

Quality management and self regulation in Dutch agri-food supply chains

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Abstract

This study investigates the impact of the business environment, specific investments, use of ICT, management support and commitment on the integration of quality management of firms with their suppliers and buyers. The study was carried out in the Dutch poultry meat chain, fruit and vegetable chain and flower and plant chain. Also the impact of integration of quality management on the two main dimensions for effective compliance behaviour, commitment and enforcement is investigated. These dimensions were derived from the 'Table of eleven', a tool developed by the Dutch Ministry of Justice, to evaluate efforts of compliance with regulations. In addition, the effect of integration of quality management, commitment and enforcement on the growth of revenues and buyer satisfaction about quality is studied. The objective is to investigate whether self regulation could be effectively established in agri-food supply chains and especially to what extent self regulation is affected by the business environment of these chains. According to the findings, self regulation can be successful, because the business environment fosters a strong integration of quality management to which firms are committed and in case of non-compliance firms have effective sanction possibilities. Moreover strongly integrated chains lead to more buyer satisfaction about quality performance of suppliers and more growth of revenues. Structural Equation Modelling was used to test the measurement model, structural model and hypotheses. Future research will focus on differences between groups of firms and juridical aspects of self regulation for quality assurance in the selected chains.

Introduction

Today firms in agri-food supply chains find themselves in turbulent, uncertain and fast changing business environments. During the last decade, concerns about quality have been raised among consumers due to several sector wide crises like the BSE crisis, dioxin crisis, classical swine fever and hoof and mouth disease. Crises occurring in agri-food sectors are often broadly reported in the media. Mass media and specialised publications propagate an evaluation of firms' quality performance to the public (Frombrun and Shanley, 1990) and have an impact on how consumers think about the assurance of quality (Van Kleef et al., 2006). National and international governmental agencies also react on the crises by setting up regulations and legislation in the area of quality and safety of agri-food products. For example the European Union introduced the General Food Law in January 2005 which obligated firms to trace back and forward their products. The crises have also increased the awareness of the

(negative) side effects of bio-industrial production. In showing their responsibility to the society, firms will have to comply with legislative demands for quality and safety of their products at least, but firms often impose even more stringent requirements as being obligated by law on each other. By doing this, they could obtain a positive image in business and to a wider extent in society. Attaining this kind of corporate social responsibility fosters communication, trust, openness and knowledge sharing in the chain, requirements which are also necessary for the achieving consumer demands (Cooper and Ellram, 1993; Lambert et al., 1998). Nowadays consumer demands are increasingly becoming the primarily driver in production chains, which is reflected in the buyer focus of many quality systems (Anderson et al., 1994). To safeguard the consumers quality requirements, quality management systems rely on documentation of production processes, third party auditing and certification (Jahn et al., 2004) placing strong requirements on gathering, storing, processing and transfer information between the firms in the chain.

It is expected that those increasing pressures from the business environment will result in an increased attention to quality issues in international agri supply chains. Quality is becoming an integral element of most farmers', wholesalers' and retailers' business strategies (Antle, 1999). Integration of processes for quality assurance seems to be the best strategy to deal with external pressures, because no individual firm is able to handle these complex demands on its own (Omta et al., 2002). In order to comply with quality requirements from other firms in the chain, firms often have to invest in specific equipment and training of personnel, which accelerate the integration of quality management, because integration with the buyers is an effective mean to safeguard the specific investments being done by the suppliers.

Within these relationships ICT is of paramount importance, because systematic and regular receiving of in-process and final inspection data of quality systems at every stage of the supply chain is extremely important to assure the quality of products. Often integration of information is the start for successful integration of supply chains (Hill and Scudder, 2002; Lambert and Cooper, 2000; Swartz, 2000). The enormous development of ICT tools facilitate closer co-operation by eliminating significant barriers that existed between the many independent actors in the supply chain before (Cramer, 2004; Matopoulos et al., 2004; Van der Zee, 2004).

Successful implementation of quality management systems also requires effective change in organisational culture which is almost impossible without concentrated management support (Kaynak, 2003; Van der Spiegel, 2004). The management of firms could show their support by establishing both organisational and technical systems to communicate internally and externally about their quality performance in order to improve the communication with stakeholders such as consumers and governance (Beulens et al., 2003).

Moreover for the success of the integration of quality management, firms are searching for partners in the chain that show commitment to their to quality requirements. Buyers identify commitment among suppliers in the chain as a key to achieving valuable outcomes for themselves and want to maintain this attribute in their relationships. Therefore affective commitment has a positive impact on the desire to continue the relationship between firms in the chain. This will result in long-term relationships in which firms believe the relationship is worth working on (Morgan and Hunt, 1994).

However concerns have been raised about the burdens (especially administrative) being placed on the firms, because at the moment compliance with and monitoring of both private and public regulations for quality in agri-food supply chains are carried out simultaneously. In order to reduce these burdens, nowadays the Dutch government strives to specify the objectives and conditions for firms to fulfil a certain policy and should not longer use a 'command and control' approach. This phenomenon is known as self regulation, which is also know in literature as self-enforcing', 'self-governance' and 'self-organising' (King and Lenox, 2005). Integration of quality management in agri-food supply chains is very advantageous for self regulation, because the government could align their information needs on existing information and communication streams that firms use for their own purposes (LNV, 2004).

Firms increasingly respond to these tasks by adapting (private) quality management systems in which firms asks their suppliers and sometimes even their buyers to comply with certain regulations (Freriks, 2006). Buyer or supplier requirements have been increasingly adapted in agricultural chains especially by retailers as the demanding firms which can also be regarded as a form a self regulation (Andrews, 1998; Baarsma et al., 2003). Never before guaranteeing quality has been such a strong incentive for the integration and cooperation in agri-food chains.

The integration of quality management between firms in the chain together with commitment and enforcement is regarded as a self regulation system in this study. The two dimensions commitment (level of spontaneous compliance) and enforcement (effectiveness of maintenance to legislative demands) represent the two main dimensions of compliance behaviour of the ‘Table of eleven’, a tool developed by the Dutch Ministry of Justice (www.it11.nl).

Problem statement

Agri-food chains are embedded in their business environment and are facing many requirements with regard to quality of their products. At the moment it is unknown if the increasing pressures from the business environment have an effect on the integration of quality management in agri-food supply chains and if in relationships with stronger integrated quality management higher levels of self regulation behaviour could be obtained. In addition, the effects of more integrated quality management and higher levels of self regulation on buyer satisfaction and growth of revenues of the firm are unknown. Also other important determinants for integration of quality management in these chains like specific investment of suppliers for complying with requirements of buyers, management support towards quality and the role of the use of ICT on the integration of quality management in the chain are investigated. Within this study these problems are addressed from both the supplier and buyer side of the focal firm¹.

Research questions

The central research question in this study is:

To what extent has external pressure from the business environment an impact on the integration of quality management in agri-food chains and to what extent is effective self regulation of quality assurance possible in these chains?

For adequately answering this research question, four sub-questions were formulated:

1. Is the level of integration of quality management of the focal firm with its suppliers and buyers affected by external pressures from the business environment on focal firms in agri-food chains?

¹ Focal firms are firms where research had been conducted or had filled out the questionnaire.

2. Is the level of integration of quality management of the focal firm with its suppliers and buyers affected by the level of specific investments for quality assurance, management support for quality, commitment to quality requirements and use of ICT in agri-food supply chains?
3. Are the levels of compliance behaviour (commitment and enforcement) affected by the level integration of quality management of a firm with its suppliers and buyers in agri-food supply chains?
4. Is growth of revenue of the focal firm and satisfaction of the buyer about the quality performance of suppliers affected by the level of integration of quality management and the level of compliance behaviour (commitment and enforcement) in agri supply chains?

Theoretical/Research model

In Figure X.X. the research questions that are proposed above are adapted into a number of hypotheses together with their expected effects. The hypotheses will be derived below

