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ASSESSMENT MODEL FOR INTER- ENTERPRISE QUALITY SYSTEMS BASED ON ISO 9000:2000 NORM

In the Pork Sector of the Netherlands from
Breeding to Slaughtering Production Stages

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Wageningen, April 2009



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Preface

The present research idea was developed due to my desire to contribute to a running project. One of the objectives was that the findings were of interest of an organization(s) that pursue defined goals. These goals should be of collective interest, with social purposes and social responsibility.

Of my interest were theories in quality management systems and in supply chain management, among others because they offer a holistic view of an organization management and of a whole chain in a sector, thus proving to be a rather comprehensive source of knowledge.

This way, after becoming aware of the project of Q-PorkChains and how Wageningen University was involved, it was my intention to advance towards one of its specific objectives with my experience in quality management systems and studies of other managerial theories.

Acknowledgements are given to the experts that with patience answered thoroughly all the inquiries of the research and were of decisive help for its completion, and also, to the supervision of Dr. Jacques Trienekens and of Dr Nel Wognum.

I wish that my findings contribute to the challenging objective of Q-Porkchains project and dedicate my work for the benefits of the swine sector.

Wageningen, March 2009

Bibiana María Armenta Gutiérrez

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Executive Summary

The present project takes place within the frame of Q-PorkChains project, whose objective is to improve the quality of pork and pork products in Europe. One of the multiple tasks of the project aims at developing a chain-wide quality management system after having found inefficiencies when it comes to quality management systems in the industry.

The objective of the present research is in line with the former task, but the frame is considerably more specific: it is developed in The Netherlands, for the fresh pork meat chain and for the links of the first stages of the chain: breeding, primary production process and slaughtering. The objective is:

To develop an assessment model to evaluate inter-enterprise quality management systems in the first stages of a fresh pork meat chain based on

- the norm ISO 9000:2000,*
- on the study of other managerial theories, and*
- on the evaluation of its applicability to the pork sector of The Netherlands from breeding to slaughtering production stages.*

To obtain sufficient theoretical setting, theories on quality management systems and on supply chain management are reviewed. From quality management systems variables are derived from theories and empirical research. In this area total quality management and especially ISO 9000 series were used to extract the variables. Supply chain management theory is particularly important to give a more inter-organizational approach to the first theories. Based on the gathered information from literature study, an initial model is developed with three levels of abstraction: *fundamentals*, *variables* and *indicators*.

The two main fundamentals are:

- ✿ Customer orientation
- ✿ Supplier management activities

That relate to downstream and upstream interrelations respectively. These fundamentals are assessed through *variables* with corresponding *indicators* of performance.

Once an initial assessment model is developed, application of the model is done through case studies to the first stages of the fresh pork meat chain. Case studies were done using preliminary research in Q-PorkChains project, other information about pork production in The Netherlands and interviews with three experts of the field. Output of the case studies is a refined assessment model with modification of the existing components of the initial assessment model and elimination of non applicable ones, based on the analysis of the operability of the model.

The research outcome is a final assessment model to evaluate inter-enterprise quality management systems on the first stages of the pork chain, as proposed in the objective. On the basis of the present research it is recommended that an assessment model for inter-enterprise quality management in the pork industry of the Netherlands takes into account the realization and alignment throughout the chain of at least the following features:

Regarding customer orientation

- ▲ Effective communication aligned through connectivity and willingness to share information along the chain

- ▲ Oriented practices towards fulfilling and enhancing customer satisfaction
- ▲ Provision of necessary resources to fulfill and enhance customer satisfaction

Regarding supplier management activities

- ▲ Categorization of suppliers identifying particularly key suppliers
- ▲ Determination and implementation of appropriate practices taking into account previous categorization of suppliers
- ▲ Determination and implementation of quality assurance practices for supplier selection, verification of purchased product and requirements.

Indicators to assess correct performance of the previous features may vary within stages and within countries. The ones encountered for the specific case of fresh pork meat in The Netherlands for stages breeding, producers and slaughtering in the present research are the ones illustrated in table 4.1.

The developed assessment model will help to evaluate:

- Orientation of the company towards quality and supply chain practices
- Whether quality problems that arise from inter-enterprise practices are being solved by existing quality management systems
- Whether existing QMSs hold a holistic view of the chain by studying the alignment of proposed inter-enterprise quality practices

Further evaluation of the model is possible and recommended, specially taking into account the limitations of the present research. In any case, the developed assessment model shall be useful to evaluate inter-enterprise quality management systems on the pork meat chain and for further creation of assessment models for chain-wide quality management systems.

Abbreviations

EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
GFL	General Food Law
ICT	Information and Communication Technology
IKB	Integrale Keten Beheersing (total surveillance of animal production)
ISO	International Organization of Standardization
IT	Information Technology
JIT	Just In Time
LEI	Landbouw Economisch Instituut (Agricultural Economics Research Institute)
QM	Quality Management
QMS	Quality Management Systems
SC	Supply Chain
SCM	Supply Chain Management
SCQM	Supply Chain Quality Management
TQC	Total Quality Control
TQM	Total Quality Management
PDO	Protected Designation of Origin
PGI	Protected Geographical Indication
PSE	Pale, soft, exudative
R&D	Research and development
RSE	Red, soft, exudative
TSG	Traditional Speciality Guaranteed

1 Introduction

Pork meat is of great importance in European diet being the principal meat of consumption. Due to growing consumers' awareness of health problems and to every time higher food safety regulations established by European Union food law but also by companies themselves in order to achieve competitiveness in the market, it is of great use to work towards the improvement of pork and its derivative products both for commercial purposes and for human health assurance.

In this context, the European Union and Sixth Framework Programme funded a challenging project focused on the production and processing of pork products. The project is carried out by important research organizations in Europe. The aim is to improve the quality of pork and pork products by developing production chains of high quality that match consumer demands (Q-PorkChains, 2007, p. 36).

To achieve this goal the project has been divided in six pillars that interact with each other and sometimes support other pillar's activities. The fourth pillar named *Integration and Sustainable Management of the Production Chain* seeks to deliver new approaches, system designs and supportive tools for integrated management of pork chains, focusing on chain quality systems, sustainable chain logistics and management of innovations in chains. It is on this particular subject that the present research is centered, focusing specifically on the role that quality systems are playing in the pork chains of The Netherlands. The research is delimited by directing efforts on the ISO 9000 norm within the different quality systems and from breeding to slaughtering production stages within the pork chain.

1.1 Problem statement

The context of the present research project takes place within the Q-PorkChains project that is performed by important research organizations all over Europe and whose overall objective is to improve the quality of pork and pork products for the customer. Particularly task IV.2.a aims at developing reference models for inter-enterprise quality management based on HACCP, Total Quality Management and inter-enterprise quality management principles. This objective was created after taking into account various inefficiencies in the European pork industry, some of which are the large differences in the quality management systems (QMS) that have been adopted within countries and within stages in the supply chain. Another problem is the nature of the quality management system adoption, for which a holistic approach does not seem to exist for the different disciplines within the pork chain (Q-PorkChains, 2007).

In order to design a reference model for inter-enterprise quality management it is necessary to evaluate actual performance of existing inter-enterprise quality management systems. To evaluate these systems an assessment model is necessary to provide guidelines for studying relevant practices that should be included in such systems.

1.2 Background information

Q-PorkChains project was approached by dividing it in pillars with their correspondent tasks and steps; in this set up, the present research intends to contribute by focusing particularly in pillar number IV: Integration and Sustainable Management of the Production Chain, and within this pillar, attention is drawn to the topic of quality systems and their contribution to the overall objective of Q-PorkChains project.

When looking closely to pillar number IV, work package IV.2 points in the direction of evaluating the quality systems in the chain, more precisely the step number two of this work package consist of an analysis of the state of the art of quality systems in various European pork chains. Within this task, system ISO 9000:2000 is highlighted for it is considered to provide a well structured and internationally accepted frame for this analysis (Q-PorkChains, 2007). Furthermore the description of the task stresses the importance of a study of production stages from breeding to slaughtering.

Inspired by this challenging and important project and after taking into account the availability of time allocated to this research and the priorities given to the intended area of study, as stated in the previous paragraph, the researcher wants to make a contribution to the study of the functioning of quality systems in the production stages from breeding to slaughtering in The Netherlands, based on the norm ISO 9000:2000.

1.3 Project definition

Following Verschuren and Doorewaard (1999) guidelines for a research project design, we can say that the project is practice-oriented: its context refers to the first stages of the fresh pork meat chain of The Netherlands. It is also a design research: it aims at designing an assessment model based on the norm ISO 9000:2000 and other relevant theories. The model will provide elements for assessing inter-enterprise quality management systems in the previously mentioned context, useful for further research on design of criteria for chain-wide quality management systems. In order to contribute towards the solution of the problem, the model should be able to evaluate whether the existing quality management systems solve quality problems and satisfy the need of having a general, standard, trustworthy, integrated and holistic quality system that could ensure coordination throughout the whole chain.

The objective of this research project can be defined as follows:

To develop an assessment model to evaluate inter-enterprise quality management systems in the first stages of a fresh pork meat chain based on the norm ISO 9000:2000, on the study of other managerial theories, and on the evaluation of its applicability to the pork sector of The Netherlands from breeding to slaughtering production stages.

Figure 1.1 illustrates the scope of the research objective.

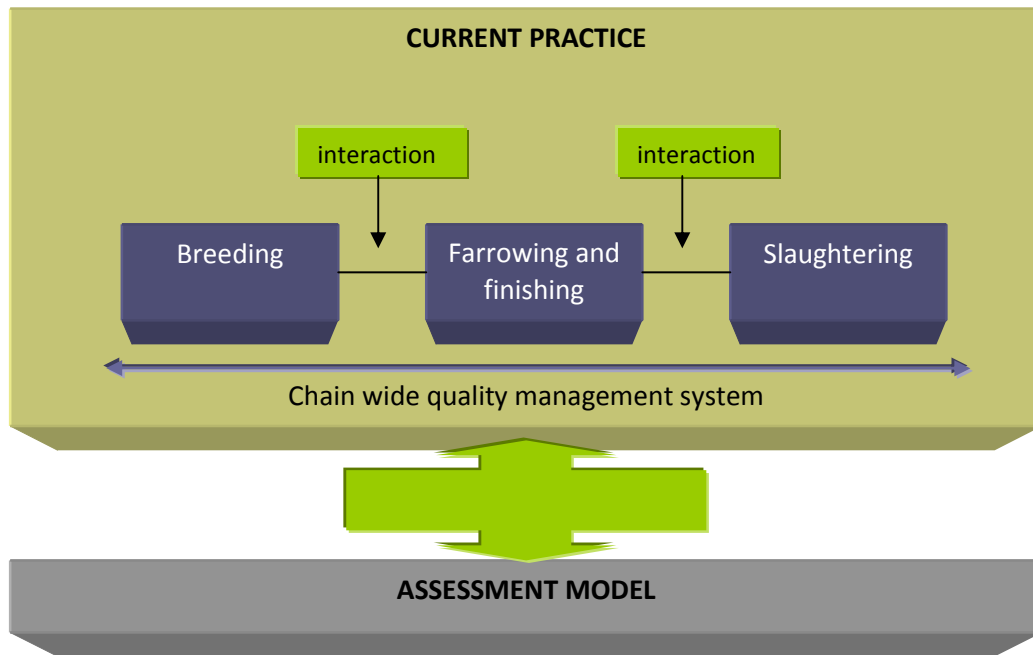


Figure 1. 1 Research project objective

1.4 Research questions

With the aim of identifying the necessary knowledge to accomplish the research objective, the latter has been explored and is expected to be achieved when the following questions are answered:

- I. **What is a suitable model to assess inter-enterprise quality management systems for companies in the Netherlands in production stages from breeding to slaughter?**
 - a. What variables can be derived from theory in Quality Management Systems?
 - b. What variables can be derived from Supply Chain Management theory?
 - c. What set of variables can be derived from confrontation of the previous sub questions for assessing the performance of a QMS for companies in the Netherlands in production stages from breeding to slaughter?
- II. **What limitations can be observed when applying the assessment model to the stages under study?**
 - a. Is the model suitable to the stages under study?
 - b. Under what conditions are the encountered variables operative?
- III. **What can be deduced from the results of testing the model in the stages under study, to make recommendations for improving the assessment model for inter-enterprise quality management?**
 - a. What adjustments can be made to the model after its application to the stages under study?
 - b. What improvements can be done to the initial assessment model?

