not supported in the Chinese pork chain, but the relationship between quality management practices and performance was supported.

We suppose these conflicting results might come from a sector effect. To scrutinize the relationship between supply chain management and performance further, the present study examines the Chinese poultry chain, and distinguishes not only different aspects of chain compliance including logistics compliance and quality compliance, but also different aspects of performance including customer satisfaction, external efficiency, and profitability and competitive edge. Thus, we propose:

H_2: The level of supply chain compliance of a company is positively associated with the level of company performance.

Figure 1 presents the research conceptual framework:

Figure 1. The research conceptual framework.

Methodology

Data Collection and Study Population

The study domain is the poultry chain in the Mainland China. Given the vast geographic size of China, this study focuses on three regions: Beijing (the capital) and Hebei province located in Northern China; Shandong, an eastern coastal province; and Guizhou, a province located in South-west China. Comparatively, Beijing, Hebei and Shandong represent the more developed regions, whereas Guizhou is a less developed province.

First, to optimise the validity of the questionnaire items, valuable insights were obtained through a series of pilot interviews, literature study and pre-test survey (Straub, Boudreau, and Gefen 2004; Churchill and Lacobucci 2010). These not only helped to construct the final structured questionnaires, but also provided valuable information on the Chinese poultry sector and the distribution status of poultry firms in the sampling areas.

The survey was conducted between October 2008 and June 2009. The respondent companies were selected based on multistage cluster sampling. Although an overall list of the companies in the poultry chains was not available, three main criteria were used to select candidate companies in order to obtain a representative sample. These criteria include firm type (supermarket, restaurant, trader, processor, intermediary and commercial farm), firm size (mini, small, middle, large, and super and international), and administrative level of a location ((national and provincial) capital city, other city, and county). Table 4 shows the locations, administrative levels of locations and firm size of the respondent companies. Other principles employed to select respondent companies are as follows:

1. For a supermarket or a restaurant with more than one store, the survey was conducted only with its head store or one of its major stores. Most supermarkets have individual consumers as their major customers, thus, we only asked them to fill in the part of the questionniare concerning their most important suppliers. But for a few membership warehouses with organiations as their main customers, the researcher also asked them for information about their most important customers.

2. With regard to restuarants, though the whole population of restaurants is pretty huge, only those restaurants providing poultry as their sole or main products were targeted in this research. Meanwhile, the objective of this research is to examine inter-organizational information exchange, thus, we looked for those restaurants purchasing poultry products from organizations instead of those from individuals in wet markets.

Table 4. Locations, administrative level of a location, and firm size of the total sample: frequency (and percentage).

	Supermarkets	Restaurants	Traders	Processors	Intermediaries	Farms	Others[a]	All firms
Location								
Beijing & Hebei	9	28	15	14	11	12	2	91 (53%)
Shandong	5	2	2	4	3	3	-	19 (11%)
Guizhou	11	12	7	7	8	16	1	57 (33%)
Total	25	42	24	25	22	31	3	172 (100%)
Administrative level of the location								
(Provincial) capital city	6	35	21	11	10	11	3	97 (56%)
Other city	8	1	2	4	4	4	-	23 (13%)
County or town	11	6	1	10	8	16	-	52 (30%)
Total	25	42	24	25	22	31	3	172 (100%)
Firm size[b]								
Mini	2	28	24	10	21	23	2	110 (64%)
Small	8	10	-	5	1	7	1	31 (18%)
Middle	8	2	-	5	-	1	-	17 (10%)
Large	3	2	-	2	-	-	-	7 (4%)
Super & international	4	-	-	3	-	-	-	7 (4%)
Total	25 (15%)	42 (24%)	24 (14%)	25 (15%)	22 (13%)	31 (18%)	3 (2%)	172 (100%)

[a]'Others' refers to organizations of which the main activities include both scientific research and business transaction.

[b] Firm size is partly based on the "National Criteria to Divide Big-, Middle-, and Small-sized Enterprises" (National Committee of Trade and Economics of China [2003]143).

We did not try sending a post mail survey, because companies in China are not used to it. The targeted firms were contacted mainly through informants in organizations such as Supermarket/ Restaurant Associations, Administration Offices for Industry and Commerce, and Centers for Animal Disease Control and Prevention. These organizations provide administrative or support services, so have close business contacts with the targeted companies. Most of the targeted companies were willing to take part in the survey. This contributed to a response rate of over 90%.

To minimize response bias, we have targeted top and key managers as the respondents within each focal company. We asked each respondent to select their most important supplier and customer, and answer the questions related to their most important supplier and customer. The questionnaires, together with the instruction letters, were sent out by various measures according

to the preferences of the respondents. They were mostly sent out by e-mail to the supermarkets, and by fax or e-mail to the processors, intermediaries and farms. As for most of the restaurants and traders, printed questionnaires were taken to them by the researcher and research assistants. Each returned questionnaire was checked timely and carefully. When a questionnaire was found incomplete or confusing, the researcher called or visited the respondents to confirm their answers, in this way to make sure that the respondents understood the questions correctly and provided answers precisely.