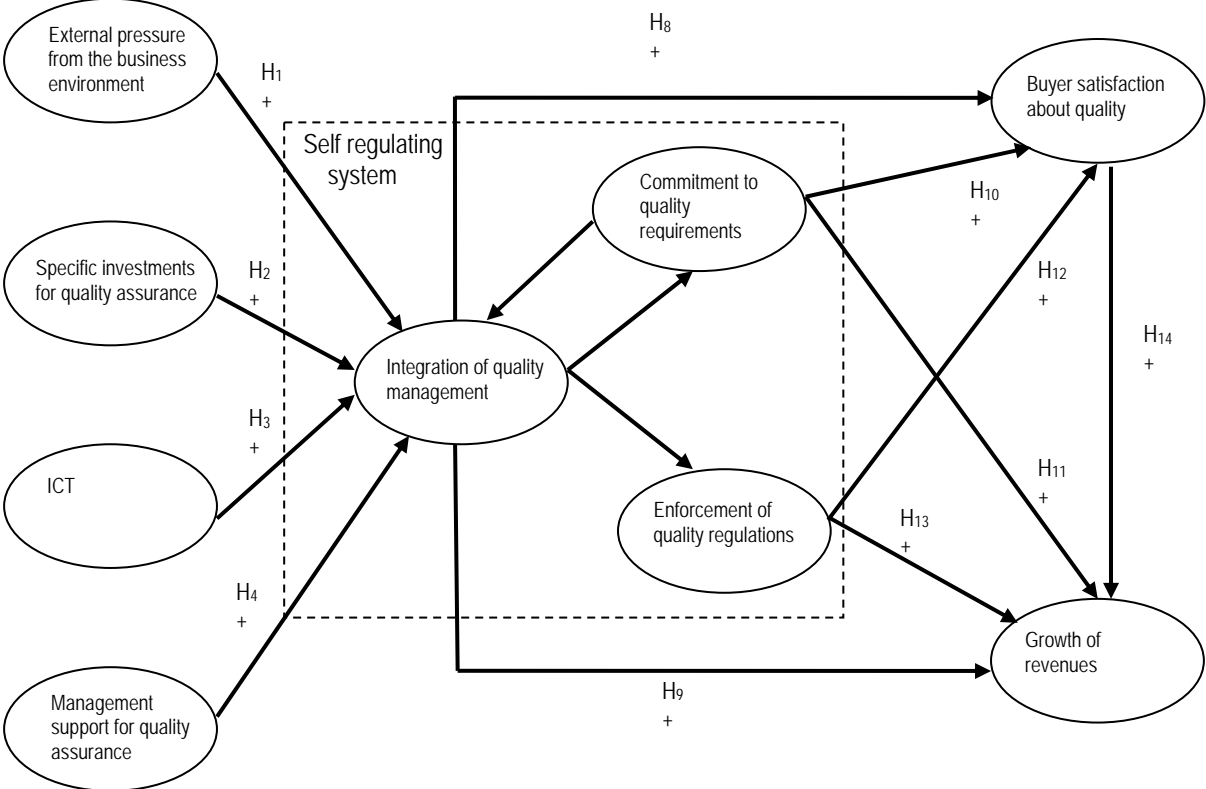


Figure 1: The research model

For the supplier and buyer side of the focal firm a separate model was developed. Constructs that are specific for the focal firm, for example external pressure from the business environment, are included in both models.

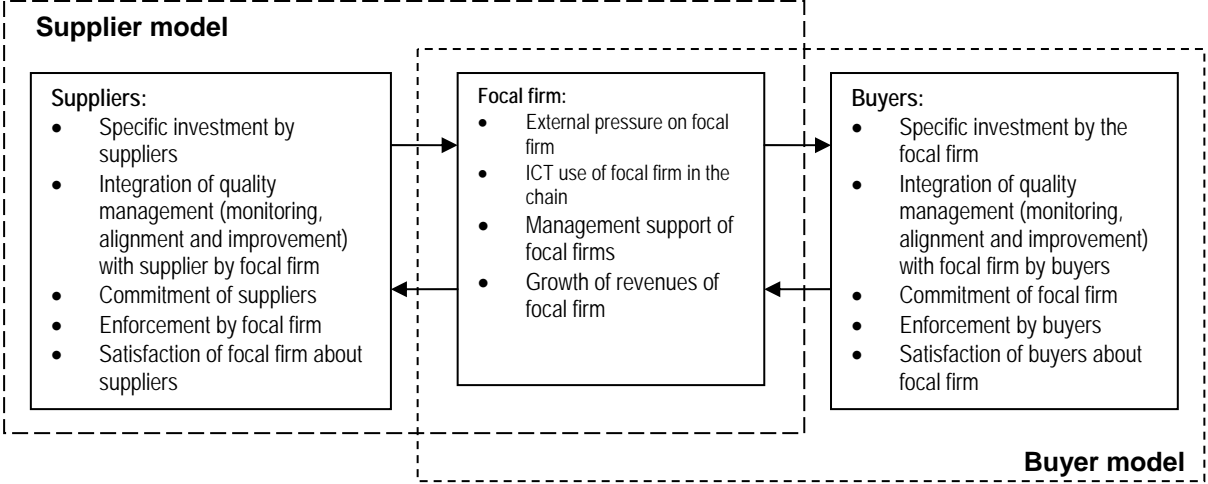


Figure X.X. Included constructs in the the supplier and the buyer model

For measuring constructs that were focusing on the relationship between the focal firm and the supplier or the buyer, the same kind of questions were used making the models comparable, although the perspective from the focal firm was different. Each hypothesis in figure X.X. is proposed for the supplier and buyer model.

Factors influencing integration of quality management

In this section the expected effects of pressure from the business environment, transaction specific investments, use of ICT in the chain, commitment and management support of the focal firm for quality assurance on the integration of quality management with the suppliers and buyers of the focal firm.

External pressure and integration of quality management

In the contingency theory, competitiveness and even the ability to survive can depend on a timely adaptation to environmental trends (Boyd and Fulk, 1996; Miller and Friesen, 1983). Integration of activities in a supply chain is seen by many authors as the appropriate strategy for effective competition and strategic advantages in the marketplace also with regard to quality management (Anderson et al., 1994; Morris and Young, 2000; Orriss and Whitehead, 2000; Spekman et al., 1999; Tuncer, 2001). Although someone may argue that the environment puts the same pressure to all organisations in a certain industry, empirical

evidence shows that environmental heterogeneity exists within one industry (Strandholm et al., 2004). Therefore the following hypothesis is proposed:

H_{1S}²: The higher the level of external pressures from the business environment on the focal firm, the higher the level of integration of quality management of between the focal firm and its suppliers.

H_{1B}: The higher the level of external pressures from the business environment on the focal firm, the higher the level of integration of quality management between the focal firm and its buyers

In prior research of the author several external pressures were ranked by 47 experts of quality management in the chains investigated using an adaptive conjoint analysis. The main external pressures from the business environment on the focal firms according to this research were selected (media attention, legislation, consumer demands and corporate social responsibility; not separately depicted in the model), which exert pressure on the integration of quality management in the agri-food supply chains. These pressures were combined into one index, representing the external pressure from the business environment on the focal firm. In Appendix 1 it is shown how this index for external pressure from the business environment was calculated.

Specific investments and integration of quality management

The production of quality products is necessary dependent on the delivery of quality materials, so it is essential that materials supplied meet buyer's specifications (Kaynak, 2003; Shin et al., 2000). Buyers who are concerned with the procurement of high quality products request that the suppliers make relation specific investments and adaptations that will improve quality management. Therefore suppliers need specialised production equipment, information structures and training of personnel. Moreover when the suppliers make dedicated investments, the suppliers will be better able to perform tasks that take the specific requirements of the buyer into account and the value of the supplier to the buyer will increase. When these assets are specialised, efficient use of these resources demands comprehensive vertical co-ordination in order to achieve optimal use of these resources (Buvik and Halskau, 2001). This is in fact one of the central hypothetical predictions of the transaction cost theory

² S and B refers to respectively the buyer and supplier model.

that in order to safeguard specific investments from opportunism, transactions could be carried out in integration (Williamson, 1975). Many researchers recognise the level of asset specificity by far as the most important dimension of the transaction determining the form of governance (David and Han, 2004; Leiblein, 2003; Rindfleisch and Heide, 1997). Due to integration transactions costs are reduced which could result from moral hazards e.g. selecting inferior suppliers. Therefore the following hypotheses are proposed:

H_{2S}: The higher the level of specific investments of the suppliers for meeting the quality requirements of the focal firm, the higher the level of integration of quality management between the focal firm and its suppliers.

H_{2B}: The higher the level of specific investments of the focal firm for meeting the quality requirements of the buyers, the higher the level of integration of quality management between the focal firm and its buyers.

ICT and integration of quality management

Within the chains involved in this study firms are often working jointly together with their suppliers and buyers to assure quality of the products. Higher developed integration is often indicated by more standardised and automatic interfaces and flows of data, possibilities that are offered by using ICT (Hill and Scudder, 2002). Not only the physical communication methods, but also the range of information and the depth of information exchanged is changed by the use of ICT in the chain (Leek et al., 2003). Many quality management systems include requirements for receiving in-process and final inspection data from suppliers (Petersen et al., 2002). Especially the use of the Internet for transferring quality data in business relationships is expected to increase in future. Therefore the following hypotheses are proposed:

H_{3S}: The higher the use of ICT in the chain by the focal firm, the higher the integration of quality management between the focal firm and its suppliers

H_{3B}: The higher the use of ICT in the chain by the focal firm, the higher the integration of quality management between the focal firms and its buyers

Management support and integration of quality management

Successful implementation of quality management in the chain often requires a lot of change in organisational culture like communication, openness and knowledge sharing. Management support is a key factor in developing relationships with suppliers (Ellram, 1995). Firms have to believe in quality management, the concept has to be 'alive' within the firm and should not be a book on a shelf. Management support to quality management of the individual firms is generally recognised as one of the fundamental elements which helps to establish these goals necessary for adequate quality management (Forza and Filippini, 1998) and being critical to improve interactions with suppliers and buyers (Kaynak, 2003). Consequently the following hypotheses are proposed:

H_{4S}: The higher the level of management support of the focal firm, the higher the level of integration of quality management between the focal firm and its suppliers

H_{4B}: The higher the level of management support of the focal firm, the higher the level of integration of quality management between the focal firm and its buyers

Management support was only measured for the focal firm, because it was expected that respondents could not answer these questions adequately for their buyers.