1.5 Research Framework

In order to ensure good realization of the research objective and to arrive at a proper formulation of the research issue, a graphical display of the research framework of this project has been built and it is shown in figure 1.2.

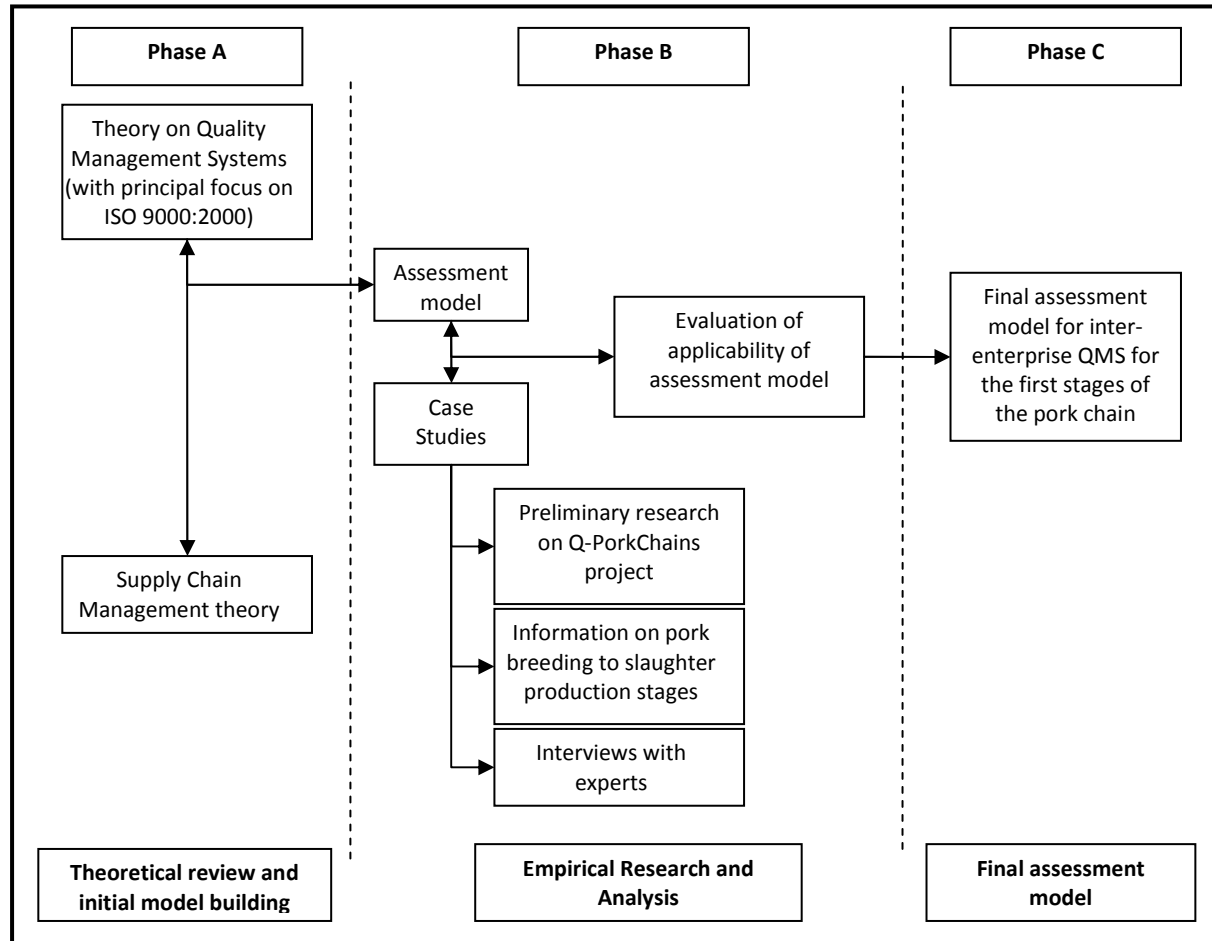


Figure 1. 2 Research Framework

To realize the research objective, three distinctive phases have been identified: Phase A that corresponds to the initial model building in which theoretical review takes place; Phase B consists of empirical research and analysis; and Phase C for reviewing the results and giving the desired assessment model. Each of the phases will be broader described below.

Phase A

Theoretical insight is needed on the theories of the areas of interest (as shown in Phase A of figure 1.2) to build an assessment model that provides a point of reference when studying the performance of the QMS on the studied stages in Phase B. The main emphasis of the theoretical review is on ISO 9000:2000 norm but other theories from total quality management systems, as well as of supply chain management will be studied to be able to develop a more complete assessment model.

Initial model building takes place in this first stage. This initial model is directly developed from the theoretical review and will be further developed with the results of phase B.

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Phase B

With the outcome of phase A of an initial assessment model based on desk research, a second level of refinement of the model takes place in phase B. Case studies are carried out where preliminary research on Q-PorkChains, other documents or available information on pork production and interviews with experts are used to evaluate the applicability of the model.

Phase C

Finally, in Phase C, the obtained results are reviewed to create a final assessment model for inter-enterprise quality management in the first stages of production: from breeding to slaughter, as stated in the research objective. When necessary new variables will be included or existent variables will be excluded to better comply specific situation of the fresh pork meat industry for the first stages of the chain in The Netherlands.

Following the theoretical framework, an outline of the report that follows the planning of the research is presented in figure 1.3.

1.6 Research strategy

The approach of this research is qualitative, and the usage of a mix of strategies is necessary: in the first phase (Phase A) of the research, mainly desk research is done where existing material is studied, while the main approach of the research is satisfied by a case study.

Profound insight on the applicability and improvement of the model should be the output of conducting interviews with experts in combination with study on preliminary research on Q-PorkChains and other relevant information and documents on pork production. This research strategy turns out to be a case study with focus on depth, qualitative and empirical proceedings.

Case studies take place for each of the three first stages of the chain (breeding, producing and slaughtering), with major focus on their two links (breeding-producing, producing-slaughtering).

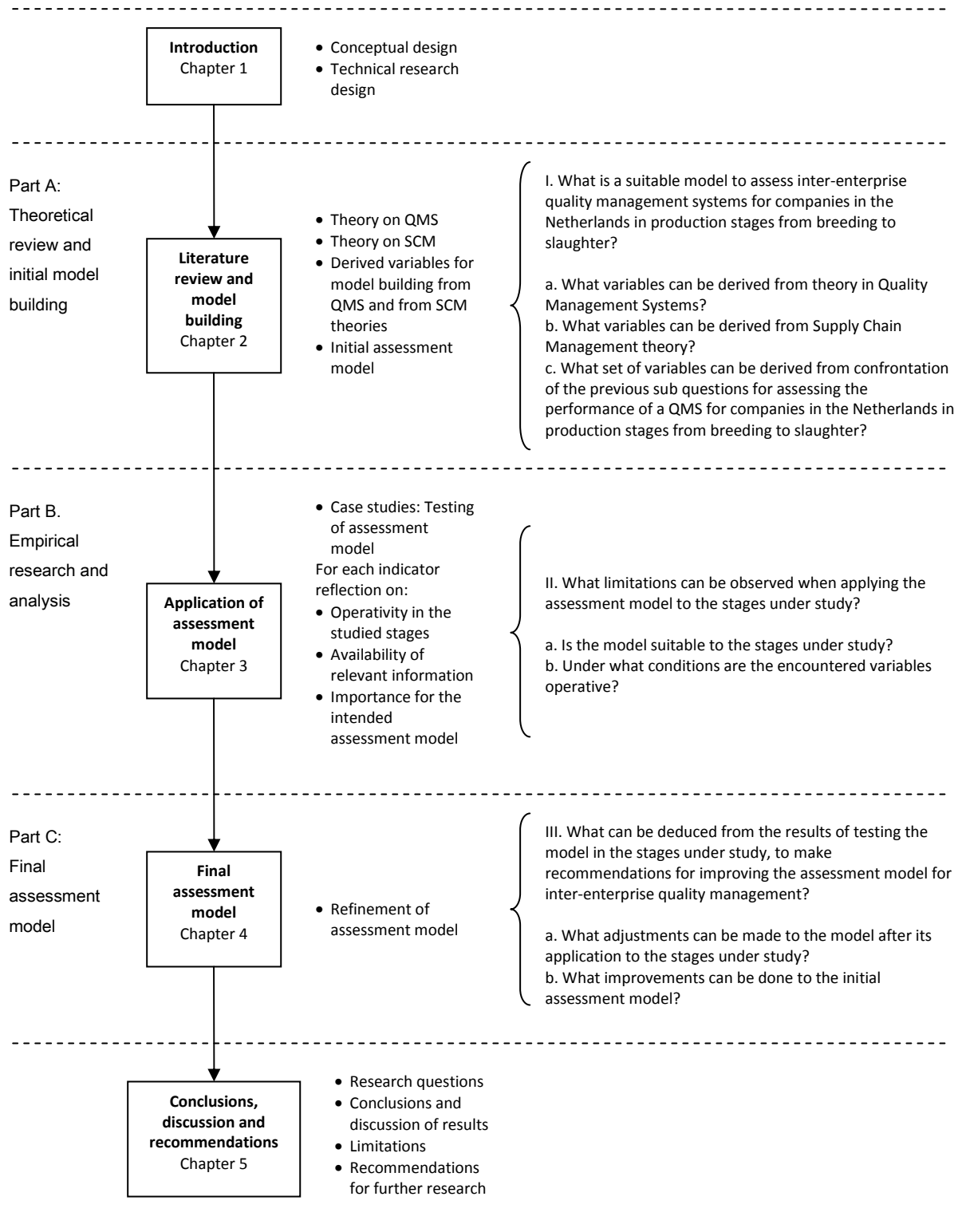
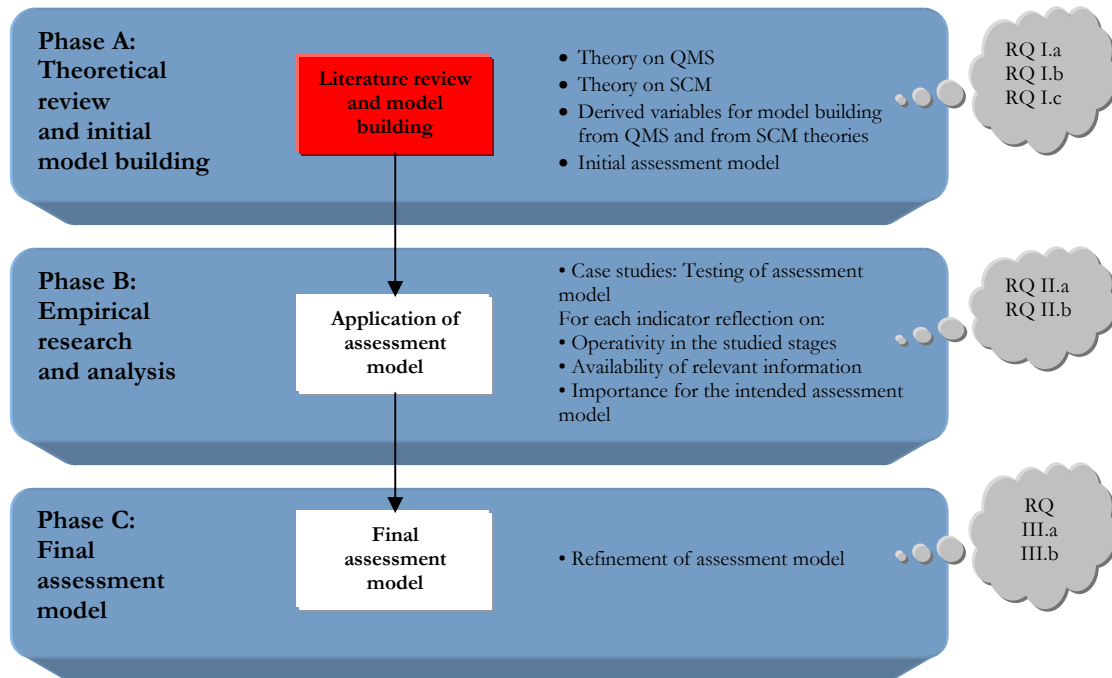


Figure 1. 3 Outline of the report

2 Literature review and model building



The present chapter will answer the following research question:

RQ I. *What is a suitable model to assess inter-enterprise quality management systems for companies in the Netherlands in production stages from breeding to slaughter?*

- What variables can be derived from theory in Quality Management Systems?
- What variables can be derived from Supply Chain Management theory?
- What set of variables can be derived from confrontation of the previous sub questions for assessing the performance of a QMS for companies in the Netherlands in production stages from breeding to slaughter?