Finally, 165 questionnaires were obtained for the company-supplier sample, with answers from respondent firms on the relationships with their most important suppliers. Meanwhile, 96 questionnaires were obtained for the company-customer sample, with answers from the respondent firms on the relationships with their most important customers.

Company Profile

The sample consists of 172 respondent companies, including 25 supermarkets, 42 restaurants, 24 traders, 25 processors, 22 intermediaries, 31 commercial farms and 3 other firms (Table 5). Two (membership) supermarkets having organizations as their most important customers have contributed not only to the customer sample but also the supplier sample. Other supermarkets and restuarants have individual consumers as their major customer, thus have contributed only to the customer sample.

Table 5. Firm type and numbers of the company-supplier (CS) and the company-customer (CC) samples.

	Supermarkets	Restaurant	Traders	Processors	Intermediaries	Farms	Others	All firms
The CS sample	25 (=2[a]+23)	42	23 (=21[a]+2)	24 (=20[a]+4)	22 (=20 [a]+2)	27 (=24[a]+3)	2 (=2[a]+0)	165 (=89[a]+74)
The CC sample	2 (=2[a]+0)	-	22 (=21[a]+1)	21 (=20[a]+1)	20 (=20[a]+0)	28 (=24[a]+4)	3 (=2[a]+1)	96 (=89[a]+7)
Total	25	42	24	25	22	31	3	172

Note. a.The number of the respondent firms that contribute to both samples.

Table 6 displays the profile of the respondent companies. It is shown that the average firm age was 8.8 years. The oldest organization, an institute with both breeding and selling chicken as main activities, was set up 52 years ago. The youngest organizations, including two restaurants and one farm, were set up just one year ago. The average ages of farms and restaurants are significantly younger than those of processors and the 'others'.

Table 6. Profile of the total sample on firm age, respondent position, and poultry types: number (and percentage).

	Supermarkets	Restaurants	Traders	Processors	Intermediaries	Farms	Others	All Firms
Firm age in years: (mean and S.D.)	8.04 (5.02)	6.95 (5.29)	7.17 (4.43)	10.32 (6.47)	9.64 (5.43)	6.84 (5.21)	28.67 (20.60)	8.77 (7.52)
Respondent Position								
- senior or key employee	24	38	20	20	18	28	3	151(88%)
- others	1	4	4	5	4	3	-	21 (12%)
Poultry Type								
- chicks only	-	4	12	12	12	16	2	58 (34%)
- ducks only	-	-	1	5	1	4	1	12 (7%)
- other poultry only	-	1	-	-	-	2	-	3 (2%)
- at least two types of poultry	25	37	11	8	9	9	-	99 (58%)
Total	25 (15%)	42 (25%)	24 (14%)	25 (15%)	22 (13%)	31 (18%)	3 (2%)	172 (100%)

As for the profiles of the respondents, the results show that 87.8% of the respondents of the survey were senior employees or key employees (there is often no specific senior employee in a small company except the owner). This indicates a high quality of respondents, who should have a clear understanding of what practices their organizations employ with regard to their most important customers and suppliers.

With regard to poultry types, most respondent companies (57.6%) were involved in at least two types of poultry, while the second largest group of firms (33.7%) were involved in chick products only.

Measurements and Data Analysis Method

Grounded on previous studies, perceived communication benefits was operationalized with two constructs, including 'perceived communication benefits for buyers' and 'perceived communication benefits for suppliers'. Supply chain compliance was operationalized with 'logistics compliance' and 'quality compliance'. And company performance was operationalized with 'custermer satisfaction', 'external efficiency', and 'profit & competitive edge'. Appendix 1 presents a summary of these constructs and measurement items.

To analyze the data and test the hypotheses, partial least squares (PLS) path modeling technique was employed. Following Chin (1998b), we ran bootstrapping[1] with 500 resampling.

PLS path modeling is a type of structural equation modeling (SEM) technique. Supply Chain Management reserach very often involves an analysis of relationships among latent variables (LV). The advent of SEM techniques allowed social scientists to perform path analytic modeling with LV, and to stimultaneously examine theory and measures. This in turn has led some to describe this aproach as an example of 'a second generation of multivariate analysis' (Fornell 1987, : 408). Nowadays, SEM techniques are the most applied and consolidated means of testing relations and causality in the field of management information systems (e.g. Pavlou and Chai 2002; Dibbern et al. 2004), buyer-supplier relationships (e.g. Claro 2004), and marketing resesarch (e.g. Steenkamp and Trijp 1991; Malhotra, Peterson, and Kleiser 1999).

There are two distinct families of SEM techniques: (1) the covariance-based SEM techniques, as represented by LISREL and AMOS; and (2) the component-based SEM techniques, also known as variance-based techniques, of which PLS modeling is the most prominent representative (Chin 1998b). Applying PLS modeling has some advantages over covariance-based SEM tools (Chin 1998b). The main characteristics of PLS path modeling, which have increased its popularity within the research community and motivated our choice in this study, include (Henseler, Ringle, and Sinkovics 2009):

1. PLS path modeling delivers LV scores, i.e. proxies of the constructs, which are measured by one or several indicators, namely, manifest variables (MV).