Commitment and integration of quality management

For firms that want to integrate their quality management the selection of suppliers might be very critical and the procurement process of firms is the most important indicator for delivering superior quality (Shin et al., 2000). As a result suppliers that have the same attitudes with regard to quality will be highly valued and buyers are very willing to integrate and maintain relationships with such partners (Morgan and Hunt, 1994). Moreover suppliers that have invested heavily in order to comply with the quality requirements of buyers might find it very important to be committed to integration of quality management with the buyer in order to safeguard their investments. Therefore the following hypotheses are proposed:

H_{5S}: The higher the level of commitment of the suppliers to quality requirements of the focal firm, the higher the level of integration of quality management between the focal firm and its suppliers.

H_{5B}: The higher the level of commitment of the focal firm to quality requirements of the buyers, the higher the level of integration of quality management between the focal and its buyers.

Integration of quality management and self regulation behaviour

This section elaborates on the hypotheses regarding integration of quality management and self regulating behaviour. The hypotheses relate integration of quality management to the dimensions of the self regulating behaviour of the ‘Table of eleven’, commitment and enforcement

Integration of quality management and commitment

In relationships with strongly integrated quality management buyers make customised appointments to align the production processes with their suppliers, communicate quality requirements timely and precisely to their supplier, provide their suppliers with information that can help them to improve the quality management, etc. Therefore it is reasonable to expect that due the ongoing integration of quality management commitment of suppliers to quality requirements of buyers increases over time, because buyers provide suppliers also with openness about their business processes. According to Kumar et al. (1995) when in a chain the interests of the firms are convergent, commitment will emerge. High interdependences which are the case in the strongly integrated chain make it dangerous for the firm to participate in opportunistic behaviour, Because both firms expect to receive value from the relationship, each partner has a strong motivation to build, maintain and strenghten the relationship. Therefore the following hypotheses are proposed:

H_{6S}: The higher the level of integration of quality management between the focal firm and its suppliers, the higher the level of commitment of the suppliers to the quality requirements of the focal firm

H_{6B}: The higher the level of integration of quality management between the focal firm and its buyers, the higher the level of commitment of the focal firm to quality requirements of the buyers

Enforcement and integration of quality management

Within integrated quality management systems, firms ask from their suppliers outcomes of specific quality tests and inspections, participation in their quality monitoring system and easy access to their procedures for quality assurance. Due to this integration, measurements of quality requirements are registered at many different places and could be compared, resulting in easily detecting of discrepancies. Firms that strive to a strong integration of quality management will be strongly focused on compliance with their quality requirements. In order to achieve this, they will take sanctions to their suppliers in case on non-compliance, which are expected to be perceived as stringent by the suppliers. Although the word co-operation in chain is often used with buyer-supplier relationships, the most important objective laying behind is the control of the suppliers (Grievink et al., 2003). Therefore the following hypotheses are proposed:

H_{7S}: The higher the level of integration of quality management between the focal firm and its suppliers, the higher the level of enforcement by the focal firm to in case of non-compliance to the quality requirements by the suppliers

H_{7B}: The higher the level of integration of quality management between focal firm and its buyer, the higher the level of enforcement by the buyers of in case of non-compliance to the quality requirements of the focal firm

Integration of quality management, self regulating behaviour and performance

In this section the influence of integration of quality management and commitment and enforcement, the dimensions of self regulating behaviour on performance are discussed. Performance is split into satisfaction of the customer about the quality performance of suppliers and the growth of revenues. Also the effect of satisfaction of focal firm about the quality performance of its suppliers and the customer satisfaction about the quality performance of the focal firm on the growth of revenues is discussed.

Integration of quality management, buyer satisfaction and growth of revenues

Many authors have stressed the impact of integration of quality management on both the performance of a firm and the buyer satisfaction about the quality performance of suppliers. Cooper and Ellram (1993) stated that managing the supply chain as an entity can create competitive advantage and greater profitability. Forza and Filippini (1998) found that

stressing quality in the relationship with the supplier, had a positive relationship with improvement of the conformance to specification, whereas stressing quality in the relationship with buyer had a positive relationship with buyer satisfaction. Also Humphreys et al. (2004) found positive relationships between integrating information exchange, supplier evaluation and performance. Also other studies also found (partial) positive relationships between the implementation of quality management practices and plant performance for example Kaynak (2003) and Samson and Terzovski (1999). Based on these studies the following hypotheses are proposed:

H_{8S}: The higher the level of integration of quality management between the focal firm and its suppliers, the higher the level of satisfaction of the focal firm about the quality performance of its suppliers

H_{8B}: The higher the level of integration of quality management of between the focal firm and its buyers, the higher the level of satisfaction of the buyers about the quality performance of the focal firm

and,

H_{9S}: The higher the level of integration of quality management between the focal firm and its suppliers, the higher the growth of revenues of the focal firm

H_{9B}: The higher the level of integration of quality management between the focal firm by its buyers, the higher the growth of revenues of the focal firm

Growth of revenues was measured as the perceived growth of revenues of the focal firm compared to its main competitors. It was only measured for the focal firms, because firms have no clear insight in the growth of revenues of their suppliers.

Commitment, enforcement, buyer satisfaction and growth of revenues

According to Morgan and Hunt (1994) a common theme emerging from various literature on relationships show that that firms identify commitment among suppliers as a key to achieve valuable outcomes for themselves. Commitment results in many advantages in the relationship like working at preserving relationship investments by co-operating with

suppliers who resist attractive short-term alternatives in favour of expected long-term benefits. Firms review potentially high risk actions as being prudent, because they will not expect that their suppliers will behave opportunistically. Due to commitment in the relationship, firms like to engage in a repetitive set of actions to prolong the benefits of integration of quality management. Therefore firms in the chain desire to continue the relationship, because of the positive affect to each other (Kumar et al., 1995). Therefore the following hypotheses are proposed:

H_{10S}: The higher the level of commitment of the suppliers to the quality requirements of the focal firm, the higher the satisfaction of the focal firm about the quality performance of suppliers

H_{10B}: The higher the level of commitment of the focal firm to the quality requirements of the buyer, the higher the satisfaction of the buyers about the quality performance of the focal firm

H_{11B}: The higher the level of commitment of the suppliers to quality requirements of the focal firm, the higher the growth of revenues of the focal firm

H_{11S}: The higher the level of commitment the focal firm to quality requirements of the buyers, the higher the growth of revenues of the focal firm

Morgan and Hunt (1994) also argue that though there are many contextual factors that contribute to the success or failure of specific relationships, it is theorised that the presence of relationships commitment is successful for relationship success, not power or enforcement and its ability to 'condition' others. Therefore the following hypotheses are proposed with regard to enforcement of quality requirements and satisfaction about quality performance:

H_{12S}: The enforcement of quality requirements by the focal firm to suppliers has no effect on satisfaction of the focal firm about the quality performance of the suppliers

H_{12B}: The enforcement of quality requirements by the buyers to the focal firm has no effect on satisfaction of buyers about the quality performance of the focal firm

H_{13S}: The enforcement of quality requirements by the focal firm to its supplies has no effect on the growth of revenues of the focal firm

H_{13B}: The enforcement of quality requirements by the buyer to the focal firm has no effect on the growth of revenues of the focal firm

Buyer satisfaction and growth of revenues

Several authors (Ahire and Dreyfus, 2000; Choi and Eboch, 1998; Fornell et al., 1996) have stated that more satisfied buyers will show more loyalty to firms resulting in increased sales and a better competitive position. Often certification opens doors that were previously closed or would be closed if certification was not obtained. Within this research it was also checked if the growth of revenues of firms increased if they were satisfied about their suppliers. Therefore the following hypotheses are proposed:

H_{14S} The higher the level of satisfaction of the focal firm about the quality performance of its suppliers, the higher the revenue growth of the focal firm

H_{14B} The higher the level of satisfaction of the buyers about the quality performance of the focal firm, the higher the revenue growth of the focal firm

Methodology

Data collection

Three different chains from the Netherlands were chosen in this study. The poultry meat chain was chosen, because this chain has faced many problems and crises with regard to quality and safety of its products. The fruit and vegetable chain was chosen, because of its rich variety of products and has faced fewer problems with regard to quality and safety of products than the poultry meat chain. Moreover these two chains are very important for retailers, because they offer retailers the possibility to differentiate from each other. At least the flower chain was chosen, because this is an agricultural chain, which does not produce edible products and the contents of quality is more broadened to other issues of quality like environmental quality and corporate social responsibility. The chain perspective of the questionnaire was included by adapting the subjects of the questions with regard to the relationships of the focal firm with both its most important suppliers and its most important buyers. For both kinds of firms the same questions about the relationships with regard to quality management were being asked. The chain perspective was further enlarged by selecting chain two linkages in each chain; the primary producers and the traders/processors. Data was collected during the period October to December 2005 by means of a self administrated questionnaire that was mailed to 3,444 potential respondents.