To develop a suitable model for assessing the performance of the companies under study on QMS, literature study has been done in the following theoretical areas:

- Quality Management Systems (QMS)
- Supply Chain Management (SCM)

The mentioned theories constitute a framework for developing chain-wide QMS criteria. Because the main focus of this research is the study of inter-enterprise QM rather than of intra-organizational QM, special attention is directed to the interrelationships within members of the chain.

In section 2.1, theory on Quality Management Systems is presented; from this QMSs the one that forms the basis for the evaluation of quality performance of this research is ISO 9001:2000 that will be broader explained; other variables for the assessment model when necessary, will be selected from Supply Chain Management theory which will be discussed in section 2.2, finally a conceptual model will be presented in section 2.3.

2.1 Theory on Quality Management Systems

Pork industry in The Netherlands has been compelled to implement Quality Management Systems (QMS) as a way to respond to certain environmental pressures i.e., legal and competitive pressures, and an every time more aware consumer in relation to food safety and other quality characteristics that have not always been an issue, such as environmental practices. For pork industry in The Netherlands the following QMSs are used: ISO 9000 series, GMP (good manufacture practice), HACCP (Hazard Analysis and Critical Control Points), IKB (Integrated Chain Control or Integrale Keten Beheersing, in Dutch) and GLOBALGAP (Global Good Agricultural Practice) (Wognum et al., 2007). From these, QMSs, GMP and GLOBALGAP are based on, or use some ISO guidelines, while IKB uses elements of GMP and HACCP. IKB and HACCP have a more technological focus whereas ISO has a managerial one.

Aligned with the purpose of Q-Porkchains project, in which special recognition has been given to ISO 9000:2000 norm as a provider of a frame for analysis of the art of quality systems in pork chains, the present research selected ISO 9000:2000 for the development of a chain-wide QMS within the other quality systems.

It is significant in the present chapter to discuss: 1) total quality management, to provide a prospect on the evolution of quality management systems and its fundamentals, and to give an overview of the most important quality principles used in quality management, as presented in section 2.1.1; 2) ISO 9000 series in a more thorough way, because is the baseline QMS of this research, as done in section 2.1.2; and 3) as a conclusion of literature research on QMS theory, a first approach to variables that can be derived is presented in section 2.1.3.

2.1.1 Total Quality Management

Total Quality Management (TQM) is found at the latest stages of the development of quality management since their beginnings on 1930 when Shewart talked about statistics to reduce variation in processes and about customer satisfaction (Luning et al., 2002). Other fathers of quality, best known as quality gurus, were Deming, Juran, Feigenbaum, Crosby, who along with other figures i.e. Ishikawa and Garvin, drove the evolution of quality from mere inspection to statistic control, quality assurance, quality control and total quality management (Rao Tummala and Tang, 1996).

For a historical view on the development of quality, refer to figure 2.1, which depicts the focus of quality management through the years.

To explain what TQM is, it is possible to say that TQM is not a fixed model but is more of a philosophy that according to Dean and Evans (1994 cited in Luning et al., 2002, p. 287) covers a total company-wide effort including all employees, suppliers and customers and seeks continuously to improve quality of products and processes to meet the need and expectations of customers.

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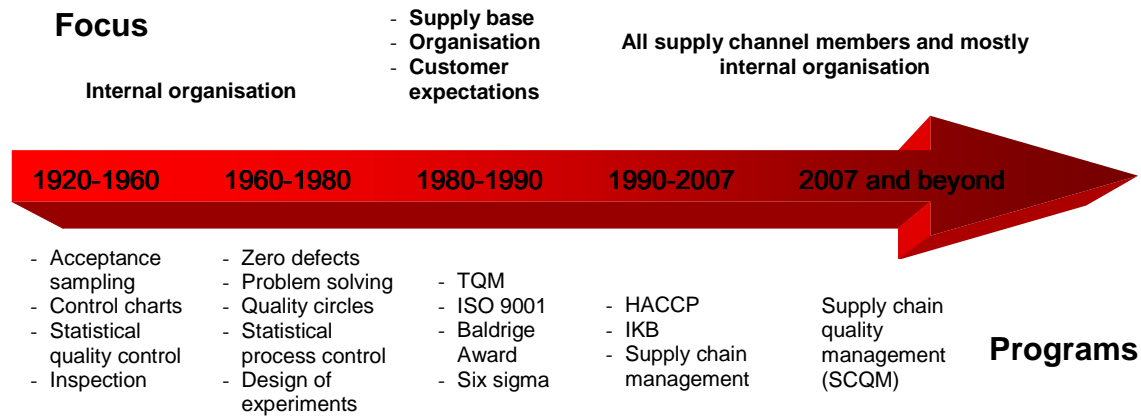


Figure 2. 1 Evolutionary timeline and focus of supply chain quality management (Robinson and Malholta, 2005 cited in van Plaggenhoef, 2007, p. 77)

Throughout quality management history, it is possible to identify core concepts or principles that were promoted by the quality gurus and that are present in most quality models. These are, according to Rao Tummala and Tang (1996):

- Customer focus
- Leadership
- Continuous improvement
- Strategic quality planning
- Design quality, speed and prevention
- People participation and partnership
- Fact-based management

Other authors, e.g. Saraph et al., (1989), Ahire et al., (1996), Black and Porter (1996), have validated TQM elements in empirical research (cited in van Plaggenhoef, 2007). From these authors Saraph et al., (1989) have validated an instrument for measuring critical factors of quality management in a model that suggests eight critical areas of managerial planning and action that must be practiced to achieve effective quality management in a business unit. The factors and their corresponding measurement items are presented in Appendix I. Other authors (Quazi and Padibjo, 1998) developed a survey questionnaire in line with the Malcolm Baldrige/ Singapore Quality Award criteria to study quality management practices in Singapore SMEs. The survey questionnaire is presented in Appendix II. Factors and measurement items from these studies will be evaluated on its relevance to be included in the assessment model in section 2.1.3.

To notice the applicability of TQM principles, it is worth to mention their promotion through business e.g., by the foundation of several quality awards, from which we can identify the European Quality Award (EQA, created by the European Foundation for Quality Management in 1992 and supported by the European Committee of the European Organization for Quality) and the Malcolm Baldrige National Quality Award (MBNQA, introduced in 1987 by the US government to promote quality leadership (van Plaggenhoef, 2007)). These awards evaluate performance of companies on several categories that are in line with TQM principles. The values of relative percentages given to the evaluated categories of these two awards, give a considerably major importance to the principle of **customer satisfaction** which show the significance of this principle for business in a company's performance on quality.

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Criticism has been given to TQM approach by authors such as Robinson and Malhorta (2005, cited in van Plaggenhoef, 2007, p. 76). According to them, TQM theories lack development into inter-organizational chain wide approaches, in other words, they have not yet been fully integrated with SCM theories. For this purpose they propose a holistic approach which they call Supply Chain Quality Management (SCQM), and that would be at the end of the evolutionary timeline shown in figure 2.1.

Such integration of theories is also sought in the present research, on which elements of TQM and SCM will be used to build the proposed assessment model.

2.1.2 ISO 9000 series

ISO (International Organization for Standardization) is a non-governmental organization which develops international standards in a wide variety of subjects mainly technical but it also has economic and social impact. ISO claims to be the largest developer of standards in the world with over 17000 developed international standards and 1100 new standards published every year. ISO is constituted by international standard institutes from 157 countries all around the world with a Central Secretariat in Geneva, Switzerland, that coordinates the system. When a new norm is developed by a technical committee interested in the subject, it is submitted for voting to the member organizations (International Organization for Standardization, 2008).

ISO 9000 is in fact a “family” or a series of norms constituted by ISO 9000, ISO 9001, ISO 9004 and ISO 19011 that comprise the previous versions of ISO norms: ISO 9000 refers to all the published norms by the technical committee ISO/TC176, Quality management and quality assurance.

The ISO 9000 family or ISO 9000 series consists of a series of standards and guidelines relating to QMS that provide requirements or give guidance on good management practice (International Organization for Standardization, 2008). The standards that make up the ISO 9000 family are the following:

- ISO 9000: describes fundamentals of QMSs and specifies the terminology for QMSs (ISO, 2000b).
- ISO 9001: provides a set of standardized requirements for a quality management system, regardless of what the user organization does, its size, or whether it is in the private, or public sector (International Organization for Standardization, 2008). In the version 2000, ISO 9001 consolidates ISO 9001, 9002 and 9003 of the version 1994, which were directed to specific areas:
 - ISO 9001: it constituted a model for quality assurance in companies concerned with design, development, production, installation and servicing processes.
 - ISO 9002: it constituted a model for quality assurance for the processes of production, installation and servicing.
 - ISO 9003: it constituted a model for quality assurance for the processes of final inspection and test.
- ISO 9004: the aim of this standard is improvement of the performance of the organization and satisfaction of customers and other interested parties (ISO, 2000b). Whereas ISO 9001 is mainly focused on customer satisfaction, ISO 9004 is recommended for satisfaction of other stakeholders, for improving effectiveness of company's quality management and for achieving company's own business goals. The implementation of this norm does not grant a certification as with ISO 9001, but again,

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ISO 9001 certification will demonstrate customers its capacity to meet their requirements, while ISO 9004 will be used for managers that want to go beyond ISO 9001 requirements and pursue continual improvement of performance (Hoyle, 2005).

- ISO 19011: guidance on auditing quality and environmental management systems (ISO, 2000b).

Another ISO norm related to the subject but that does not belong to the ISO 9000 family, would be ISO 22000:2005. It is a standard for food safety management systems and contains requirements for any organization in the food chain. This norm can also be certified by an accredited organization to demonstrate conformance of a company's food safety management system. The present research does not use theory from ISO 22000:2005 norm, but only from ISO 9000 family. For food safety management systems HACCP and IKB are the used systems in the studied stages.

From ISO 9000 series only ISO 9001 can be certified, this means, it is audited by an authorized third party or accreditation body that, if applicable, gives the international recognition of compliance with ISO quality requirements of the process(es) that its QMS covers. This certification is a powerful marketing tool as well as a provider of security to customer and is considered to be the most widely used international certification (Luning et al., 2002, p. 185). However, it not only provides a competitive advantage to the company in terms of external recognition. When implemented thoroughly, it will help the organization to manage quality systematically, to fulfill customer needs effectively and perhaps exceed them by continual improvement practices. It certainly does not mean a warranty of product conformity.

Discussion has arisen on the advantages of ISO 9000, at least on advantages concerning internal improvement of quality performance, and abundant research has been done to assess its effectiveness. For example, Stelzer, et al., (1997) in a study made on European software suppliers with an implemented ISO 9000 QMS, evaluates whether companies have achieved software process improvements with the help of ISO 9000, and found out that the impetus for a cultural change is what makes the implementation of a QMS based on ISO 9001 norm advantageous, more than the technical content itself. This impetus is given by the creation of a company-wide culture that seeks continual improvement.

When arguing that criticism towards ISO 9000 standards sometimes does not distinguish between its distinct objectives, Stelzer, et al., (1997, p. 68) highlights the differences of objectives of the ISO 9000 standards which, on one hand, provide guidelines for quality management and, on the other hand, describe requirements for quality assurance of the quality system.

ISO 9000 family is based on eight principles that provide the reason for the requirements which, in turn, are related to one or more of these principles (see figure 2.2). The principles are derived from the collective experience and knowledge of the international experts who participate in ISO Technical Committee ISO/TC 176, Quality management and quality assurance, which is responsible for developing and maintaining the ISO 9000 standards (International Organization for Standardization, 2008).

Most of these principles are aligned with other quality models and with the fundamentals of quality in the course of its development as mentioned in TQM section, and are considered, on their own, as a framework that can be used by senior management to guide their organization towards improved performance (International Organization for Standardization, 2008).