2. PLS path modeling avoid small sample size problems and can therefore be applied in some situations when other methods cannot (Chin and Newsted 1999).

3. PLS path modeling can estimate very complex models (i.e. models consisting of many LV and MV) without leading to estimation problems (Wold 1985).

4. PLS path modeling makes less stringent assumptions about the distribution of variables and error terms (Fornell 1982, 443; Bagozzi 1994); however, it does not make less stringent assumptions about the representativeness of the sample.

5. PLS path modeling can handle both formative measurement models and reflective ones (Chin 1998a; Diamantopoulos and Winklhofer 2001). Although the inclusion of formative measures in covariance-based SEM has been well documented (Jöreskog and Goldberger 1975; MacCallum and Browne 1993), analysts usually encounter identification problems.

6. PLS path modeling is methodologically advantageous to covariance-based SEM whenever improper or non-convergent resutls are likely to occur (i.e. Heywood cases; see (Krijnen, Dijkstra, and Gill 1998).

[1] Bootstrap is nonparametric approach to estimate the precision of the PLS estimates (Chin 1998). The general approach is to resample with replacement from the original data set. Parameter estimates are calculated for each instance, and the variation in the estimates are analysed. For details about bootstrap, see Efron and Gong (1983).

Empirical Results

Descriptive Statistics

Table 7 lists the means and standard deviations for each construct, calculated based on unweighted observed variables. Recalling that the observed indicators of perceived communication benefits and of supply chain compliance are measured using a 5-point Likert scale, ranging between 1 for 'not agree at all' and 5 for 'totally agree', the means being all above 3 indicate that the respondents agree with the relevant statements with regarding to perceived communication benefits and supply chain compliance. Meanwhile, the observed indicators of performance are measured using a 7-point Likert scale, ranging between 1 for 'not agree at all' and 7 for 'totally agree'. Thus, the means being all above 4 indicates that the respondents agree with the relevant statements with regarding to performance.

Table 7. Construct mean and standard deviations (S.D.) for the respondent companies in relationships with their most important suppliers and customers.

The Company-Supplier Sample			**The Company-Customer Sample**		
Constructs	*Mean*	*S.D.*	*Constructs*	*Mean*	*S.D.*
1. Perceived communication benefits for the companies	4.08	.70	1. Perceived communication benefits for customers	4.18	.71
2. Perceived communication benefits for the suppliers	4.18	.67	2. Perceived communication benefits for the companies	4.16	.59
3. Logistics compliance	4.30	.65	3. Logistics compliance	4.57	.49
4. Quality compliance	***4.17***	.63	4. Quality compliance	***4.46***	.56
5. Satisfaction	5.93	.91	5. Satisfaction	5.96	.82
6. Efficiency	5.44	1.23	6. Efficiency	5.50	1.27
7. Profit & competitive edge	5.42	1.23	7. Profit & competitive edge	5.43	1.23

Note. The mean of quality compliance (**bold** and *italics*) of the company-supplier sample is significantly different from that of the company-customer sample.
Construct 1-4 are measured using a 5-point Likert scale, and construct 5-7 using a 7-point Likert scale.

The respondent companies from the two samples reported similar scores for most of the constructs except for 'quality compliance'. Thus results seem to reflect that the surveyed companies have similar opinions concerning perceived communication benefits for themselves, perceived communication benefits for their suppliers and customers, logistics compliance and satisfaction. Thus, we can summarize the following in general.

The respondent companies tended to believe that the communication with their most important suppliers had produced high and almost equal benefits for themselves and for their main suppliers. Meanwhile, they tended to believe that the communication with their most important customers had also produced high and almost equal benefits for themselves and for their most important customers. These benefits obtained from communication had supported them in practices including problem resolution, quality control, timely and precise delivery, and pricing decisions. The results seem to prove that it might be advantageous for both a company and its

main customers, and for both a company and its main suppliers, to invest heavily and more or less equally in information exchange with each other.

The respondent companies were of the opinion that their main suppliers had complied well with their logistics and quality requirements. Meanwhile, the respondent companies tended to believe that they themselves had also complied well with their customers' logistics and quality requirements.

Companies in the chain were satisfied with their performance compared to their main competitors in the last twelve years. Specifically, they were satisfied with the product quality of and the prices paid to their suppliers. They had paid less money and had taken less time, thus they had realized higher (external) efficiency in the transactions with their main suppliers and customers. Further, they tended to believe that they had achieved better performance, compared to their main competitors in the last twelve months in terms of profitability, sales growth rate, and overall competitive edge.