Validity and reliability

Within this study, the constructs external pressure from the business environment, use of ICT in the chain and the growth of revenues of the focal were formative constructs. Formative constructs can be viewed as being composed of the items which directly represent the operational definition. Formative constructs should be used when constructs are regarded as explanatory combinations of items. The other constructs were reflective constructs which represent latent variables that cannot be measured directly, for example the level integration of quality management in the chain, but is computed from one or more items. The different characteristics of the formative and reflective constructs mean that the techniques used for the validation of reflective constructs (for example factor analysis and internal consistency) cannot be used for the validation of the formative constructs. Formative and reflective constructs were assessed for content validity, (Do the construct measure what is intended to measure? And nomological validity; Do the construct behave as it is expected to behave?). In

addition the reflective constructs are assessed for convergent validity, discriminant validity and reliability.

For assessing the convergent validity and reliability of the constructs, a three step approach was being used. First an Explorative Factor Analysis (EFA) was carried out on the data. The objective of EFA is to identify common factors in the observed data (Lattin et al., 2003). For assessing the appropriateness of the factor solutions being found, the inter-item correlation between items constituting a construct (higher than 0.5), the factor loadings (higher than 0.6) and the total variance being explained (higher as 60%) were used.

Second the derived constructs from the EFA were refined by a Confirmatory Factor Analysis (CFA) using Lisrel 8.72. CFA offers the possibility to test if prior notion about which items should load on certain factors is consistent with the patterns in the data, quite the opposite principle as EFA (Lattin et al., 2003). For the assessment of the CFA, the magnitude of factor loadings with the accompanying t-values (higher than 1.96 for significant loadings) and overall model fit were being used. The overall measurement model fit can be assessed by many fit indices, like the Chi-Square combined with the number of degrees of freedom, NFI, NNFI, GFI, CFI and AGFI. The suitability of the ratio between the Chi-Square and the degrees of freedom is dependent on model complexity and number of observations (Baumgartner and Homburg, 1996). The other fit indices should be higher than 0.90, except for the AGFI, which should be higher than 0.80. Another often used fit indices is the RMSEA which should be lower as 0.080 or less conservative, lower as 0.10. For a proper assessment the model fit, several fit indices should be taken into account simultaneously.

Third the reliability of the constructs was calculated using the composite reliability and variance extracted which should be respectively higher than 0.70 and 0.50 in order to obtain reliable results. The composite reliability is comparable with the Cronbach α , but is often somewhat more conservative in its estimates.

Discriminant validity assesses the extent to which a construct and its indicators differs from another construct and its indicators. Discriminant validity was assessed by two methods. First discriminant validity of a construct is established when the Cronbach α are larger than the averaged interscale correlations (Ghisella et al., 1981; Kaynak, 2003). Second if the percent of variance extracted by the indicators of the a construct is consistently greater than the

squared inter construct correlations of the construct, discriminant validity of the construct with respect to all other constructs is established (Fornell and Larcker, 1981).

Structural model

For testing the hypotheses, Structural Equation Modelling (SEM) was being used. The most important characteristics of SEM which makes it different from other techniques are the estimation of multiple and interrelated dependence relationships, the ability to represent unobserved concepts in these relationships and account explicitly for measurement error in the estimation process. In fact SEM carries out a number of separate, but interdependent multi regression equations simultaneously, pre-specified by the researcher. For assessing the validity of the model, the same fit indices as for CFA can be used.

Results

Response

For collecting the data 3.444 questionnaires were sent and 585 useable questionnaires were returned, a response rate of 17%. This response rate is satisfying, especially regarding the fact that no reminder questionnaire was sent. Table 1 shows the distribution of the response across the six groups.

Table 1 Response rate across the six groups

	Poultry farmers	Poultry processors^c	Fruit and vegetable growers	Fruit and vegetable traders/processors	Flower and plant growers	Flower and plant traders/processors	Total
Total number of firms	599 ^d	313 ^e	1,436 ^f	1,951 ^g	1,996 ^f	3,801 ^g	10,096
Total sample mailed	599	313	600	702	600	630	3,444
Non eligible firms ^a	8	4	1	12	3	8	36
Incomplete and blank	5	1	6	4	11	9	36
Useable	116	34	151	98	102	84	585
Response rate (%) ^b	20	11	25	14	17	14	17

^aNon eligible firms are duplicate addresses, liquidated firms and firms who changed their activities.

^bResponse rate = (total useable questionnaires)/ (total sample mailed – non eligible firms)

^cThese firms do not only process the meat, but also act as traders of these products

^dAll firms with more than 35.000 chickens (Product Boards for Livestock, Meat and Eggs)

^eTotal number of poultry meat processors present in the Netherlands (Product Boards for Livestock, Meat and Eggs)

^fGrowers with more than 10.000 m² greenhouse, (Nederlandse Agrarische Database, 2004, Agri Direct Marketing)

^gTotal number of traders, (Chamber of commerce, www.kvk.nl, accessed 25 October 2006)

The number of questionnaires returned for the traders and processors of poultry meat was very low. Regarding the lower number of firms and the high number of very small firms in this sector, this result was expected³.

Validity and reliability

All the questions included in the questionnaire were either adapted from previous studies or developed for this study. Content validity was assessed during the pre-test of the questionnaire in which the statements in the questionnaire were examined by both experts and practitioners in the field of quality management. Nomological validity was also achieved, because in the structural model many relationships being hypothesised were found to be significant.

The exact outcomes of the factor loadings from both the EFA and CFA can be found in Appendix 2. together with the significance of the loadings from the CFA. The outcomes of these analyses were highly satisfying. All the data from the six kinds of firms in this study were pooled together (Laros and Steenkamp, 2004; Steenkamp and Baumgartner, 1998)⁴. The CFA was carried on the total measurement model for the supplier model and the buyer model. This approach can be regarded as the ultimate test for the convergent validation of the constructs, because in one big CFA errors between all indicators can freely correlate⁵.

Table 2: Fit indices for the assessment of the fit for the supplier and buyer model

Model	χ^2	df	RMSEA	NFI	NNFI	CFI	GFI	AGFI
Supplier	599.69	257	0.050	0.969	0.979	0.982	0.918	0.897
Customer	693.34	257	0.056	0.964	0.973	0.977	0.907	0.882

³ According to a spokesman of the Boards for Livestock, Meat and Eggs in the Netherlands there are approximately twenty big slaughterhouses and forty big cutters. (Ms. Ariënne Visser, personal phone call, December 2005). She stated that previous research in this sub-group had obtained even lower response rates.

⁴According to (Steenkamp and Baumgartner, 1998) if the purpose is to compare structural models in a nomological net, metric invariance and factor⁴ variance invariance are required. However also the covariance invariance was tested which implies that also no further investigation of paths in six different models is needed. Metric invariance means that the factor loadings on the constructs do not differ significantly across the groups. Factor (co) variance invariances mean that the variance of the constructs and the covariances between the constructs do not differ significantly across the groups. From these tests it can be concluded that for both the supplier model and the buyer model metric and factor (co) variance invariance is supported and a good fit to the data is remained. No detailed group analysis are needed with regard to the measurement model and the data of the groups can be pooled together (Laros and Steenkamp, 2004).

⁵Moreover by using one big CFA for the total model the problem of saturated models (resulting in perfect model fits) is also avoided. In that case no assessment of the fit of the individual constructs can be made, because the number of degrees of freedom is zero. Degrees of freedom are used to calculate the fit indices; so without them it becomes impossible to assess the fit of the model. Researchers usually solve this problem by estimating multiple constructs simultaneously.

Both measurement models show very acceptable fits, which means that the measurement models give a good representation of the underlying covariance matrices (Table 2). For the supplier model, the ratio between the Chi square and the degrees of freedom is 2.33, which is satisfying, especially regarding the large sample size. Moreover the RMSEA is far below the threshold level of 0.080 or 0.100 and other fit indices, like the NFI, NNFI, CFI and GFI have also higher levels as the recommended level of 0.90. Also the AGFI, which is sensitive to non normality, is far above its threshold level of 0.80. The measurement model for the buyers shows an almost comparable fit as the supplier model, but scores just a little bit lower on all fit indices.

Table 3: Reliability indicators of the constructs for the supplier and the buyer model

Construct	Supplier model			Buyer model		
	Cronbach α	Composite reliability	Variance extracted	Cronbach α	Composite reliability	Variance extracted
Management support	0.81	0.82	0.63	0.81	0.82	0.61
Transaction specific investments	0.91	0.91	0.71	0.87	0.88	0.64
Integration of quality management*	0.89	0.81	0.59	0.91	0.86	0.68
Monitoring	0.87	0.87	0.70	0.90	0.90	0.75
Alignment	0.88	0.87	0.70	0.88	0.90	0.72
Improvement	0.85	0.85	0.58	0.87	0.86	0.61
Commitment	0.90	0.90	0.75	0.83	0.84	0.64
Enforcement	0.76	0.77	0.63	0.65	0.74	0.59
Satisfaction	0.85	0.86	0.67	0.84	0.87	0.70

*Integration of quality management is a second order construct that consists of three first order constructs, monitoring, alignment and improvement.