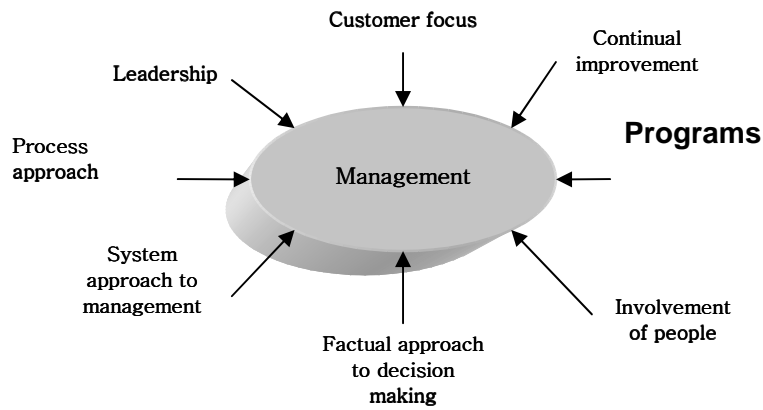


Figure 2. 2 The eight quality management principles of ISO 9000 (Hoyle, 2005)

Relationship with earlier mentioned principles of TQM can be seen in figure 2.3, in which the arrows represent the relation between principles. The not so clear relation between the principles *design quality, speed and prevention* and *process approach* was proposed by Rao Tummala and Tang (1996, p. 28).

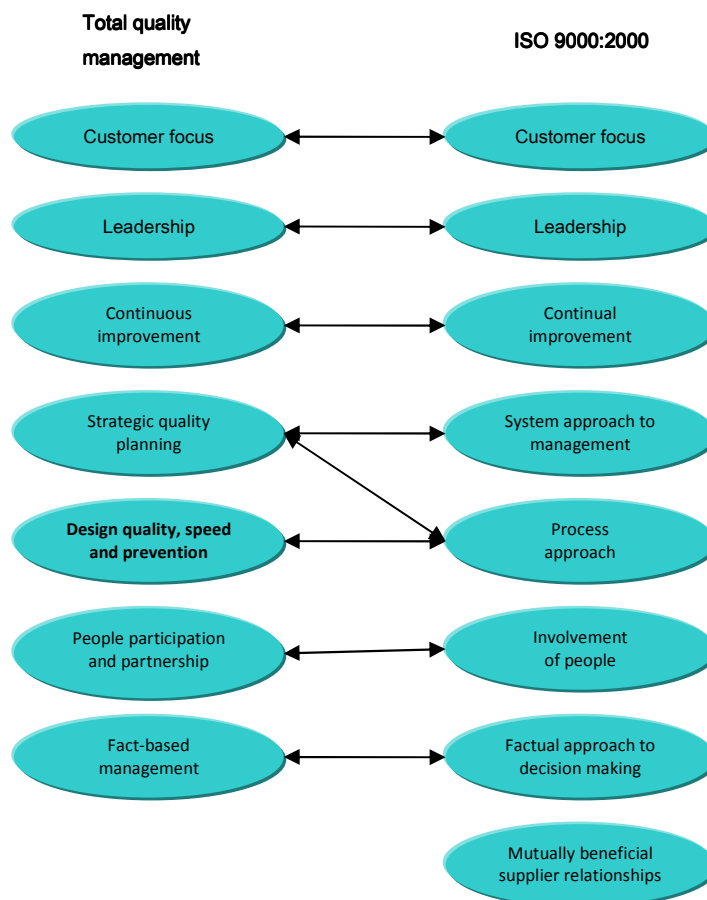


Figure 2. 3 Relation between principles of TQM and ISO 9000 family

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As mentioned in the criticism given to TQM, this one does not have a focus on inter-organizational practices and this is evident in figure 2.3 where *supplier relationships* principle of ISO 9000:2000 does not have a match in TQM core concepts. For the rest of the principles it is clear the relationship between them, and thus, the connection of ISO 9000:2000 norm with TQM.

ISO 9001:2000 principles are reflected on their requirements. The requirements are framed into four major topics as reflected in figure 2.4.

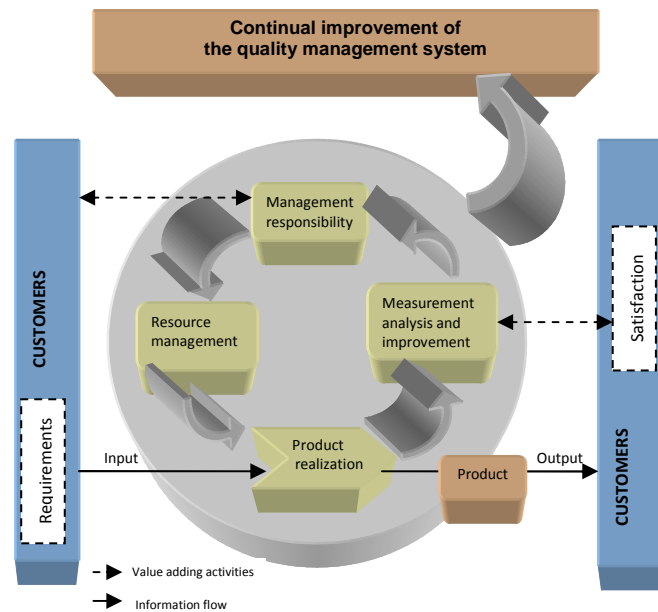


Figure 2. 4 Model of a process-based QMS (ISO, 2000c)

In the picture, the following general scheme is shown: there are inputs → **Customer requirements**, which are processed by the company using a series of interrelated cyclic activities that transform them into outputs → **Product that satisfies customer requirements**. This mechanism of conversion of inputs into something new is understood as a *process* and is exemplified with the elements of the ISO norm in figure 2.4; this recourse also works as an example on how the principle of process approach should be applied, in this case it is applied to the norm it self. The management of the company as a chain of interrelated processes is a management that uses a process approach and is one of the core principles that ISO promotes to manage quality.

Apart from the *process approach* principle, other elements have been depicted in figure 2.4: within the company, the overall ISO 9001 norm and its requirements concentrate on four major topics: management responsibility, resource management, product realization, and measurement, analysis, and improvement. The cyclic arrangement of the four main elements facilitates a *continual improvement* of the quality management system. Because the requirements are means to accomplish the principles and the objectives of quality management and quality assurance of a QMS based on ISO 9001 norm, they are important for the assessment model of the present research, and from them, variables will be derived. The requirements have been synthesized and are presented in Appendix III.

2.1.3 Derived components from QMS theory

Section 2.1 has presented the fundamentals of TQM with particular emphasis on ISO 9000 series as well as the historical evolution of QMS. From the study of these theories it is possible to advance in the construction of the proposed assessment model. In this section the research question I.a *What variables can be derived from theory in Quality Management Systems?*, will be answered.

Theories on quality management (i.e. TQM, ISO 9000, Malcom Baldrige National Quality award, European Quality award) coincide in at least four principles. These principles are: customer focus, leadership, continuous improvement and strategic quality management. As theories in quality management evolve, a more chain integrated approach is developed which stresses the importance of managing the interrelations with suppliers and customers. All the principles and practices proposed by quality management theories can also be applied to these interrelations or linkages between organizations. In this order of ideas it is possible to apply a quality system such as ISO 9001 directly to these linkages and evaluate, for example, the degree to which data is used to take decisions, the process approach that is given to the purchase practice and the involvement of suppliers in the design of a new product. Considering all the requirements of a quality system based on ISO 9000:2000 norm for each of the linkages on the first three stages of the pork industry is beyond the time constraints of the present research. The most important elements are to be chosen to build the assessment model.

From ISO 9000 principles, particularly the principles of **customer orientation** and **mutually beneficial relationships with suppliers** enhance the importance of a QMS focused on downstream and upstream relations in the supply chain, because from the eight, these two are exclusively directed to external relations. The other six principles are directed to intra-organizational practices, although they are also useful for management of linkages within companies. Furthermore the principles are mutually interrelated and so, the requirements within the Norm that address **customer orientation** and **mutually beneficial relationships with suppliers** principles, simultaneously address other of the six principles in most of the cases.

Because of the significant importance of these two principles to the supply chain, special attention is drawn to the practices within the ISO 9001:2000 norm that contributes to their realization. The model will assess main orientation towards these two principles. For the building of the assessment model these two orientations will be called **fundamentals** and will be distinguished by this bullet * .

* Customer orientation

ISO 9001:2000 norm addresses *customer focus* principle in the requirements presented in table 2.1. From these table it is distinguished the relevance that each requirement would have on an assessment model for inter-enterprise quality management, depending on its focus. There will only be useful the requirements that have an inter-organizational focus. Clauses within the Norm that address the requirements are presented in brackets in front of each requirement.

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Requirement ISO 9001	Intra-organizational focused	Inter-organizational focused
Management commitment: top management must communicate to the organization the importance of meeting customer (as well as statutory and regulatory) requirements (Clause 5.1)	Internal communication of customer requirements	
Top management shall ensure that customer requirements are determined and are met with the aim of enhancing customer satisfaction (Clause 5.2)		Customer satisfaction orientation
Establishment of quality objectives and quality policies committed to comply requirements for product (Clauses 5.3 and 5.4.1)	Customer focus integration in organization's quality strategy	
Appointment of a management representative that ensures the promotion of awareness of customer requirements throughout the organization (Clause 5.5.2)	Internal promotion of customer requirements	
Top management shall review information on customer feedback at planned intervals. Output of the review shall include, among others, decisions and actions for the improvement of product related to customer requirements (Clause 5.6)		Customer satisfaction orientation
The organization shall determine and provide the resources needed to enhance customer satisfaction by meeting customer requirements (Clause 6.1)		Provision of resources to meet customer requirements
Determination and review of customer specified requirements including requirements for delivery and post-delivery activities (Clauses 7.2.1 and 7.2.2)		Customer satisfaction orientation
The organization shall determine and implement effective communication with customer in relation to: a) product information; b) enquiries, contracts or order handling; and, c) customer feedback (Clause 7.2.3)		Effective communication with customer
The organization shall identify, verify, protect and safeguard customer property provided for use or incorporation into the product (Clause 7.5.4)		Care for customer property
Monitoring customer satisfaction as a measurement of QMS performance. Methods for obtaining and using this information shall be determined (Clause 8.2.1). The analysis of data shall provide information relating to customer satisfaction (Clause 8.4)		Customer satisfaction orientation
Release of product shall not proceed unless approved by the customer, where applicable (Clauses 8.2.4 and 8.3)	Control of nonconforming product	

Table 2. 1 *Customer focus* requirements on ISO 9001:2000 vs. relevance for assessment model

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From ISO 9001:2000 requirements on customer focus, we select those **variables** that are relevant for an assessment model on inter-enterprise quality system as presented in table 2.1. Variables will be distinguished with this bullet in the assessment model: ★

As a result of this table, we conclude that requirements of ISO 9001 related to Customer Focus address at least one of the following main variables:

- ★ Effective communication with customer: effective transfer of important types of information would represent an indicator of an effective communication system.
- ★ Orientation towards customer satisfaction: there is not consensus on how to measure customer satisfaction (Fornell, 1992) and it is not the purpose of the present research to measure it, but it is possible to identify the orientation of a company towards fulfilling customer satisfaction by evaluating its compliance with appropriate indicators that need to be developed.
- ★ Provision of resources to meet customer requirements: practices regarding provision of these resources should be identified and include in the model as indicators of customer orientation. **For a list of issues to be considered for performance improvement refer to ISO 9004 (2000a, pp. 14-15).**
- ★ Care for customer property: the final requirement related to customer orientation from ISO 9001:2000 clause 7.5.4 is the care of customer property that is in the possession of the company. This point is not mentioned in other reviewed models and may not be applicable in all the companies as it belongs to the only clause of the Norm that can be excluded to obtain the certification. In order to have an exhaustive assessment model, this requirement will be included in the original model and will be tested for applicability in the case studies.

These will be the main four variables for assessing customer orientation in the model. Further operationalization of the variables is needed. A third level of operationalization of the assessment model appears as **indicators** and will be distinguished with this bullet ✧ .