Of particular interest is that the company-supplier sample has scored significantly lower than the company-customer sample for suppliers' compliance with customers' quality requirements. This might reflect that, although the companies have complied well with customers' quality requirements in general, they do not comply as well as that their customers think they should have. This finding is a valuable warning for companies in the Chinese poultry chain to pay more attention to improving their chain quality compliance, and to make sure that they do meet their customers' quality requirements and expectations.

Validity and Reliability of Measures and Constructs

We identified the constructs in the present study as reflective constructs, by following the four primary decision rules stated in (Jarvis and MacKenzie 2003) and based on insights obtained from the field research. Then, we examined content validity, discriminant validity, and nomological validity. Meanwhile, we also checked item multicollinearity for all of the constructs.

The content validity is based on the literature and further confirmed by experts, officers, and practitioners during interviews and the pre-test (Straub, Boudreau, and Gefen 2004). All of the correlation coefficients between the variables are well below the common cut-off of 0.8. This proves the discriminant validity, thus we can employ all of these constructs in one model. The nomological validity has been confirmed by estimating the structural equations in our theoretical models (Churchill 1979; Steenkamp and Trijp 1991). A number of significant relationships have been found between the constructs (see Figure 2) as they should be (Bollen and Lennox 1991).

To assess item multicollinearity, Pearson correlation has been applied to pairs of items of each constructs. The only problem found was that the correlation coefficients between 'market share' and 'overall competitive edge' for both the company-supplier and the company-customer samples are slightly higher than the threshold value of 0.80. Thus, the item of 'market share' has been dropped. As for all other constructs, the correlation coefficients lie well below the threshold

of 0.8, which exhibit no problem of item multicollinearity (Malhortra, Peterson, and Kleiser 1999; Diamantopoulos and Winklhofer 2001).

Relationship between Perceived Communication Benefits and Company Performance: The Mediating Effect of Supply Chain Compliance

The structural equation model on the influence of perceived communication benefits on company performance was tested by PLS path modelling. Figure 2 and 3 presents the results of the Communication-compliance-performance Model for companies in relationships with their most important suppliers and with their most important customers respectively. The overall model explains about 25.7% of the variance of the endogenous latent variables for the company-supplier sample and about 20.9% for the company-customer sample. This indicates that a satisfactory model fit is obtained for each sample. PLS provides standardised path coefficients, so we can compare the direction and the magnitude of the impacts based on the path coefficients.

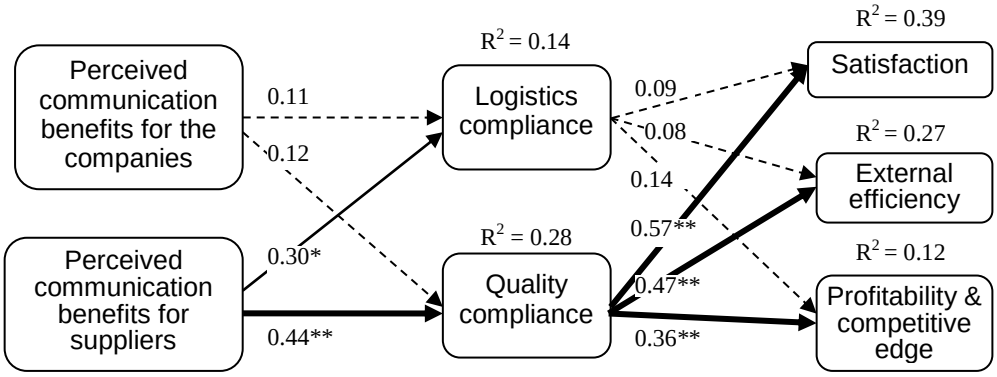

Figure 2. The Relationships in the Communication-Compliance-Performance Model for the Company-Supplier (CS) sample (N=165).

Note. **being significant at $p < 0.01$ level; * being significant at $p < 0.05$ level.
Dotted lines show the tested relationships being *not* significant.

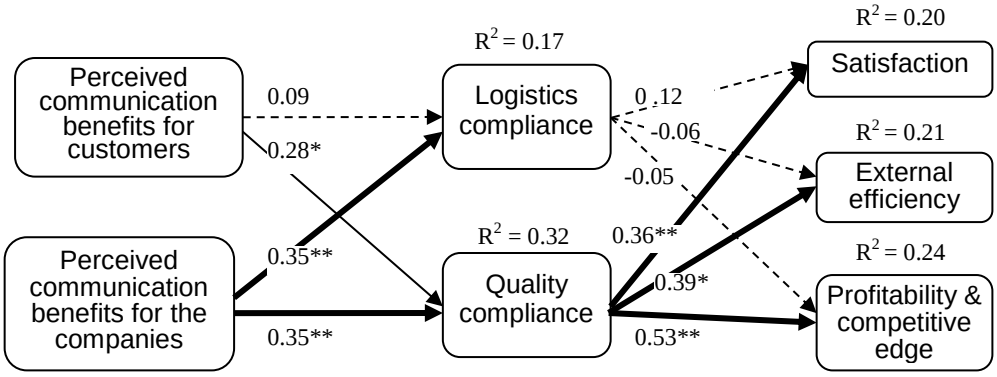

Figure 3. The Relationships in the Communication-Compliance-Performance Model for the Company-Customer (CC) sample (N=96).