For the reflective constructs being used the reliabilities are reported in Table 3. The constructs external pressure, use of ICT in the chain and growth of revenues are formative construct and therefore no reliability indicators are being calculated. From Table 3 it can be concluded that the constructs being used were highly reliable. All constructs exceed the threshold levels for the different reliability indicators.

In appendix 3 the outcomes for the discriminant analyses are shown. The correlation coefficients were lower than the reliability coefficients, suggesting that the measures have discriminant validity. The percent variance extracted by the scale items is consistently greater

than the squared interscale correlations of the construct. So it can be concluded that discriminant validity is achieved in both models.

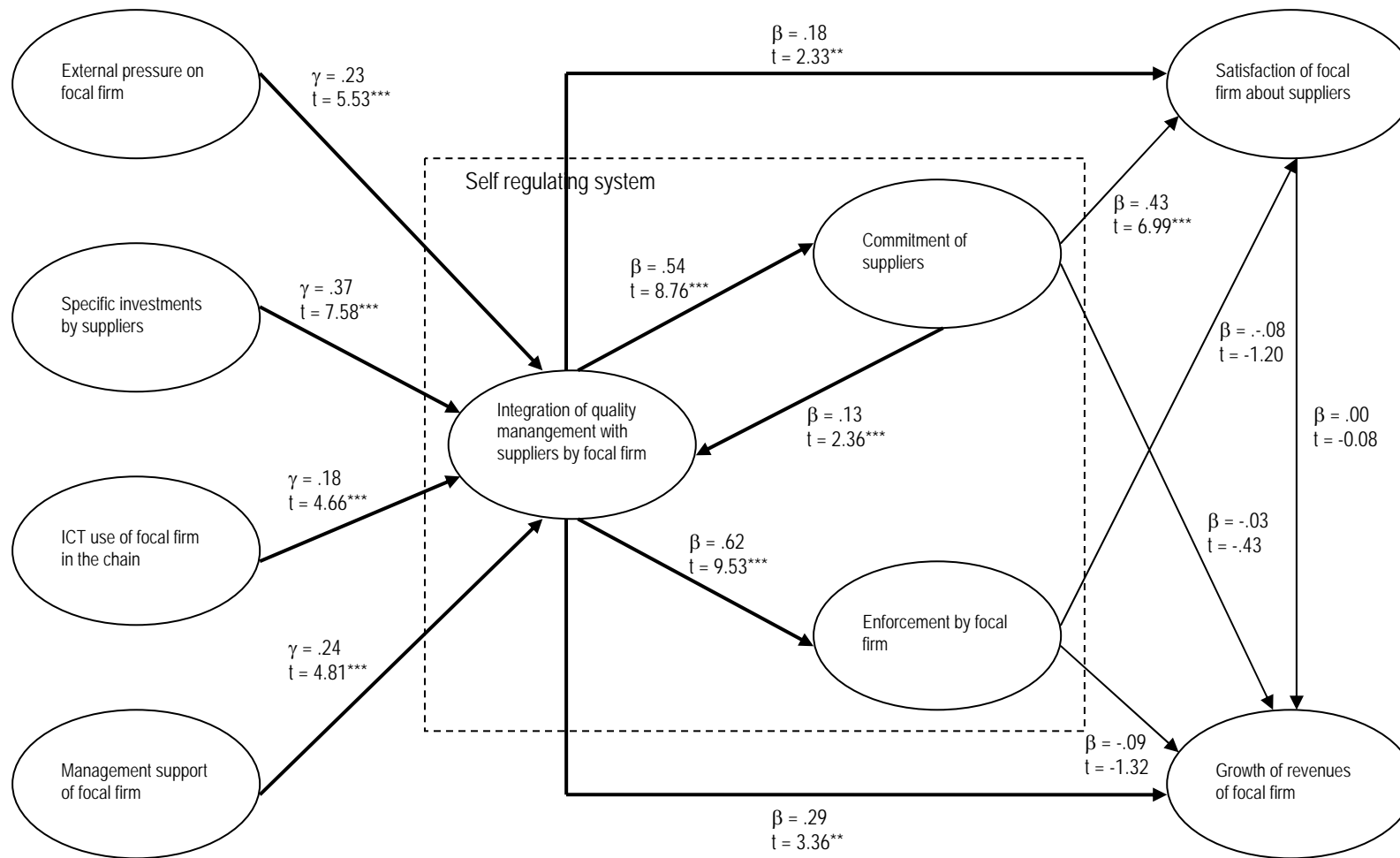
The structural model

In figures 2 and 3 the estimated structural models for respectively the supplier and buyer side of the focal firm are shown. The overall fit of the model is good, the Chi-square value divided by the number of degrees of freedom is 2.43 for the supplier model and 2.83, which is satisfying, especially regarding the large sample size (Baumgartner and Homburg, 1996). This means that the model explains the covariance matrix well. Also other often used goodness of fit indices, like NFI, NNFI and CFI are above the threshold levels of 0.90 and also the AGFI is far above the threshold level of 0.80. Only the GFI is slightly below the threshold level of 0.90, but this is very marginal. For evaluating the goodness of fit of structural models, especially the NFI and AGFI are important fit indices, because they are sensitive to the number of significant paths in the model (Hair et al., 1998). Also the RMSEA was below the upper threshold of 0.080 (or 0.10). Taking all these fit indices together there is no worry for misinterpretations of individual parameter estimations. Moreover many paths or hypotheses turned out to be highly significant, which implies that the nomological validity of the model has been achieved.

The explanatory powers of both models were good; several equations have an R^2 of more than 0.30 which is satisfying in social sciences. Especially the integration of quality management is well predicted by the model, with a R^2 of 0.696 (see Table 4). Only the growth of revenues of the focal firm was not so well explained in both models, likely because growth is dependent on many other variables.

Table 4. The R^2 for the different constructs in the supplier and customer model

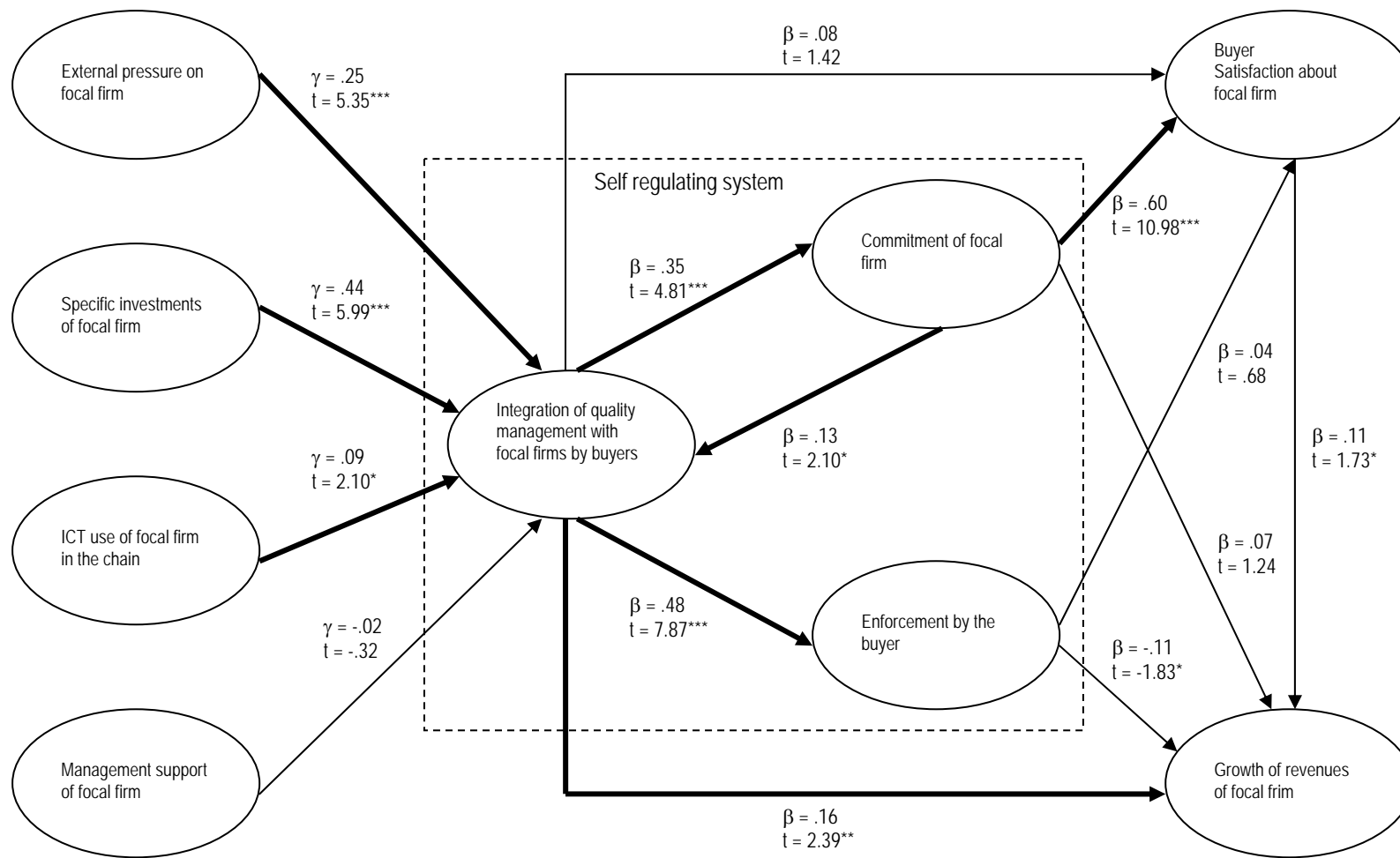
Construct explained	R^2	
	Supplier model	Customer model
Integration of quality management	0.696	0.501
Commitment to quality requirements	0.384	0.194
Enforcement of quality requirements	0.381	0.231
Satisfaction about quality performance	0.277	0.420
Growth of revenues of the focal firm	0.053	0.032