From the requirements mentioned in table 2.1 **indicators** of compliance with the variables can be derived. **Requirement** of determination and implementation of **effective communication** with customer in relation to: a) product information; and, b) enquiries, contracts or order handling (Clause 7.2.3 of the Norm) can be operationalized as follows:

When it comes to the pork sector of The Netherlands, its main technologically-driven quality system IKB, has particular requirements on the information that should be kept and exchanged along the chain. Due to IKB penetration of 95% in the pork industry of The Netherlands technological requirements will not be included in our assessment model. Independent bodies control the compliance with IKB regulations by carrying out periodic audits and imposing penalties when there is no compliance, from which the most strict one would be expulsion of the system. Expulsion from IKB means lower income for farmers (IKB pigs are bought more expensive than non accredited pigs) and a subsequent lack of competitive advantage.

Transferring of information regarding **product, enquiries, contracts or order handling**, can thus be divided in the assessment model into two indicators:

- ✧ Information transfer regarding traceability
 - Effective communication regarding traceability is differentiated in the following types:

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- Traceability required by law: stated in the General Food Law EU 178/2002, Article 18 (see appendix V). In Europe the General Food Law, is the law that sets the basic requirements on traceability for the feed and food sectors. On top of the GFL, other requirements are formulated for each food business sector.
 - Traceability required by the QS: in The Netherlands IKB is the QS that sets the rules for the pork sector. Its implementation also satisfies Dutch legal requirements e.g., VKI (food chain information) requires data to be incorporated in IKB databases. As previously mentioned, IKB has 95% penetration in the Dutch pork meat sector.
 - Traceability beyond regulations: it is possible to talk about traceability for other purposes beyond health and safety purposes, which are embraced by the QS's and GFL requirements. Other purposes include economical, marketing and future competitiveness.
- ✧ Customer requirements regarding product intrinsic and extrinsic attributes
- Proposed by Luning et al., (2002) as a quality concept, consumer quality requirements of a product can be divided into intrinsic and extrinsic perceived quality attributes. According to Theuvsen (2003), cited in Varsi (2008, p. 17) downstream information flows are necessary to communicate extrinsic quality attributes such as country or region-of-origin, or process standards (organic farming, certified quality, improved animal welfare, etc) and intrinsic quality attributes. A general classification of perceived quality attributes (intrinsic and extrinsic) as well as specific quality attributes for the studied stages of pork meat in The Netherlands is presented in appendix VI.

For other **indicators** to assess customer orientation we direct attention to other models and elements within the theory of TQM. From Quazi and Padibjo (Quazi and Padibjo, 1998) we have the following statements that aim to measure company's orientation towards customer satisfaction (see Appendix II):

- ✧ Company collects data to monitor changes in customer satisfaction. Company systematically asks a customer what they expect from the product/service
- ✧ Company knows what customers expect
- ✧ Company systematically ask customers if they are satisfied with the product/service they purchased
- ✧ Company records all customers' complaints
- ✧ Company looks for the cause of losing a customer
- ✧ Company uses customer complaints to improve its product/service

From these statements the latter four can be grouped in an assessment of company's orientation towards collecting customer feedback and using this information for improvement. First statement should be assessed separately. Second statement belongs to determination of customer's requirements.

From Rao Tummala and Tang (1996) the following practice has been extracted as indicator to accomplish effective fact-based management and is considered to be one of the necessary resource to meet customer requirements:

- ✧ The strategies to invest in information technology and tools for diagnosing and solving quality improvement problems are considered

Once concluded the selection of components from TQM theories to include in the assessment model for the fundamental of **customer orientation**, second fundamental will be discussed bellow.

✿ **Mutually beneficial relationships with suppliers**

Mutually beneficial supplier relationships principle is addressed through the ISO 9001:2000 norm in the clauses presented in table 2.2. Once again, differentiation between inter-organizational vs. intra-organizational focus is done to distinguish the relevance in the assessment model of each requirement.

Requirement ISO 9001	Intra-organizational focused	Inter-organizational focused
Processes for supplier selection: criteria for selection, evaluation and re-evaluation of suppliers shall be established (Clause 7.4.1)		Quality assurance of suppliers
Purchasing information: requirements on product, procedures, processes, equipment, qualification of personnel and QMS shall be determined and communicated to the supplier (Clause 7.4.2)		Quality assurance of purchased products
Verification of purchased product: Inspection procedures are implemented to make sure that purchased products meet requirements (Clause 7.4.3)		Quality assurance of purchased products
Analysing data to provide information relating to suppliers (Clause 8.4)	Data analysis to evaluate the effectiveness of the QMS	

Table 2. 2 *Mutually beneficial supplier relationships* requirements on ISO 9001:2000 vs. relevance for assessment model

Mutually beneficial supplier relationships principle requirements on ISO 9001 norm, as referred in Table 2.2, do not include a deeper approach towards building supplier solid relationships. From the Norm one variable can be extracted, with its subsequent indicators being the requirements mentioned in table 2.2:

- ★ Quality assurance of purchased products (specially those affecting quality of the final product)

Other useful model extracted from theory review is the one developed by Saraph, et al., (1989). This model includes factors to evaluate *supplier quality management*, which from the eight distinguished areas of the model is the only one that refers to inter-organizational practices. The proposed selected factors to achieve effective supplier management are the followings:

- ✧ Extent to which suppliers are selected based on quality rather than price of schedule
- ✧ Thoroughness of the supplier-rating system
- ✧ Clarity of specifications provided to suppliers

With the aim of getting more insight into the variables that can assess practices of mutually beneficial relationship with suppliers, theory on Supply Chain Management is studied and an overview of the findings is presented in the following section.

2.2 Theory on Supply Chain Management

Once the focus of the most used QMs has been analyzed, and bearing in mind that the objective of the research is to work towards recommendations for an assessment model for **inter-enterprise** quality management, attention of QMS in the direction of the inter-enterprise links has to be drawn. For this purpose the most suitable theory is Supply Chain Management (SCM).

In section 2.2.1 a review on SCM theory is presented together with its core concepts and as a conclusion of this literature study, a first approach to variables that can be derived for the assessment model is presented in section 2.2.2.

2.2.1 Literature review

SCM has its origins in the manufacturing industry with the concepts of JIT and quality control, when suppliers were involved in operations of the Toyota motor factory to obtain the right amount at the right time and so decrease inventory, and Deming suggested that closer collaboration with suppliers will result in cost savings and increase of quality (Vrijhoef and Koskela, 2000). It is due to the every time increasing need of obtaining competitive advantage that companies have been forced to look for alternatives outside their own possibilities, such as aligning goals, sharing resources and collaborating across company boundaries (Fawcett et al., 2007).

The supply chain has been defined as “the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer” (Christopher, M., 1992 cited in Vrijhoef and Koskela, 2000). It is on the management of these linkages in the first stages of the pork industry of The Netherlands that the present research is focused. In the correlation of the research main focus with the definition of supply chain theory it is possible to see SCM theory’s usefulness for the present research.

SCM theory emphasizes concepts such as customer orientation, collaboration between suppliers and customers, specialization of organizations on core competences, people management, process thinking, systems thinking and holistic view, empowerment, continual and incremental improvement, importance of performance measurement, importance of timely and accurate information and collaborative innovation.

Relationship with earlier mentioned principles of TQM and ISO 9000 can be seen in figure 2.5, in which the arrows represent the relation between principles.

According to SCM theory, as well as QMs, the final goal of every organization should be to achieve *customer satisfaction*. *Customer orientation* should be reflected in the organization culture and structure. It is the customer who guarantees the company survival, and so, the strategy of the organization should include practices of continual improvement that seek to exceed customer expectations or permit the company to adapt to new requirements, conditions, or even customers.

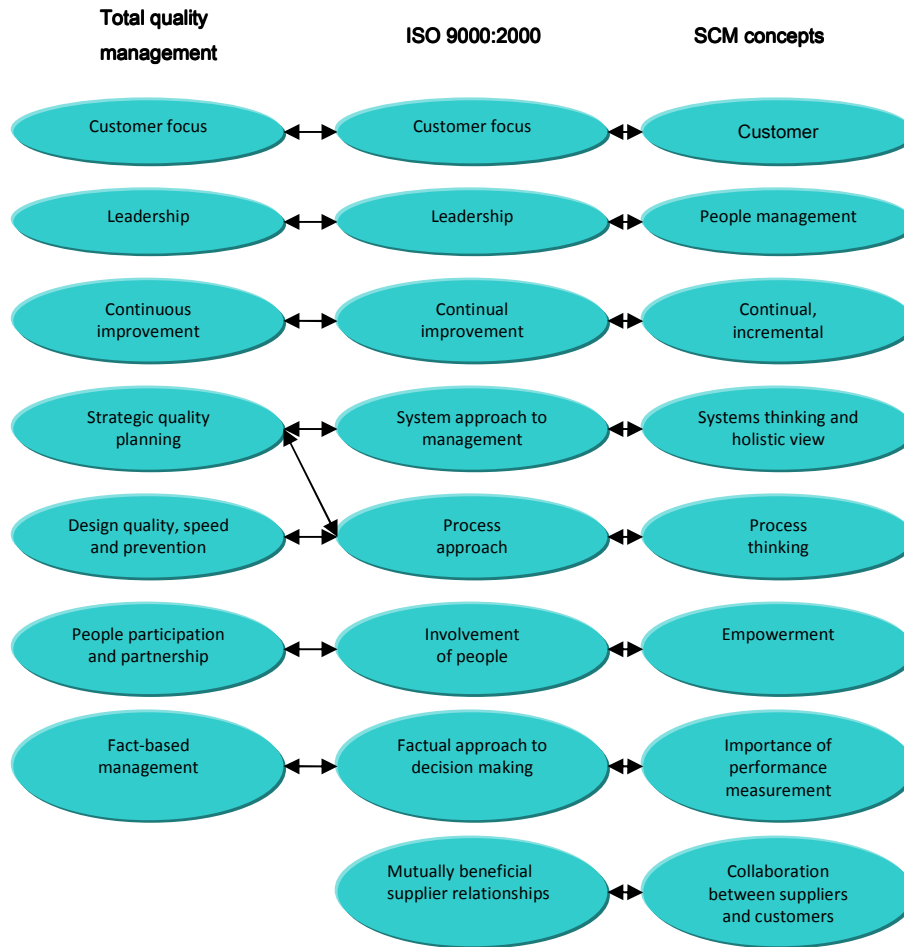


Figure 2. 5 Relation between SCM concepts, TQM principles and ISO 9000 family principles

Research studies have developed models for encountering the factors that influence SCM the most. An interesting empirical study was made in Taiwan and Hong Kong from a set of more than 100 companies on each country (Lin et al., 2005). The model was tested positively for reliability and validity, and the findings identified critical factors or variables for SCQM that are presented in Appendix IV.

The study found out that effective quality management is highly correlated with *supplier participation strategy* and this relationship influences business performance and customer satisfaction, being these two the dependent variables for measuring organizational performance as follows:

- Satisfaction level: component items include employee and *customer satisfaction*
- Business results: component items include productivity, cost performance, profitability, sales growth, earning growth, and market share

Interesting conclusions of the study were:

- SCQM process incorporates not only the participation of suppliers but also, the relevant TQM practices in their environment.
- Organizational performance can be optimized when the organization considers its suppliers as important trading partners and members of the value chain.
- Quality also continues to be an important attribute in any relationship between the company and its suppliers.

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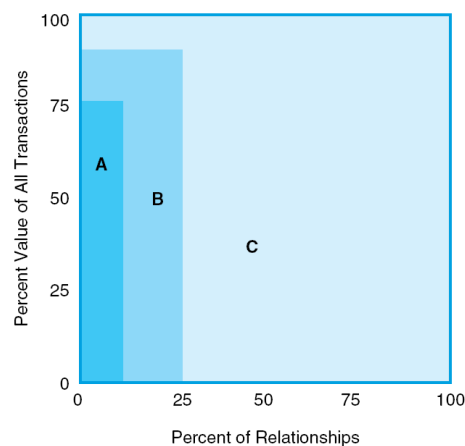
Another important research analysis results from a survey of 962 Australian manufacturing companies to identify some of the factors critical for successful agile organizations in managing their supply chains (Power et al., 2001). In the study 43 variables were identified to be significant. They were studied with respect to their contribution to indicators of agile performance. The chosen indicators were: customer satisfaction, process changeover times, productivity, delivery performance, technological competitiveness, stock turns, and product innovation. Conclusions of the study showed that more agile companies were more *customer focused*, leaned towards *involvement of suppliers* in this process, and used technology towards promoting customer satisfaction.