Note. **being significant at $p < 0.01$ level; * being significant at $p < 0.05$ level.
Dotted lines show the tested relationships being *not* significant.

When looking at the relationships between 'perceived communication benefits' and 'supply chain compliance', it appears that 'perceived communication benefits for buyers' and 'perceived communication benefits for suppliers' have different influences on 'supply chain compliance'.

For a company in relationships with its most important suppliers, communication benefits obtained by the company (as the buyer) were not significantly associated with its suppliers' compliance with its requirements. But communication benefits obtained by its suppliers were positively and significantly associated with the suppliers' compliance with the company' logistics and quality requirements. These results reflect that when a company communicates with its main suppliers, the benefits obtained by its suppliers are likely to help these suppliers to comply better with its logistics and quality requirements. Thus, it makes sense for a company to help its main suppliers to really benefit from the information exchange, if the company intends to improve its suppliers' compliance with its requirements.

For a company in relationships with its most important customers, the communication benefits obtained by its customers do not necessarily help the company to comply better with the customers' logistics requirements; however, they are likely to help the company to comply better with the customers' quality requirements. Meanwhile, the communication benefits obtained by the company itself are likely to help it to comply better with the customers' logistics and quality requirements. Thus, it makes sense for a company to ensure not only itself, but also its main *customers* to really benefit from the information exchange, if the company intends to improve its compliance with its customers' requirements.

Based on the above empirical proofs from the buyer and the supplier sides, we may draw an important conclusion that it makes sense for a company to help not only itself, but also its important suppliers and customers to really realize benefits from their mutual information exchange. In this way, the company is likely to improve its suppliers' compliance with its requirements and its own compliance with its customers' requirements.

When looking at the relationships between 'supply chain compliance' and company 'performance', we can see from Figure 2 that for a company in relationship with its main suppliers, its suppliers' logistics compliance does not necessarily influence its performance; however, its suppliers' quality compliance is likely to improve each aspect of its performance. Similarly, we can see from Figure 2 that for a company in relationship with its main customers, its logistics compliance does not necessarily influence its performance; however, its quality compliance is likely to improve each aspect of its performance in term of customer satisfaction, external efficiency, profitability, and overall competitive edge. Thus, another valuable finding is that it appears that it is a company's main suppliers' compliance with its quality requirements, and its own compliance with its customers' quality requirements, rather than logistics compliance, that make the company stand out from its main competitors.

Here logistics compliance does not yet show its potential value in improving company performance. A likely explanation is that there is limited implementation of logistics management in the Chinese poultry chain. Another possible reason is that logistics compliance does not necessarily make a company stand out from its main competitors, though it might

contribute to the improvement of company performance to certain extent. This would be worth examining further in future research.

When looking at the relationships between 'perceived communication benefits' and company 'performance', the results of total effects estimation show that for a company in relationships with its main suppliers, the communication benefits obtained by the company itself (the buyer) are not significantly associated with its company performance. However, the communication benefits obtained by its main suppliers are likely to make it stand out from its main competitors in satisfaction, external efficiency, profitability, and competitive edge. Similarly, the results of total effects also show that for a company in relationship with its main customers, the communication benefits obtained by its customers are not significantly associated with its performance. However, the communication benefits obtained by the company (the supplier) are likely to make it stand out from its main competitors in customers' satisfaction.

Thus, we may draw a valuable conclusion as: communication benefits obtained by suppliers are likely to make themselves and their main customers stand out from their main competitors. Differently and notably, the communication benefits obtained by buyers do not necessarily make themselves or their main suppliers stand out from their main competitors, though such benefits might help to improve their own and their suppliers' performance to certain extent.

Buyers are often with higher marketing and negotiation powers than their suppliers. They tend to less actively comply with their suppliers' requirements while their suppliers tend to more actively comply with their requirements. However, the above results indicate that it is valuable for a buyer to actively help its main suppliers to realize benefits from their information exchange.

Effect of Company Characteristics on the Relationships between Information Exchange Benefits and Performance

To explore the effect of company characteristics on the relationships between information exchange benefits and performance, five control variables were then added to each endogenous construct in the Communication-compliance-performance Model. They are company size, company age, company type[2], quality standard implemented[3], and administrative level of a location[4]. Other parts and paths of the model remained as the same. The overall model explains about 31.1% of the variance of the endogenous latent variables for the company-supplier sample, and 34.0% for the company-customer sample.

The results show a company's characteristics are likely to influence in one way or the other how well it is likely to comply with the requirements of its main customers, and how well its comparative performance is likely to be achieved (Table 8). However, they do not necessarily

[2] Company type is modelled as a dummy variable: with 1 for companies having trading activities as main functions, being closer to end markets and with more market power; and 0 for companies having production activities as main functions, being farther from end markets and with less market power.