$\chi^2 = 806.06$; $df = 329$; $RMSEA = 0.052$; $NFI = 0.963$; $NNFI = 0.975$; $CFI = 0.978$; $GFI = 0.903$ $AGFI = 0.881$

*** $p < 0.01$, ** $p < 0.05$; * $p < 0.1$; $N = 540$

Figure X.X. The structural model for the supplier side of the focal firm. Bold lines represent significant relationships



$\chi^2 = 929.45$; $df = 329$; $RMSEA = 0.058$; $NFI = 0.957$; $NNFI = 0.967$; $CFI = 0.971$; $GFI = 0.890$; $AGFI = 0.865$

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$; $N = 540$

Figure X.X The structural model for the buyer side of the focal firm. Bold lines represent significant relationships

Discussion

Factors influencing integration of quality management

External pressure and integration of quality management

In both models there was a highly significant positive relationship between the pressure from the business environment and the integration of quality management. ($\gamma = 0.23$; $t = 5.53$ in the supplier model; $\gamma = 0.25$; $t = 5.35$ in the buyer model). Thus, the more external pressure the focal firm perceives from the business environment, the more it integrates quality management with its suppliers and buyers. The significance of these relationships are in line with previous research which suggests that external pressures from the business environment have a huge impact on quality management in supply chains. For example direct legislative demands of the government on the implementation of quality management has been identified by many authors as the most important factor for implementing quality management systems (Downey, 1996). Also research in mass media has shown that media influence people's cognition in a number of ways. During the last decade the level and types of media coverage of a variety of business matters has grown steadily (Chen and Meindl, 1991), especially with regard to crises in agriculture. Due to huge media attention the European consumers have become increasingly concerned about the quality of food and the negative effects of bio-industrial production (Gellynck et al., 2004; Trienekens and Beulens, 2001). The importance of negative attention impact on business is evident; advertising has been shown to be five times less effective than negative media attention (Verbeke and Ward, 2001). In order to deal with external pressure (e.g. government, action groups and consumers) firms often use certain standards as good practices to respond to these pressures (Van Kleef et al., 2006).

The highly significant relationship between the pressure from the business environment and integration of quality management supports the contingency theoretical expectation that a firm has to adapt its practices to the demands from its external environment in order to achieve a long-term success. In this case integration of quality management can be regarded as an appropriate strategy for dealing with these external pressures (Omta et al., 2002). When firms experience external pressure from their business environment with regard to quality, integration of quality management systems is often started in order to deal with these requirements. This vision is strengthened by a study of Cap Gemini and Ernst & Young in

which a majority of respondents of food manufacturers (86%) and retailers (87%) from Europe agree that assuring quality was the task of the total food supply chain. In this study it was also confirmed that co-operation in the whole agri-food supply chains is essential in order to assure the quality of products (Grievink et al., 2003).

Transaction specific investments and integration of quality management

Also the level of transaction specific investments is strongly related to the integration of quality management in both models ($\gamma = 0.37$; $t = 7.58$ in the supplier model; $\gamma = 0.44$; $t = 5.99$ in the buyer model). Thus the higher the level of transaction specific investments of the suppliers, the higher the level of integration of quality

Thus finding is in line with the logic of the transaction cost theory. Firms might invest in specialised assets to assure quality of these products. (Buvik and Halskau, 2001). To a great extent, quality management is based on specific investments like physical assets, personnel skills, training and information systems. When there are many specific investments in the chain, bilateral dependence will emerge. This will also higher the risk of opportunism. In such situations, buyers want to exercise control over the production and logistics of the (Buvik and Halskau, 2001; De Jong and Nootboom, 2001). From a buyers point of view it is important to influence the establishment of quality related processes, like standards and methods for quality monitoring, inspections, tests and providing the supplier with all kind of information that might help him to improve quality (Buvik and Halskau, 2001; De Jong and Nootboom, 2001). Therefore the integration of quality management systems can be used as a means for safeguarding specialised investments for opportunistic behaviour, because it creates a shared operational control over these requirements.

ICT and integration of quality management

The use of ICT by the focal firm in the chain had a positive effect on integration of quality management in both models ($\gamma = 0.18$; $t = 4.46$ in the supplier model; $\gamma = 0.09$; $t = 2.10$ in the buyer model). This means that the more the focal firm makes use of ICT in the chain, the more integrated the quality management systems will be between suppliers and buyers. Using ICT, quality indicators can be measured, stored and transferred making quality management more transparent. These finding are in line with the literature. Leek et al. (2003) found that a majority of buyers and suppliers stated that ICT has a positive impact on their firms enabling them to access information about each other and also their competitors. They indicated that

ICT had made communications with suppliers more accurate. Interesting is also that in this study the relationship between use of ICT and integration of quality management with the suppliers is stronger than with the buyers. Leek et al. (2003) found in their study of the use of ICT in the British food sector similar results. According to them, especially suppliers improve their relationship with buyers by making extensive use of ICT. Also Hill and Scudder (2002) found that firms using Electronic Data Interchange (EDI) reach higher degrees of coordination in the supply chain.

Management support and integration of quality management

Management support for quality management of the focal firm is positively related to the integration of quality management with suppliers ($\gamma = 0.24$; $t = 4.81$). Thus the higher the level of management support for quality management, the higher the level of integration of quality management of the focal firm with its suppliers. For firms that show a high management support likely privilege quality performance over price when selecting suppliers, leading to more integration of quality management (Kaynak, 2003).

However management support of the focal firm is not significant related with the integration of quality management with the buyers ($\gamma = -0.02$; $t = 0.32$). An explanation could be that if management finds quality management important, the firm wants to translate this vision upstream. Support for this explanation is found in the data, because if analyses are conducted with leaving out the variables transaction specific investment and commitment, management support becomes significant. The industry structure of agriculture in which buyers are often much larger than the suppliers, suppliers have not the possibility to enforce integration of quality management to their buyers, although likely they strive to it. HIER NOG WAT OVER MACHT

Commitment and integration of quality management

Integration of quality management in the chain is positively related to commitment in both models ($\beta = 0.13$; $t = 2.36$ in the supplier model; $\beta = 0.13$; $t = 2.10$) in the buyer model). This implies that the higher the level of commitment of suppliers for quality requirements of buyers, the higher the level of integration of quality management between buyers and suppliers. Buyers who are very quality conscious will choose suppliers that are also very quality conscious leading to consistent attitudes in the relationship over time. Commitment

between firms implies a relationship with expectations that firms are willing to solve problems in future (Mehta et al., 2006; Morgan and Hunt, 1994). Without commitment of the supplier, the buyer might be reluctant to start integration of quality management with such a supplier, because he might be uncertain that the relationship will last long enough to realise long term benefits of the relationship (Krause, 1999). During the pre-test of the questionnaire many advantages of commitment to quality requirements were mentioned, like focusing on long-term in stead of short-term collaboration VOEG NOG WAT TOE

Integration of quality management and self regulation behaviour

Self regulation behaviour according to the ‘Table of eleven’ consisted of commitment to and enforcement of quality requirements. This section goes into the effect of integration of quality management on both dimensions.

Integration of quality management and commitment

Commitment is significantly positively related to integration of quality management in both models ($\beta = 0.54$; $t = 8.76$ in the supplier model; $\beta = 0.35$; $t = 4.81$) in the buyer model). Thus, the higher the level of integration of quality management between suppliers and buyers, the higher the level of commitment of suppliers to comply with quality requirements of their buyers. Effective integration of quality management facilitates success factors for commitment such as a common interest of the firms; firms know each others behaviour and have a history of collaboration (Balk-Theuws et al., 2004). Open communication on specifications, improvement of processes, transfer of outcomes of specific quality tests and inspections, alignment of quality management, taking into account each other’s capabilities, will enhance the understanding between buyers and suppliers and will result in more commitment (Humphreys et al., 2004). This finding is in line with previous research of Kumar et al. (1995) who stated that commitment will emerge when the interdependence structure is such that the interests of the firms converge. Due to monitoring of their suppliers, buyers are able to select suppliers who are able and willing to comply with specific and stringent quality requirements.