Another important feature to provide exceptional customer satisfaction is through the use of timely and accurate information throughout the chain, this is, of every stage in the chain with its corresponding customers, so there is an open flow of information. This feature is essential when it comes to managing chains, because it is one of the obstacles of true chain integration, largely constituting the problem of the bullwhip effect by creating every time greater variation in demand as we move further up the chain because of the uncertainty of customer real demands, causing more inventory at each stage.

According to Fawcett, et al., (2007) two main components should be taken into account to assure effective information sharing: *Connectivity*: technology is highlighted as an information sharing enabler of today. Information systems offer advantages of e.g. automation, diminution of distances, reduction of lead time, that were not possible before and that will improve performance in SC and assure competitiveness, and; *Willingness*: referred to as the practices implemented in the organization to make connectivity possible.

The last essential feature of SCM that will be discussed in this chapter is *collaboration with suppliers*. SCM implies that closer collaboration with customer and suppliers will result in the creation of value, as if the chain was a corporate team constituted by the different organizations of the chain.

SCM theory affirms that not all suppliers are equally important for an organization: it is possible to distinguish three classes of suppliers, the same way that Pareto distinguished different classes of customers on his principle of 80% of sales belonging to only 20% of customers. Following this principle, it is stated that a small percentage of all suppliers (10% to 20%), deliver a high percentage of all transactions (80%), and so suppliers are classified in A, B and C as shown in the Figure 2.6.



"A" relationships represent the most likely alliance candidates.
"B" relationships are important and should be managed with care, focusing on the future.
"C" relationships should be managed efficiently with emphasis on fairness.

Figure 2. 6 ABC classification of suppliers (Fawcett et al., 2007)

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Knowing that building alliances imply commitment of resources and other great efforts, strategic alliances should be built starting with suppliers A and perhaps some of type B depending on the importance they represent to the organization. Suppliers of less value contribution should also be treated fairly and the nature of the relationship should be mutually beneficial.

After studying the different key factors of SCM, it is the purpose of the present research to evaluate the discussed issues in the empirical part, in a systematic way; for that reason, the most important characteristics have been extracted of the mentioned concepts that should exist in a company, according to SCM theory, to have a lean supply chain, and are included in the assessment model developed in the following sections.

2.2.2 Derived components from SCM theory

Section 2.2 has presented the fundamentals of SCM. From the study of this theory it is possible to add elements to the construction of the proposed assessment model. Thus, in this section the research question I.b *What variables can be derived from Supply Chain Management theory?*, will be answered.

From the literature study on SCM previously summarized, key practices can be extracted to include in the assessment model of this research, considering their decisive importance on the consecution of a lean supply chain. *Customer orientation* is cited by all authors on SCM theory as well as *collaboration with suppliers and customers*. Efficient information exchange is one of the prerequisites of compliance of the previous two. Other major aspects of SCM theory are process approach, usage of technology to facilitate information sharing and continuous improvement. Development of the major aspects on SCM is done mainly with the purpose of achieving better fulfillment of the two biggest core concepts: customer focus and supplier relationships.

From these two core concepts, some important features can be highlighted to be included in our assessment model:

✿ Customer orientation

When it comes to achievement of **customer satisfaction**, useful indicators for our assessment model are extracted from Fawcett, et al., (2007, p. 41). He states that successful strategies consist of the following elements:

- ◇ A clearly communicated goal to help customers succeed (not relevant for assessment model because is intra-organizational focused)
- ◇ A clear understanding of downstream requirements
- ◇ Investments in customer-valued capabilities
- ◇ Training provided to customers
- ◇ Resources shared with customers

Use of timely and accurate information throughout the chain is essential to obtain chain integration and to achieve it connectivity and willingness have to be in place on each organization member of the chain. Fawcett, et al., (2007, p. 391) also presents decisive **type**

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of information that should be shared with customers in the chain. The assessment model should assess whether SC is held together and their value-added activities are synchronized by the flow of the following information:

- ✧ Inventory levels: when information on inventories is known by members of the chain, total inventory levels can be adjusted, reducing costs (costs of excess of inventory but also costs of not fulfilling customer demands) and, in the case of perishable products, helping to maintain quality.
- ✧ Order status for tracking/tracing: it is important for customers to know whether their suppliers received the accurate information of an order on time, if the order is being processed and when they can expect it to arrive, so they can do timely and suitable orders according to their production plan.
- ✧ Performance metrics: the importance of customer feedback has been already discussed and information sharing on performance metrics will help the chain not only to improve performance by recognizing strengths and weaknesses, but also to identify whether shift of tasks or processes is needed.
- ✧ Capacity and capability information: Information on changes in capacity and/or capabilities will allow coordination with members of the chain e.g. for customers to schedule orders.

✱ Supplier relationships

From SCM two main variables can be distinguished to be assessed in the model, with their subsequent indicators:

- ✱ Categorization of suppliers: not all suppliers should be treated the same way because company does not have enough resources nor the need to build strategic alliances with all of them, although fairness should remain a fixed constant in all relationships. With the aim of assessing the appropriate activities to carry out with suppliers it is first worth to categorize them for each of the stages under study. On the other hand, due to time limitations, not all suppliers and not all relationships can be studied, and so, it is necessary to acknowledge which the key suppliers are, and direct efforts towards studying this link. Categorization of suppliers following the conditions to build an strategic alliance proposed by Fawcett, et al., (2007, p. 348) give the following **indicators** for our assessment model:
 - ✧ Purchases volume that the relationship represents (for suppliers type A 10% to 20% of the commodities represent 80% of the total spend).
 - ✧ Amount of share that the supplier represents for the company's business.
 - ✧ Supplier's possession of unique skills, technology or other aspect required by the company.
 - ✧ Influence that the supplier can have on a strategic component, service or upstream/downstream relationship.
 - ✧ Potential scarcity of the product/service delivered by the supplier.
 - ✧ Advantages that an intensive collaboration with the supplier can signify, e.g. better quality, lower costs, shorter cycles or unique service.
- ✱ Specific practices should be carried out depending on the type of supplier. **Key activities** and **general practices** for suppliers will be included in the assessment model as **indicators**. In order to foster good relationships with suppliers some of the most important practices are summarized in Fawcett et al., (2007, pp. 350-351) and constitute **indicators** of good **general practices to carry out with suppliers**:

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- ❖ Maintain personal contact
- ❖ Stating clear specifications regarding product, process and contract.
- ❖ Making promptly payment
- ❖ Applianc of equal policies and treatment among suppliers, unless as recognition of improvement or better performance
- ❖ Providing support/training on quality or other relevant processes
- ❖ Evaluate and process suggestions quickly and likewise provide feedback
- ❖ Maintain the confidentiality of secret information, such as cost, technology and performance information
- ❖ Following contract obligations fully

Depending on the phase of the development process of building a strategic alliance, the following practices can be encounter according to Fawcett, et al., (2007, pp. 352-355). These are **indicators** of recommended **practices to carry out with key suppliers**:

- ❖ Long-term contract govern alliance (often 1-5 years)
- ❖ Confidentiality agreements protect proprietary technologies and properties. How jointly developed technology will be used in the future is specified
- ❖ Exit criteria are spelled out at the beginning of the relationship
- ❖ Dedicated teams to foster personal relationships and establish continuity between alliance partners, facilitating collaboration, problem solving, and brainstorming activities
- ❖ Technology linkages are established to make information exchange routine and are supported by a policy that promotes frequent, honest and open information sharing
- ❖ A problem resolution methodology to resolve the occasional misunderstandings and breakdowns that may occur is in place
- ❖ Performance measures to evaluate their own and each other's performance are aligned

Apart from the formal and tangible activities, SC managers, according to Fawcett et al., (2007) recognize key intangible attributes that are essential to build successful strategic alliances. One of them is broadly recognized in literature as a basic component for successful relationships and should also be evaluated in the empirical part of this research as **indicator** of good supplier management activities:

- ❖ Trust

2.3 Conclusions

The present chapter concludes by giving answer to the first research question: *What is a suitable model to assess inter-enterprise quality management systems for companies in the Netherlands in production stages from breeding to slaughter?*

For practical reasons in the development of the assessment model, conventions on the bullets shown in table 2.3 are used to differentiate the level of the components.

Assessment model levels	Fundamentals	Variables	Indicators
Bullet used	✱	★	◇

Table 2. 3 Bullets to indicate the level of the component in the assessment model

It is possible to conclude from this section that customer focus and seeking beneficial relationship with suppliers are key areas that should be covered in the evaluation of inter-enterprise quality management. The assessment model is divided into two fundamentals that will be further examined as follows:

- ✱ Customer orientation: section 2.3.1
- ✱ Supplier management activities: section 2.3.2

2.3.1 Customer orientation

Customer orientation is one of the factors of most relevance according to QMS different models and SCM theories. ISO 9001 requires from top management to ensure that customer's current and future requirements are determined and are met, and that the organization strives to exceed customer expectations with the aim of enhancing customer satisfaction; quality awards rank customer focus and satisfaction with the highest score among the criteria evaluated; quality gurus and TQM models consider customer focus as a principle of quality management; SCM fundamentals have a strong emphasis on customer orientation. In synthesis, all academic sources agree that it is the customer the reason for a company to exist, and so, every organization should delineate specific activities to meet the final super objective of matching company's delivered product/service with customer needs' fulfillment. As Fawcett, et al., (2007, p. 32) affirms: "the real measure of quality is whether or not a product or service lives up to customer expectations".

From the ISO 9001:2000 norm requirements on customer orientation, on section 2.1.2 *ISO 9000 series* we extracted the requirements that address a good functioning of the link between companies. SCM theory goes a step beyond and includes more commitment with key customers and an understanding of further downstream customers' expectations. Other models from TQM present some indicators of a company's factual orientation towards customer satisfaction. To assess the functioning of the linkages with a more holistic view, requirements from both theories are included in the assessment model for **customer orientation** presented in table 2.4. This table also depicts the components for assessing each variable.

Variable	Indicator
Effective communication (aligned through connectivity and willingness)	<p>There is effective transfer of the following information:</p> <ul style="list-style-type: none"> ❖ Traceability (extracted from ISO 9001:2000 clause 7.5.3, and information on pork production) ❖ Extrinsic and intrinsic quality attributes (see appendix VI) (extracted from ISO 9001:2000 clause 7.2.3, and Luning et al., (2002)) ❖ Information on inventory levels with other members of the chain (extracted from SCM theory) ❖ Information on company's capacity and capability to other members of the chain (extracted from SCM theory) ❖ Information of order status for tracking/tracing with customers (extracted from SCM theory) ❖ Data to monitor changes in customer satisfaction (as extracted from TQM (Quazi and Padibjo, 1998)) ❖ Customer feedback including complaints (extracted from ISO 9001:2000 clause 7.2.3, and TQM (Quazi and Padibjo, 1998))
Customer satisfaction (oriented practices towards fulfilling and enhancing customer satisfaction)	<ul style="list-style-type: none"> ❖ Customer requirements are determined and are reviewed, including requirements for delivery and post-delivery activities, e.g. requirements of the customer or other interested parties; market research, including sector and end-user-data; contract requirements; competitor analysis; benchmarking, and; process due to statutory or regulatory requirements (as extracted from ISO 9001 clauses 7.2.1 and 7.2.2; TQM (Quazi and Padibjo, 1998)) ❖ There is review of information on customer feedback at planned intervals. Output of the review include, among others, decisions and actions for the improvement of product related to customer requirements (extracted from ISO 9001 clause 5.6, and TQM (Quazi and Padibjo, 1998)) ❖ Monitoring customer satisfaction as a measurement of QMS performance. Methods for obtaining and using this information are determined. The analysis of data provides information relating to customer satisfaction (See appendix VII) (extracted from ISO 9001 clauses 8.2.1 and 8.4, and TQM (Quazi and Padibjo, 1998)) ❖ There is understanding of downstream requirements (extracted from SCM theory) ❖ Training is provided to customers (extracted from SCM theory)
Provision of resources (necessary to fulfill and enhance customer satisfaction)	<ul style="list-style-type: none"> ❖ There is determination and provision of the resources needed to enhance customer satisfaction by meeting customer requirements (investments in customer-valued capabilities) (extracted from ISO 9001 clause 6.1 and SCM theory) ❖ There are resources shared with customers (extracted from SCM theory) ❖ The strategies to invest in information technology and tools for diagnosing and solving quality improvement problems are considered (as extracted from TQM (Rao Tummala and Tang, 1996))
Care for customer property	<ul style="list-style-type: none"> ❖ The organization identifies, verifies, protects and safeguards customer property provided for use or incorporation into the product (extracted from ISO 9001 clause 7.5.4). Customer property includes (ISO, 2000a, p. 32): <ul style="list-style-type: none"> – Ingredients or components supplied for inclusion in a product – Packaging materials supplied directly by the customer – Customer materials handled by service operations such as storage – Services supplied on behalf of the customer, such as transport – Customer intellectual property, including specifications, drawings and proprietary information