[3] Quality standard implemented is represented by the highest quality standard adopted by a company.

[4] Administrative level of a location is an ordinal variable: with 1 for town or county, 2 for other cities, and 3 for national or provincial capital cities.

change the significance of the relationships between the constructs in the model that is presented in Figure 3. Thus, we conclude that the results of the relationhsips between perceived communication benefits, supply chain compliance and performance found in this study are likely to be tenable for different companies with different characteristics.

Table 8. The significant effect of company characteristics on supply chain compliance and performance.

	The Company-Supplier Sample					**The Company-Customer Sample**				
	size	age	type	quality	location	size	age	type	quality	location
Logistics compliance							-	+		
Quality compliance				-		+				
Satisfaction					-†				-	-†
Efficiency					-†				-	-†
Profit & competitive edge			-†					-†		

Notes. a. The company characteristics examined are: company size, company age, company type, quality standard implied, and the administrative level of a location. Specifically, company type: 0 = production firms with lower market power; 1 = trading firms with higher market power. Administrative level of a location: 1 = town or country, 2 = medium-sized city; 3 = national or provincial capital city.
b.† The path coefficients being significant for both the company-supplier and the company-customer samples at $p<0.05$ level.

In general, the size, business age, and type of a company do not necessarily affect how well its suppliers are likely to comply with its logistics or quality requirements, but are likely to influence how well it is likely to comply with the logistics or quality requirements of its main customers. Meanwhile, the type, the highest quality standard employed, and the administrative level of the location of a company are likely to influence the level of each aspect of its performance compared to its main competitors.

For both the company-supplier and the company-customer samples, company type has interestingly shown negative and significant effects on 'profit & competitive edge'. A trader or a retailer is likely to report a lower level, whilst a commercial farm or a processor is likely to report a higher level of profitability and competitive edge, compared to its main competitors in the last twelve months. The survey was conducted during the Financial Crisis (2008-2009). The researcher noticed that retailers complained about their sheer reduced sales due to the Financial Crisis, especially those in the eastern and coastal advanced regions in China. This result might therefore reflect the fact that traders and retailers, who normally sell multiple types of products, were confronted with higher challenges in sales than before, and thus tended to be pessimistic and score lower on their performance. Conversely, commercial farms and processors of poultry products, a type of basic consumption product, did not experienced much higher challenges in sales than before, and thus tended to be optimistic and score higher on their performance comparatively.

In constrast to our expectation, for both the company-supplier and the company-customer samples, the administrative level of a location has shown negative effects on performance including satisfaction and external efficiency. This might imply that a company located in a smaller city is likely to be more satisfied with the product quality of and the price paid to their main suppliers, and is likely to make its main customers feel more satisfied. Meanwhile, it is likely to spend less money and less time, thus be more externally efficient in the transactions with its main suppliers and customers. A likely explanation is that most production companies are located in small towns or cities because of lower costs and the environment protection policy. As mentioned above, they deal with poultry products, a type of basic consumption product. Therefore, they did not experience higher challenges during the Financial Crisis than before, and tend to make a positive assessment of their performance comparatively. However, most trading companies are located in middle or large cities being important end markets. They normally deal with multiple products including luxury goods. Therefore, they faced more challenges during the Financial Crisis than before, and tend to make a pessimistic assessment of their performance. However, there might have been unexpected effects of the Financial Crisis that were not measured in this study. To explain these findings, further research will be necessary.

Of particular interest, when a company employs a higher level of quality standard, it tends to be stricter and unsatisfied with its suppliers' compliance with its quality requirements. Meanwhile, possibly due to increased costs, higher prices and more negotiation, it is likely to suffer a lower level of customer satisfaction and a lower level of external efficiency. These findings might imply that companies and consumers in the Chinese poultry chain are more sensitive to product price than product quality. These might also reflect and explain why there is so little motivation for players in the Chinese food chain to improve food quality. This finding is a warning that new or adjusted food policy is needed to stimulate the self-motivation of the companies to employ higher levels of quality standards.

For companies in relationships with their customers, a larger firm is likely to comply better with the quality requirements than a smaller firm, but does not necessarily comply better with the logistics requirements of its main customers. A likely explanation is that a larger company is able and willing to invest to comply better with the quality requirements, in order to safeguard its long-term reputation and markets; Meanwhile, the logistics compliance has limited implementation and is still in its early stages, and this situation holds true for both small and large firms in the Chinese poultry chain.

For companies in relationships with their customers, company age has shown to be negatively associated with logistics compliance. A younger firm is likely to comply better with the logistics requirements of its main customers. A likely explanation is that chain logistics management is a relatively new practice in Chinese food chains. It might be harder for an old firm to change its old operation habits.

Company type has shown to be positively associated with logistics compliance. This might reflect that compared to a commercial farm or a processor, a trader or a retailer being closer to end markets is likely to comply better with its customers' logistics requirements. This finding is a warning for farms and processors which also have to produce and transport products to customers. They should particularly pay attention to improve their knowledge and practices in

logistics management, and in turn they might obtain particularly huge development space and competitive advantage.