Integration of quality management and enforcement

Enforcement of quality regulations by the focal firm on its suppliers is strongly related to integration of quality management in both models ($\beta = 0.62$; $t = 9.53$ in the supplier model;

$\beta = 0.48$; $t = 7.87$ in the buyer model). This means the more integrated quality management, the more stringent enforcement policy the buyers will have to their suppliers. Due to integration of quality management firms are becoming transparent in a forced way. For example, when buyers ask for the outcomes of specific quality tests and inspections, deviations from quality requirements can easily be detected. A common sanction of buyers for suppliers that do not comply frequent with their quality requirements is terminating the relationship. The valuable remark of Grievenk et al. (2003) that buyers often use integration of quality management as a means to obtain control of their suppliers seems to be confirmed by the data of this study. Power to enforce quality regulations is also dependent on the number of alternative trading partners (Cook and Emerson, 1978). However retailers dominate most agri-food chains which imply that most trading partners have quite comparable quality requirements, limiting the possibilities for suppliers to switch.

Integration of quality management, self regulation and performance

Integration of quality management and buyer satisfaction and growth of revenues

Integration of quality management with the supplier has a significant positive effect on satisfaction of the buyer about the quality performance of the focal firm ($\beta = 0.18$; $t = 2.33$). This implies that the higher the levels of integration of the focal firm with its suppliers, the higher the level of satisfaction of the focal firm about the quality performance of suppliers.

One of the general characteristic of integration in the chain is that it seeks to fulfil the goals of providing high buyer value with an appropriate use of resource, and building competitive chain advantages (Choi and Eboch, 1998; Cooper et al., 1997). Indeed, integration of quality management systems does not only ensure an effective information transfer, which is crucial for the function of a system of self-regulation, but also prevention, elimination and verification of quality assurance in other parts of the chain (LNV, 2001). All these efforts might lead to more satisfaction of the buyer about the focal firm's products, processes and ability to adapt to changing quality requirements of the buyers.

Integration of quality management between the focal firm and its buyers is not significantly related with the satisfaction of buyers about the focal firm ($\beta = 0.08$; $t = 1.42$). Thus, higher levels of integration of quality management of the focal firm with its buyers do not lead to

more satisfaction of the buyers about the quality performance of the focal firm. A likely explanation could be that buyers have done many efforts to integrate with their supplier, but the expected results were somewhat disappointing. Another reason inherent on the research design, could be that the satisfaction of the buyers about the focal firm was filled in by the focal firm itself. It might be difficult for suppliers to provide a good estimation about satisfaction of their buyers. Suppliers might think that they have done as much as possible to satisfy their buyers, whereas the buyers do not think so. Therefore suppliers might be positively biased in their perception of the satisfaction of the buyers about themselves. This reasoning seems to be reliable because between the scores on satisfaction how buyer (in this study the traders/processors) perceive their satisfaction about their suppliers and how suppliers (the primary producers) perceive the satisfaction of their buyers differs significantly^{6,7}. However integration of quality management has a positive indirect effect via commitment. This means that integration of quality management leads to more satisfaction of the buyer, when the focal firm shows strong commitment to quality requirements of the buyer. Morgan and Hunt (1994) have stated that commitment is a key mediating variable for relationship success which is also supported by this study.

There was positive relationship between integration of quality management and growth of revenues of the focal firm ($\beta = 0.29$; $t = 3.36$ in the supplier model. This means that the focal firm will have a higher growth of its revenues when it integrates its quality management with its suppliers more tighten. Also in the buyer model there was a significant relationship between integration of quality management and growth of revenues of the focal firm $\beta = 0.16$; $t = 2.39$). Thus if the focal firm has a stronger integration of the quality management with its buyers, it will achieve a higher growth of revenues.

Due to the integration of quality management, procedures are developed in which the way of working within the firm is clearly described and monitored. These efforts enlarge controllability of own production processes and the processes of the suppliers. As a result

⁶ Mean of buyers' perceived satisfaction about their suppliers was 5.3 (1.1) while the mean of perceived satisfaction of buyers about suppliers according to suppliers was 5.9 (1.0). Both perceived satisfactions were measured on a seven point Likert scale

⁷ Another reason might be that Lisrel take into account the measurement error explicitly. Allowing for correlation between the errors of the first order constructs of integration of quality management results in a significant relationship between integration of quality management and satisfaction of the buyer about the quality performance of the buyer. However correlated measurement errors should be prevented as much as possible, because it reduces the loss of meaning of the constructs and substantial conclusions being drawn from the model Gerbing, D.W. and Anderson, J.C., 1984. On the Meaning of Within-Factor Correlated Measurement Errors. *Journal of Consumer Research*, 11, 572-579.

many failures and discussions are prevented, resulting in higher efficiency within the firm or at the suppliers or buyers. It is likely that the relationship between growth and increased level of the integration of quality management is behaving according to the law of decreasing margins. Thus if a firm improves from a bad level of quality management, the growth of revenues will be great, however if a firm has already a high level of quality management, improvements will not contribute much to the growth of revenues. However the R^2 of growth of revenues is low in both models (supplier model: 0.053 and for the buyer model 0.032). This means that growth of revenues of the firms is dependent on many other variables that are included in this study.

Commitment, enforcement, buyer satisfaction and growth of revenues

In both models there is a significant relationship between commitment and buyer satisfaction about quality performance of suppliers ($\beta = 0.43$; $t = 6.99$ in the supplier model; $\beta = 0.60$; $t = 10.98$) in the buyer model). This means that the higher the level of commitment of suppliers to quality requirements of their buyer, the higher the level of satisfaction of the buyers about the quality performance of their suppliers. With more committed suppliers it is much easier for firms to ask their suppliers to adapt their quality management systems according to new demands for (Humphreys et al., 2004).

Commitment was not significantly related to growth of revenues in both models ($\beta = -0.03$; $t = -0.43$ in the supplier model; $\beta = 0.07$; $t = 1.24$ in the buyer model). This means in the supplier model that when the focal firm has suppliers showing a high commitment to quality requirements do not obtain higher growth of revenues. For the buyer model this means that if the focal firm shows high level of commitment to their quality requirements of the growth of revenues of the focal firm do not increase. The outcomes for self regulation are comparable with the results Choi and Eboch (1998) found. They found that there was a loose coupling between the implementation of quality management systems in firms and plant performance, but a tight coupling with buyer satisfaction, which means that many companies implement quality management systems because their buyers explicitly demanded them to do so.. This phenomenon is consistent with supply chain management literature which stated that firms seek to fulfil the goals of providing high buyer value with an appropriate use of resources (Cooper et al., 1997) From a manager's perspective this means that the most important

objective is to satisfy the buyers, which seems to be more important as the plant's (financial) performance.

Results from both buyer and supplier model show that enforcement was not related to buyer satisfaction in both the supplier and buyer model ($\beta = -0.08$; $t = -1.20$) in the supplier model; ($\beta = 0.04$; $t = 0.68$). This implies that the satisfaction of a firm does not increase although it has the possibility to enforce quality requirements by inspections and sanctions. Moreover enforcement (by the focal firm) was also not related to growth of revenues of the focal firms in the supplier model ($\beta = -0.09$; $t = -1.32$). This means that if suppliers of the focal firm have the perception that the focal has the possibility to sanction in case of non-compliance, the focal firm will not realise a higher growth of revenues.

In the buyer models, there was a weak significant relationship between enforcement and growth of revenues that was only significant ($\beta = -0.11$; $t = -1.83$; $p \leq 0.10$), although this significance should be interpreted with care regarding the large number of observations in this study. This means that if the focal firm perceives that the sanctions of its buyer are stringent in case of non-compliance, it negatively effects the growth of their revenues. A possible reason could be that firms have to pay fines or have to adapt their quality management system which might be costly for these firms. It is likely that firms that are subject of sanctions for non-compliance have not a very high level of quality management and have to spend a lot of money in order to comply with quality requirement of buyers.

The findings for the relationships above with regard to commitment and enforcement are largely in line with Morgan and Hunt (1994) who stated that the exercise of power as enforcement destroys commitment and decreases co-operation and long-term success. Strong use of power in relationships with high interdependence such as for integration of quality management have the potential to be destructive (Kumar et al., 1995). These propositions turned out to be true in this study, because enforcement is neither related to buyer satisfaction nor to growth of revenues in both models.

Buyer satisfaction and growth of revenues

There was no significant relationship between buyer satisfaction and growth of revenues in the supplier model ($\beta = 0.00$; $t = -0.08$), which indicates that the revenues of the focal firm did

not grow faster if it was more satisfied about the quality performance of their suppliers. Firms might seem to be satisfied when their suppliers conform to their request to implement a quality system (Choi and Eboch, 1998), but do not take any financial advantage from this conformation. If the buyers of the focal firm are satisfied about the firm, there is a weak significant ($p < 0.10$) positive effect on the growth of revenues ($\beta = 0.11$; $t = 1.73$). Due to more satisfaction the focal firm might become a 'preferred supplier' which means that buyers might decide to buy more frequently products from the focal firm, resulting in a higher growth of revenues. However again it should be taken into account that growth of revenues is hardly explained by the model.