Table 2. 4 Assessment model: customer orientation

2.3.2 Supplier management activities

Mutually beneficial supplier relationships is one of the principles of ISO 9000 standards, because it considers that: “An organization and its supplier are interdependent and mutually beneficial relationship enhances the ability of both to create value” (ISO, 2000b). It was also discussed how the evolution of quality programs drives in the direction of more inter-organizational approaches, with the development of theories such as supply chain management and supply chain quality management. Because the focus of the present research

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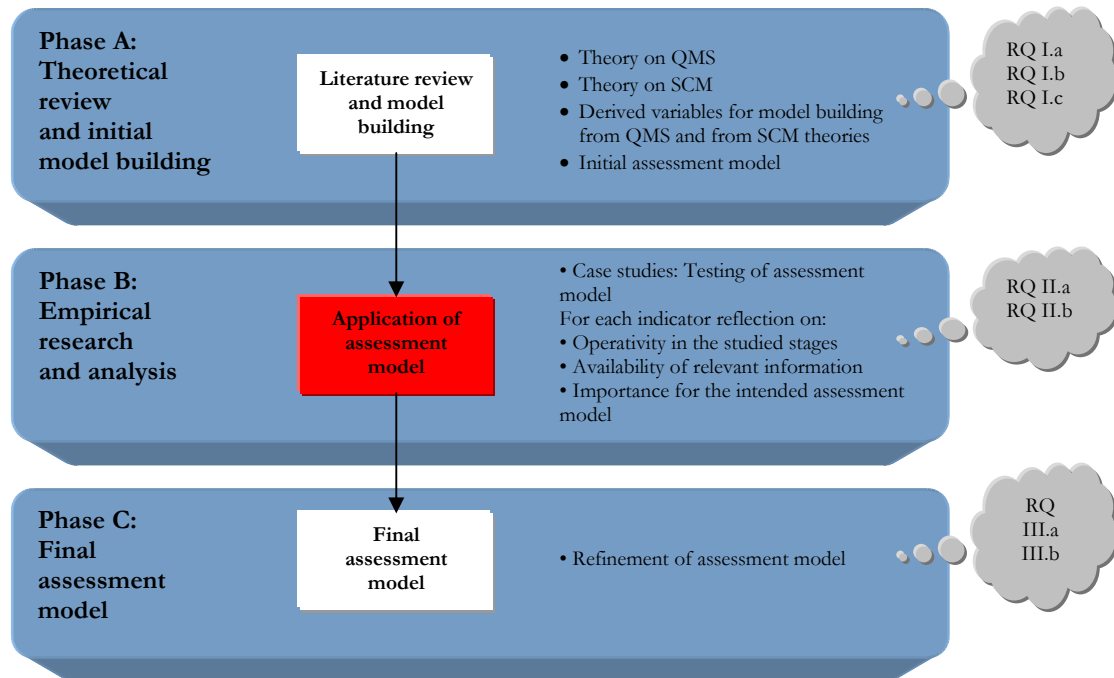
is mainly into the evaluation of organizational interrelations, this element is considered fundamental for the assessment model.

As mentioned in section 2.1.2 *ISO 9000 series*, ISO 9001:2000 norm requirements are focused on assuring the quality of purchased products. For a more profound study into the best practices to be held with suppliers, theory on SCM has been considered necessary to be integrated to our model. Using both theories the following variables of the assessment model for supplier management activities are summarized in table 2.5. This table also depicts the components for assessing each variable.

Variable	Indicator
Supplier categorization	<p>Key suppliers are identified for the stages from breeding to slaughtering, according to:</p> <ul style="list-style-type: none"> ✦ Purchases volume: 10% to 20% of the commodities represent 80% of the total spend ✦ Amount of share that the supplier represents for the company's business ✦ Supplier's possession of unique skills, technology or other aspect required by the company ✦ Influence that the supplier can have on a strategic component, service or upstream/downstream relationship ✦ Potential scarcity of the product/service delivered by the supplier ✦ Advantages that an intensive collaboration with the supplier can signify
Appropriate practices held for each type of supplier	<p>The following general practices are held:</p> <ul style="list-style-type: none"> ✦ Maintain personal contact ✦ Stating clear specifications regarding product, process and contract ✦ Making promptly payment ✦ Appliance of equal policies and treatment among suppliers, unless as recognition of improvement or better performance ✦ Providing support/training on quality or other relevant processes ✦ Evaluate and process suggestions quickly and likewise provide feedback ✦ Maintain the confidentiality of secret information, such as cost, technology and performance information ✦ Following contract obligations fully
	<p>The following practices with key suppliers are held:</p> <ul style="list-style-type: none"> ✦ Long-term contract govern alliance (often 1-5 years) ✦ Confidentiality agreements ✦ Exit criteria are spelled out at the beginning of the relationship ✦ Joint teams ✦ Technology linkages are established to make information exchange routine ✦ There is mutual problem resolution ✦ Performance measures to evaluate their own and each other's performance are aligned ✦ Relation is characterized by trust
Quality assurance of purchased products	<ul style="list-style-type: none"> ✦ There are established criteria for selecting, evaluating and re-evaluating suppliers (see appendix VIII point 6.3.1) e.g. extent to which suppliers are selected based on quality rather than price of schedule and thoroughness of the supplier-rating system (extracted from ISO 9001 clause 7.4.1, and TQM (Saraph, et al., (1989))
	<ul style="list-style-type: none"> ✦ Approval of product requirements, procedures, processes, equipment, qualification of personnel and QMS are established and efficiently communicated to the supplier (as extracted from ISO 9001 clause 7.4.2, and TQM (Saraph, et al., (1989))
	<ul style="list-style-type: none"> ✦ There have been established and implemented inspection procedures to make sure that purchased product meet requirements (see appendix VIII point 6.3.2) (extracted from ISO 9001 clause 7.4.3)

Table 2. 5 Assessment model: supplier management activities

3 Application of assessment model



In order to answer:

RQ II. *What limitations can be observed when applying the assessment model to the stages under study?*

- Is the model suitable in the stages under study?
- Under what conditions are the encountered variables operative?

Application of the model built, based on QMS and SCM theories, to the pork industry should be tested and, for this reason case studies have been done with information gathered in the following areas:

- Breeding to Slaughtering production stages in the pork chain: Breeding, finishing, farrowing and slaughtering
- Preliminary research of Q-PorkChains project
- Interviews with experts

Information on pork production was mainly extracted from Q-PorkChains project's developed work packages, scientific articles and Master and Doctoral theses.

The experts interviewed were:

- A quality manager of the biggest slaughterhouse of The Netherlands VION with a market share of 70%
- An expert researcher of the Institute of Food Safety RIKILT
- A manager of Quality and Food safety of the market leader Pork Feeding industry with 12% of Benelux feed production NUTRECO.

The present chapter presents the results of testing the assessment model by applying it to the stages breeding (section 3.1), producing (section 3.2) and slaughtering (section 3.3) of the fresh pork meat chain of The Netherlands. Supplier management activities are evaluated for the second and third stages of the link i.e. for producers and slaughterhouses because relationship between breeders and their suppliers are beyond the scope of this research.

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Section 3.4 will summarize the findings, will give a reflection on availability of information gathered and will conclude about the suitability of the model to the stages and the operativity of each variable.

3.1 Chain first stage: Breeding

✿ Customer orientation

★ Effective communication aligned through connectivity and willingness

Variable	Indicator
Effective communication	There is effective transfer of the following information:
	✧ Traceability
	✧ Extrinsic and intrinsic quality attributes
	✧ Company information on inventory levels
	✧ Information on company's capacity and capability
	✧ Information of order status for tracking/tracing
	✧ Data to monitor changes in customer satisfaction
	✧ Customer feedback including complaints

✧ Traceability

Main information that have to be transferred according to IKB requirements for farmers is related to feed labels and other delivery information of feed as well as information on feed that is prepared in the farm. Also pig farmer has to receive from the slaughterhouse (possibly via the trader) the data documented during the health inspection of its pigs. Details on medicines shall also be recorded (Kalathas, 2007, pp. 51–60).

✧ Extrinsic and intrinsic quality attributes

Producers specify desired quantity and quality of the gilts and the delivery date through verbal communication. Through breeder's magazine they communicate to farmers the latest developments on their products. Problems with deliveries are discussed face to face (Wever and Wognum, 2007, p. 15).

✧ Information on inventory levels

Inventory levels are referred in this feature as the main supply for the next stage of the link as follows: levels of semen, numbers of sows and boars, to be supplied to the producer. This type of information is not being share in the sector. As in the case of information on company's capacity and capability, because breeding companies are such big companies there might not be need for the farmers to be worried about low levels on the inventory of their suppliers.

✧ Information on company's capacity and capability

There are three big breeding companies in The Netherlands and they know the market very well. They know all the multipliers in The Netherlands and their customer's levels of demand. Base on this information they program their production. On the other hand, farmers may want to know their supplier's capacity but not into an exact detail. Their breeding providers are companies so big that it is not likely they will have a capacity or capability problem in the long term. In the short term there could be complications that could delay the delivery. In case of a malfunction in the company it would be communicated to the chain. If there is a minor malfunction in food safety or an incident is to be expected it is legally obliged to inform to governmental bodies.

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✧ Information of order status for tracking and tracing

In general this type of information is in place and is working satisfactory. By law every animal that is transported over the public road has to be labeled and every transport has to be registered centrally to the government. This way it is possible to know the route and date of every animal that is transported in The Netherlands.

Every farm registers destination and origin of every animal that is delivered. They had agreed the day of the delivery with their supplier previously.

✧ Data to monitor changes in customer satisfaction

Changes in customer satisfaction are determined by changes in end consumer preferences. The challenge on this point is that this information is not well communicated upstream the chain. Communication at the latest link of the chain i.e. information towards consumer and from consumers to the business, is at a very low level and can be improved. There is the question on whether demands are imposed to the chain by the end consumer or by the retailer. End consumer's real demands are exclusively of the domain of the retailer.

✧ Customer feedback including complaints

Information system used by farmers to pose their complaints is informal: problems between producers and breeders are discussed face-to-face.

★ Oriented practices towards fulfilling and enhancing customer satisfaction

Variable	Indicator
Customer satisfaction	✧ Customer requirements are determined and are reviewed
	✧ There is review of information on customer feedback as input to take decisions
	✧ There is monitoring of customer satisfaction. Methods for obtaining and using this information are determined
	✧ There is understanding of downstream requirements
	✧ Training is provided to customers

✧ Customer requirements are determined and are reviewed

The sector has the tool of alignment of requirements through Qs such as IKB which incorporates general accepted requirements on its system and audits companies on its performance. Beyond that, customer requirements are mainly agreed upon request of product.

✧ Review information on customer feedback as input to take decisions

Once every year, breeder organization collects data on the technical results of farrowing and finishing farms to obtain feedback on the quality of their supplied genetic material (Wever and Wognum, 2007, p. 15).

✧ There is monitoring of customer satisfaction. Methods for obtaining and using this information are determined

Not information about this practice in this link was possible to gather.

✧ Understanding of downstream requirements

According to one expert it is not really known which consumer's needs really are because retailer is leading the chain and they are imposing the most demands. As already mentioned information that goes to the end consumer is limited, but it is not known what information he really wants and which information that is being provided is not being handled well. Too much information is also not convenient. Apparently real demands of end consumer are mainly based on price.