Conclusions

This paper intends to reveal the relationship between perceived communication benefits and company performance, the mediating role of supply chain compliance on this relationship, and the difference for buying companies and suppliers.

This paper has proposed a Communication-compliance-performance Model (see Figure 2 and 3), which is composed of three man parts: perceived communication benefits, supply chain compliance, and company performance. The model can be used to understand, examine, and assess how communication benefits obtained by companies and by their suppliers/buyers help to improve supply chain compliance, and further contribute to better performance for the company and for its suppliers and buyers.

Another theoretical contribution of this paper is its extension of existing research on the value of information exchange. This paper appears to be the first to propose and examine the benefits of information exchange for buyers (i.e. perceived communication benefits for buyers) and for suppliers (i.e. perceived communication benefits for suppliers) respectively, and further to distinguish their different influence on different aspects of company performance. Previous studies often equate the value of information exchange with company performance, or often examined the relationships of information exchange with limited aspects of performance. However, we assume company performance might not be a direct but rather partly an indirect result of information exchange, and company performance itself is a broad concept covering diverse aspects.

Thus, we hereby checked the relationship between the direct benefits of information exchange (i.e. perceived communication benefits) and the indirect results of information exchange (i.e. company performance). The results of this study support that perceived communication benefits and company performance are two different constructs and could be checked in one model. Therefore, we call future research to distinguish between the direct benefits of information exchange and company performance.

Meanwhile, we examined the mediating effects of supply chain compliance on this relationship by taking the insights of Supply Chain Management. The results support the significant and positive mediating effect of quality compliance on the relationship between perceived communication benefits and company performance. However, the expected mediating effect of logistics compliance is not supported here. We call future research to check the potential mediating effect of logistics compliance in other chains in China or in the West.

In general, the most important findings are: (1) Communication benefits obtained by a company are likely to help the company and its main suppliers to improve compliance in a chain. (2) Communication benefits obtained by a company and its improved compliance with its customers' quality requirements jointly lead to better performance for the company and for its main customers. (3) A company' compliance with its main customers' quality requirement is a

key to improve the performance of the company and of its customers. (4) In contrast to our expectation, a company's compliance with its main customers' logistics requirements here is not significantly linked with company performance. This might reflect the fact that there is limited implementation of logistics compliance and this holds true for both small and large companies in the Chinese poultry chain.

This paper also contributes to the extension of our knowledge on the effects of company haracteristics on the interrelationships between perceived communication benefits, supply chain compliance, and performance. An important finding is that the five company characteristics are likely to affect the levels (magnitude) of supply chain compliance and performance, but do not necessarily change the interrelationships between perceived communication benefits, supply chain compliance, and performance. Thus, the interrelationships between perceived communication benefits, supply chain compliance and performance that were revealed in this study (see Figure 2 and 3) are likely to be tenable for different companies with different characteristics.

Managerial and Food Policy Implications

Based on the major findings of this study, we draw the following managerial implications. First, in order to advance from realizing potential communication benefits to standing out from its main competitors, a company should not only commit to realizing the potential communication benefits for itself, but also commit to helping its main suppliers and customers realize the potential benefits as well.

In practice, some companies are unwilling to share information or they only share under ressures from business partners. Some companies doubt the value of information communication compared to the financial, physical and human costs. Some are afraid that information provided to their customers or suppliers may be abused and place their organizations at a competitive disadvantage (Fawcett et al. 2007). However, what managers can learn from this study and should always bear in mind that it is not only the communication benefits obtained by a company itself, but also those by its main suppliers and customers that make it stand out from its main competitors. When a company's main suppliers obtain communication benefits, they can comply better with the company's logistics and quality requirements; and when the company's main customers obtain such benefits, they can help the company comply better with their quality requirements, thus significantly contribute to the company's performance ultimately.

Second, a company should pay great attention to quality management in its supply chain. It should commit to ensuring that its main suppliers comply well with its own quality requirements, and also ensuring that it complies well with its customers' quality requirements. These will jointly make it stand out in performance compared to its main competitors.

Third, for Chinese poultry managers aiming to achieve better performance than their main competitor, learning to improve their own logistics compliance and that of their suppliers' appears to be a great challenge but a huge potential opportunity for further performance improvement.

Fourth, by examining the influence of company characteristics, we find that the level of supply chain compliance and company performance should be evaluated on the basis of company characteristics. By cross-checking with their main counterparts and competitors with similar characteristics, a company could have a clearer understanding of how well it has performed in the area of supply chain compliance and company performance.

For food policy makers, explicit attention should be paid to how to improve the self-motivation of food companies to implement quality standards. The results of this study indicate that companies adopting higher quality standards are likely to suffer from lower customer satisfaction and lower external efficiency. This might imply that there is no much motivation in the Chinese poultry chain to adopt higher levels of quality standards. And this lack of self-motivation might be a main reason why food quality incidents happen more frequently in China than in the developed countries.