Conclusion

Many authors emphasised the impact of the pressures from the business environment on quality management in agri food supply chains. This study has shown that if firms are facing strong pressures from their business environment, quality management will be more integrated with their suppliers and buyers. Besides the pressures from the business environment, also specific investment to comply with quality requirements of buyer, use of ICT in the chain and commitment to quality requirements had a strong positive relationship with the integration of quality management. The effect of management support on the integration of quality management was significant for the supplier model, but not for the buyer model, likely, because firms with high levels of management support consequently take their strategy towards quality management into account when selecting suppliers, whereas the firm itself will be more selected on specific investments to comply with quality requirements and commitment to quality requirements of its buyers. Moreover the fact that management support could only be measured for the focal firm and not for the buyer, because respondents lack insight in their management support of their buyer, might also explain this difference. Within this study, a self regulation systems was defined as the an integration of the quality management systems between buyers and suppliers combined with to main dimensions of compliance behaviour (commitment and enforcement) of the 'Table of eleven', a tool for judging the level of compliance with requirements in general, which were adapted to the circumstances of this study.

The study indicates that strongly integrated chains have more possibilities for self regulation. First, strong integration of quality management leads to more commitment from the supplier

for the quality requirements of buyers and more commitment of the suppliers leads to more integration, so there is an ongoing process of more integration of quality management by buyers and more commitment at the suppliers. Second, more integration leads to more transparency for buyers in the quality management of their suppliers and therefore buyers have more possibilities to enforce their quality regulations in case of non-compliance. However commitment of the suppliers to quality requirements of buyers is of paramount importance for establishing higher levels of buyer satisfaction about quality performance of the buyers and integration of quality management should not be established by means of the use of strong enforcement of quality requirements by buyers, because enforcement does not lead to more buyer satisfaction and seems to have no impact on the growth of revenues. Third, integration of quality management of buyers with their suppliers leads to higher level of satisfaction of buyers about the quality performance of their suppliers. Therefore buyers will strive to on-going integration of quality management. Fourth, higher levels of integration of quality management have a positive impact on the growth of the revenues of the focal firm. Taking these remarks into account, self regulation of quality assurance will be successful in agri-food chains.

Further research will study the different groups more detailed in order to come up with comparisons between groups of firms in the selected chains on basis on the relationships being found in the model and the scores of the firms on the constructs. In future research also attention will be paid to the impact of control variables on the dependent variables. Moreover additional research will focus on juridical aspects of self regulation and the identification of 'best practices' for quality management.

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Appendix 1 Calculating the perceived external pressure from the business environment

The construct of the business environment consists of a number of pressures that are expected to have an impact on integration of quality management in the chain. Pressures can be described as trends in the environment on which the individual firms have less control, but places demands on the quality management of the firms. The pressures being incorporated in this research were derived from previous research and especially from an Adaptive Conjoint Analysis carried out by the author.

The first pressure media attention refers to attention to quality related topics in all kinds of media, but especially newspapers, magazines professional publications and TV programs, etc. These kinds of attention exert pressure on organisations and firms to conform to public inference (Greening and Gray, 1994). The second pressure was legislation which refers to national and international legislation on the field of quality for example phytosanitary measures, tracking and tracing, prescriptions for the storage and processing etc. The third pressure was changing consumer demands with regard to quality, which refers to all kind expectations of safety and freshness, demands of information supply of the products, etc. The fourth pressure was corporate social responsibility, which refers to the fact that consumers expect safe and healthy foods, which are produced under acceptable circumstances with regard to for example environment and labour.

For computing the perceived pressure from the business environment a two step approach was followed. First two questions measure the observed impact of each pressure for the quality management systems of the focal firm, by asking to what extent the pressure was an important pressure for quality activities within and to what extent the pressure was important for competition on quality in the market. The observed impact of a pressure is important because although someone may argue that the environment puts the same pressure to all organisations, empirical evidence shows that environmental heterogeneity exists within one industry (Kim and Lim, 1988). Second, a third question was concerned with the impact of the pressure on the revenues of a firm, which measures the importance a driver on a firm. For each pressure the average perceived impact is calculated by using the formula below.

$$Extpress = \frac{\sum_{i=1}^4 w_i \bar{x}_i - \sum_{i=1}^4 w_i}{6 \sum_{i=1}^4 w_i} * 100$$

Within this formula x_i is the value of the perceived impact from pressure i (unweighted average of the first two questions) on the firm and w_i is the value of the impact of the pressure i on the revenue of a firm. The six is chosen because the individual questions were measured on the seven point Likert scales, which means that there are six intervals in the scale. The index for external pressure from the business environment can range from 0 to 100, in which a high score means that a strong external pressure was experienced by the firm. This formula has been used in various context for summarising several influence into one index, for example to measure consumer satisfaction in the United States (Fornell et al., 1996), for predicting technology commercialisation success (Sohn and Moon, 2003) and for calculating a perception of competition intensity of several industries (Kemp et al., 2004).

Appendix 2 Validation checks

Measurement model of the supplier and buyer model, factor loadings from the EFA, standardised coefficients (factor loadings from the CFA), t-values and item –total correlations

	Supplier model				Buyer model			
	Item-total correlation	Factor loadings	Standardised coefficients	t-values	Item-total correlation	Factor loadings	Standardised coefficients	t-values
Management support								
Ms1	0.61	0.82	0.70	15.88	The same as supplier model. Management support is measured only for the focal firm.			
Ms2	0.72	0.89	0.85	15.94				
Ms3	0.65	0.85	0.78	15.43				
Transaction specific investments								
TsiS1	0.77	0.82	0.77	24.31	0.70	0.83	0.75	18.60
TsiS2	0.84	0.92	0.84	24.58	0.76	0.87	0.82	19.03
TsiS3	0.81	0.91	0.83	23.96	0.77	0.88	0.85	19.55
TsiS4	0.72	0.84	0.72	19.27	0.69	0.82	0.77	17.69
Integration of quality management								
<i>Monitoring</i>								
MonS1	0.72	0.83	0.81	21.04	0.61	0.87	0.82	24.14
MonS2	0.78	0.89	0.86	22.89	0.68	0.89	0.88	25.12
MonS3	0.74	0.84	0.83	21.96	0.67	0.89	0.89	25.24
<i>Alignment</i>								
AlignS1	0.76	0.85	0.83	22.68	0.73	0.84	0.80	22.35
AlignS2	0.79	0.85	0.86	20.93	0.79	0.80	0.86	21.77
AlignS3	0.73	0.80	0.82	22.20	0.78	0.83	0.88	25.77
<i>Improvement</i>								
ImproS1	0.70	0.71	0.79	18.87	0.70	0.60	0.81	21.44
ImproS2	0.71	0.78	0.81	19.24	0.73	0.58	0.86	22.22
ImproS3	0.76	0.83	0.81	19.07	0.71	0.81	0.76	19.21
ImproS4	0.63	0.77	0.64	14.59	0.71	0.87	0.69	16.92
Commitment								
ComS1	0.80	0.92	0.86	26.04	0.66	0.85	0.80	16.65
ComS2	0.83	0.93	0.89	25.04	0.67	0.85	0.72	16.66
ComS3	0.77	0.89	0.83	23.72	0.73	0.89	0.82	18.66
Enforcement								
EnfS1	0.61	0.90	0.85	11.61	0.49	0.86	0.90	6.49
EnfS2	0.61	0.90	0.70	11.61	0.49	0.86	0.53	6.70
Customer satisfaction								
SatS1	0.77	0.89	0.83	21.93	0.74	0.91	0.87	24.99
SatS2	0.80	0.92	0.93	22.05	0.80	0.93	0.94	26.78
SatS3	0.63	0.82	0.69	17.25	0.62	0.81	0.68	18.13

Appendix 3 Discriminant validity

The outcomes for the discriminant validity checks for the supplier and buyer model are shown in the tables below

Table X.X. Discriminant checks for the supplier model

	Average interscale correlation (AVISC)	Cronbach's	Percent Variance Explained (PVE)	Cronbach α - AVISC	PVE – AVISC ²
Management support (both models)	0.40	0.81	0.61	0.41	0.45
Transaction specific investment	0.39	0.91	0.71	0.62	0.56
Integration of quality management	0.31	0.85	0.67	0.54	0.57
Monitoring	0.36	0.87	0.70	0.52	0.57
Alignment	0.43	0.87	0.70	0.44	0.52
Improvement	0.44	0.85	0.58	0.41	0.39
Commitment	0.40	0.90	0.74	0.50	0.58
Enforcement	0.41	0.76	0.61	0.35	0.44
Customer Satisfaction	0.46	0.89	0.59	0.43	0.38

Table X.X. Discriminant checks for the customer model

	Average interscale correlation (AVISC)	Cronbach's	Percent Variance Explained (PVE)	Cronbach α - AVISC	PVE – AVISC ²
Management support	0.29	0.81	0.61	0.52	0.53
Transaction specific investment	0.38	0.87	0.64	0.49	0.50
Integration of quality management	0.40	0.91	0.68	0.51	0.42
Monitoring	0.33	0.90	0.75	0.57	0.64
Alignment	0.42	0.88	0.72	0.46	0.54
Improvement	0.43	0.87	0.61	0.44	0.43
Commitment	0.32	0.83	0.61	0.49	0.51
Enforcement	0.25	0.65	0.55	0.40	0.49
Customer Satisfaction	0.30	0.87	0.70	0.57	0.61