Thus, an important means of solving the food quality problem might be to facilitate companies' self-motivation to adopt quality standards by adjusting the trade-off that is brought by the quality standards. Particularly, it might be valuable to carry out relevant food policy that encourages retailers to adopt high quality standards. In the face of very powerful retailers, food production companies and logistics companies are likely to comply with the retailers' increased quality requirements.

Limitations and Future Research

First, it is worth remarking that the main findings and conclusions of this study are based mainly on the poultry chain in Mainland China. In general, they may be valuable for other non-highly integrated meat chains. However, some of these conclusions should be carefully examined if they are to be generalized to non-meat chains or highly integrated chains in the developed countries. For instance, the expected positive association between logistics compliance and performance was neither supported in the Chinese poultry chain in this study, nor in the Chinese pork chain (Han, Trienekens, and Omta 2009), however, was found in the Chinese vegetable chain (Lu et al. 2007). Therefore, we expect that the positive association between logistics compliance and performance might not exist in other Chinese meat chains, but might exist in the Chinese fruit chain which has similar logistics requirements to the vegetable chain, and might exist in food chains in the West. Thus, we also assume that it would be valuable to conduct a comparative study in the future between the non-highly integrated food chains in China and the highly integrated food chains in the West.

Second, this study focused on the relationships between companies and their most important suppliers, and their most important customers. However, we assume that the information and compliance relationships between companies and their less important business partners might take on a different picture. Based on the polarization of power and benefits, there might be more bargaining than collaboration between companies and their less important business partners. And managers have to think more carefully about the trade-off between benefits and costs of communication and chain compliance, and adjust their communication and compliance strategy based on the trade-off. Thus, we call for future research on the communication and compliance of companies with their less important customers and suppliers, which is absent from the

literature. Third, this study has examined the mediating effect of supply chain compliance on the relationships between perceived communication benefits and performance. However, the mediating effect of logistics compliance was expected but not supported in this study. Additionally, there should be diverse ways tha`t information exchange leads to performance. Therefore, we call future research to study the mediating effects of logistics compliance and other variables (such as governance structure) on the relationships between perceived communication benefits and performance.

Fourth, the results of this study reveal that some differences exist between buying companies and suppliers with regard to information exchange. This is reasonable considering that buying companies and suppliers have different functions and often different market and negotiation powers. Thus, we call for more dyadic study on supply chain information management in the future.

Acknowledgements

The authors wish to thank the two anonymous reviewers, the managing editor, and the executive editor of IFAMR for their valuable comments and encouragement. Our gratitude also goes to the Chinese poultry chain actors who shared their insights with us. The first author sincerely appreciates the research project fund from Wageningen University and Netherlands Organization for International Cooperation in Higher Education (project nr. 2100842400, contract nr. CF4661).

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Appendix. Measurements and Constructs

Note: each company was asked to select its most important supplier and customer of poultry product, and to answer the following questions related to the selected supplier and customer.

Perceived communication benefits

(5-point Likert scale, from '1 = totally disagree' to '5 = totally agree')

Perceived communication benefits for buyers **(BenefitB)**

We (our most important customers) get information from our most important supplier (us), which supports us (it) directly in:

BenefitB 1: Problem resolution
BenefitB 2: Product quality control
BenefitB 3: Timely and precise delivery
BenefitB 4: Product price decision

Perceived communication benefits for suppliers **(BenefitS).**

We (our most important supplier) get information from our most important customers (us), which supports us (it) directly in:

BenefitS1: Problem resolution
BenefitS 2: Product quality control
BenefitS 3: Timely and precise delivery
BenefitS 4: Product price

Supply Chain Compliance

(5-point Likert scale, from '1 = totally disagree' to '5 = totally agree')

Logistics compliance **(LC)**

LC1: Our most important supplier (We) delivers products timely and precisely to us (to our most important customer).

LC2: Our most important supplier (We) packages products according to the requirements of us (our most important customer).

Quality compliance (QC)

QC1: Our most important supplier (We) will help us (our most important customer) if we (they) meet quality problems or troubles.

QC2: Our most important supplier (We) provides products which fit quality requirements of us (our most important customer).

QC3: Our most important supplier (We) provide products with better quality than its (our) major competitors.

Firm Performance

(7-point Likert scale, from '1 = totally disagree' to '7 = totally agree')

Satisfaction (Satis)

Satis1: We (Our most important customer) are satisfied with the product quality of our most important supplier (us).

Satis2: We (Our most important customer) are happy with the price paid to our most important supplier (us).

Efficiency (Effi)

Effi1: It costs us less money when we purchase (sell) poultry from our most important supplier (to our most important customer).

Effi2: It costs us less time to finish an order with our most important supplier (customer) than with others.

Profit & Competitive edge (P&C)

Comparing to our main competitors in the last 12 months, we achieved better business of poultry products in term of:

P&C1: Profitability.
P&C2: Sale growth rate.
P&C3: Market share. (Dropped)
P&C4: Overall competitive edge