✧ Training provided to customers

Breeders provide information to farmers, they bring in data, and they manage and monitor the data.

★ Provision of resources to fulfill and enhance customer satisfaction

Variable	Indicator
Provision of resources	<ul style="list-style-type: none"> ✧ There is determination and provision of the resources needed to enhance customer satisfaction ✧ There are resources shared with customers ✧ The strategies to invest in information technology and tools for diagnosing and solving quality improvement problems are considered

✧ Determination and provision of resources to enhance customer satisfaction

Not specific information about this practice in this link was possible to gather.

✧ There are resources shared with customers

This is a practice not so common in the studied stages. There is not sharing of physical resources mainly due to hygienic reasons. Resources shared are mainly in the form of advice or knowledge. Also when there are projects within different companies of the same stage or within different stages there is sharing of resources up to a certain level. In the case of projects or alliances, there are contracts or clear agreements about the contribution of each member and about what the different parties can do with the output.

✧ Investments in information technology and in tools for diagnosing and solving quality improvement problems

Breeding stage (as well as other members of the chain) uses farmingnet¹ application that has been implemented by VION with the help of research institutes, to put information back in the chain. The information here available can be used by breeding companies for breeding management. Questions like which kind of breed has the best meat performance, what breed has the best technical performance on farm, which farms produce the best with a certain kind of breed to get the best result and so, the best price, are possible to answer with the use of this internet application and the practice of sharing data along the chain. This data is available via internet and each company has their own way of analyzing it and combining it with other data to improve own performance but also to improve the advice they give to farmers. That has been mainly done by feeding companies. According to one expert, breeding management data should be more involved to get a more robust data system and thus be able to make better choices with a better analysis.

★ Care for customer property

Variable	Indicator
Care for customer property	<ul style="list-style-type: none"> ✧ The organization identifies, verifies, protects and safeguards customer property provided for use or incorporation into the product Customer property includes: <ul style="list-style-type: none"> – Ingredients or components supplied for inclusion in a product – Packaging materials supplied directly by the customer – Customer materials handled by service operations such as storage – Services supplied on behalf of the customer, such as transport – Customer intellectual property, including specifications, drawings and proprietary information

It is not a practice in the studied pork chain to give property or other assets to suppliers for incorporation into the final product.

¹ See 3.3 Chain third Stage, assessment on Investments in information technology and in tools for diagnosing and solving quality improvement problems

3.2 Chain second stage: Primary production process

✿ **Customer orientation**

★ **Effective communication aligned through connectivity and willingness**

Variable	Indicator
Effective communication	There is effective transfer of the following information:
	✧ Traceability
	✧ Extrinsic and intrinsic quality attributes
	✧ Company information on inventory levels
	✧ Information on company's capacity and capability
	✧ Information of order status for tracking/tracing
	✧ Data to monitor changes in customer satisfaction
✧ Customer feedback including complaints	

✧ **Traceability**

VKI regulation (food chain information) imposes requirements on data exchange between slaughterhouse and farmers. Basically it requires from the slaughterhouse to have information of the health situation of the pig to be slaughter (e.g. information on medicated feed and water used in the past two months) and consequently take measures to assure food safety. In VION this process is organized with ultimate systems. Data from all deliveries is saved in an electronic data base that is now fully automated. From this data it is possible to derive trend analysis, performances for the last months/weeks and performance compared with other farmers. Transmitting this information back to suppliers of delivered pigs grant those with a management tool to improve uniformity and health status of their pigs. Traceability is guaranteed for each individual pig till the moment of post mortem slaughter.

✧ **Extrinsic and intrinsic quality attributes**

The supplier has a delivery, offers it and gives the necessary information to potential buyers. The channel of communicating slaughterhouse's requirements to suppliers is through a department in the slaughterhouse's company that is responsible for all the communication with farmers. They use means like magazines and field officers (people that go to farmers regularly), to inform farmers about trends of the market and to try to translate this trends in terms of their production practices.

They also organize meetings at the slaughterhouse plants where farmers can see what is being done with the pigs that they supply, what the customer requirements on quality of the meat are, the products that the slaughterhouse supplies, etc. This measure is expected to enhance communication between producer and slaughterhouse and to create commitment by understanding the process and the additional requirements that are imposed by customers.

✧ **Information on inventory levels**

Not information at this respect is transferred from producers to slaughterhouse. Buyers of the slaughterhouse try to fill the slaughterhouse's capacity by asking farmers an estimate of their supply. This informality is highly due to the variation on price per week which makes it more convenient for the farmers to have a market on the spot rather than fixed contracts.

This system functions because it is not convenient for farmers to change customers so frequently. That guarantees to the slaughterhouse a relative constant level on the supply of pigs. One strategy is to pay premium when the supplier succeeds in informing accurately, some weeks in advance, the number and type of pigs that he will deliver. This information is essential to have a good planning in the slaughterhouse.

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✧ Information on company's capacity and capability

Unlike the slaughterhouse, where there is always an over capacity, for fatteners and multipliers capacity is generally always up to the maximum level. A small fattener can wait two weeks for a suitable price on the buying of piglets, so they have some margin while the multiplying herds cannot wait because their sows keep on producing all the time, so they have a constant capacity of 95%.

Although an important tool for planning, for a large slaughterhouse like VION a diminution on the supply of one farmer has a relative minor impact in the total batch due to the high amount of pigs they slaughter every week and the diversity of farmers. VION has five slaughterhouses in the Netherlands, the pigs from farmers are collected centrally and divided to the different slaughterhouses, and thus the effect of the diminution of one of the farmer's supply is not enough to be risky.

✧ Information of order status for tracking and tracing

With the farmingnet² system, tracking and tracing is automatized. There is an application in the system where farmers can inform to the slaughterhouse VION the date and the amount of pigs to be supplied. This way tracking and tracing is in a database available via internet. Although this system was set in place six months ago, not all farmers participate.

✧ Data to monitor changes in customer satisfaction

Due to the biological cycle of the product that has to be taken into account it is not so easy to respond to changes in customer demand quickly. The strategy that farmers have adopted to anticipate changes in customer satisfaction is to produce products that can be used in a lot of different markets.

If the trend is generalized as a requirement for the chain, IKB will incorporate it in their requirements. Every farm is inspected at least once a year for IKB agents.

A challenge that farmers face at this point is the low margin they have for investments in new farming practices. When the market is paying better prices farmers are more willing to invest in changes.

✧ Customer feedback including complaints

Slaughterhouse makes sure that farmers know its requirements by means of the payment system (premium payments when approximating required specifications) and by giving feedback of performance of the delivered pigs via FarmingNet.

★ Oriented practices towards fulfilling and enhancing customer satisfaction

Variable	Indicator
Customer satisfaction	✧ Customer requirements are determined and are reviewed
	✧ There is review of information on customer feedback as input to take decisions
	✧ There is monitoring of customer satisfaction. Methods for obtaining and using this information are determined
	✧ There is understanding of downstream requirements
	✧ Training is provided to customers

✧ Customer requirements are determined and are reviewed

The slaughterhouse makes sure that farmers know their preferred quality attributes every time. They let farmers know their specifications which are sometimes communicated in a formal way through paper or they use informal channels because they know each other very well or they are members of the same cooperative. Other specifications are set by QSS. IKB

² See 3.3 Chain third Stage, assessment on Investments in information technology and in tools for diagnosing and solving quality improvement problems

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has several penalty measures for non compliance with specifications, from which expelling the producer out of the system would be the worst one since non compliance with IKB requirements means lower prices for the pigs.

Noncompliance with law requirements are sanctioned with penalties e.g. for use of prohibited substances.

❖ **Review information on customer feedback as input to take decisions**

Not specific information about this practice in this link was possible to gather.

❖ **There is monitoring of customer satisfaction. Methods for obtaining and using this information are determined**

Not specific information about this practice in this link was possible to gather.

❖ **Understanding of downstream requirements**

Producers study the market to actualize its demands and try to produce accordingly.

❖ **Training provided to customers**

As far as information was gathered no training from producers to slaughterhouses takes place.

★ **Provision of resources to fulfill and enhance customer satisfaction**

Variable	Indicator
Provision of resources	<ul style="list-style-type: none"> ❖ There is determination and provision of the resources needed to enhance customer satisfaction ❖ There are resources shared with customers ❖ The strategies to invest in information technology and tools for diagnosing and solving quality improvement problems are considered

❖ **Determination and provision of resources to enhance customer satisfaction**

The agricultural business is a low margin business. Food has become very cheap in the latest years due to previous investments on automation that have improved the efficiency of processes. Margins now are too low to allow further investments. For example resources that are needed for the new trend on welfare practices have to be paid additionally. Technology may be available but the question is on whether acquisition of new technology will give returns on the investment.

In food industry the determinant is price and the price is set not by the consumer but by the retailer.

❖ **There are resources shared with customers**

Refer to resources shared with customers on 3.1 Chain first stage.

❖ **Investments in information technology and in tools for diagnosing and solving quality improvement problems**

Information sharing is increasingly done through internet applications (like farmingnet or VION). Unfortunately not all farmers can afford investments in information technology especially when some want to quit business: since the reconstruction of the law created in 1998, many small farms have closed and large farms are becoming larger (Wognum et al., 2007, p. 10). Bigger farms need more use of technology. Technology is a diagnostic tool for farmers, since it allows them to compare their performance with each other, make analysis on technical parameters, etc., and based on these take better decisions.

Improvement on technology is visible over the last 10 years with the usage of highly sophisticated computerization of climate control in stables, feeding stations and automatic watering systems.

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★ **Care for customer property**

Refer to *care for customer property* on 3.1 Chain first stage.

✿ **Supplier management activities**

★ **Supplier categorization**

Variable	Indicator
Supplier categorization	<p>Key suppliers are identified for the stages from breeding to slaughtering, according to:</p> <ul style="list-style-type: none"> ✧ Purchases volume: 10% to 20% of the commodities represent 80% of the total spend ✧ Amount of share that the supplier represents for the company's business ✧ Supplier's possession of unique skills, technology or other aspect required by the company ✧ Influence that the supplier can have on a strategic component, service or upstream/downstream relationship ✧ Potential scarcity of the product/service delivered by the supplier ✧ Advantages that an intensive collaboration with the supplier can signify

Of the typical fresh pork meat chain (about 95% of all pork meat) the most important suppliers of each of the studied stages are as shown in table 3.1 (Wognum et al., 2007).

Breeder	Producer (farrowing and finishing)	Slaughtering
Feed producer Hardware providers Veterinarians	Breeders Feed producer Hardware providers Veterinarians Transporters Traders Dealers Distributors	Producers Feed producer Hardware providers Veterinarians Transporters Traders Dealers Distributors

Table 3. 1 Most important suppliers in the typical pork chain

From these suppliers the key suppliers according to the criterion of purchases volume, importance of the purchased product and advantages of having closer collaboration, are the suppliers that belong to the primary process. From Q-Porkchain project research (Wognum et al., 2007) it is known that key breeding suppliers for the pork meat of The Netherlands are Topigs with a market share of 75-85%, Hypor (part of Nutreco) and PIC.

The empirical part of this research studies the general practices that are held in the studied stages with suppliers of the primary process. For this reason the assessment model of this research evaluates activities for general suppliers and for key suppliers together, since it is evaluating the primary process.

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* Appropriate practices held for each type of supplier

Variable	Indicator
There are appropriate practices held for each type of supplier	<p>The following general practices are held:</p> <ul style="list-style-type: none"> ✧ Maintain personal contact ✧ Stating clear specifications regarding product, process and contract ✧ Making promptly payment ✧ Appliance of equal policies and treatment among suppliers, unless as recognition of improvement or better performance ✧ Providing support/training on quality or other relevant processes ✧ Evaluate and process suggestions quickly and likewise provide feedback ✧ Maintain the confidentiality of secret information, such as cost, technology and performance information ✧ Following contract obligations fully ✧ Long-term contract govern alliance (often 1-5 years) ✧ Confidentiality agreements ✧ Exit criteria are spelled out at the beginning of the relationship ✧ Joint teams ✧ Technology linkages are established to make information exchange routine ✧ There is mutual problem resolution ✧ Performance measures to evaluate their own and each other's performance are aligned ✧ Relation is characterized by trust

✧ **Maintain personal contact**

Members of breeder's commercial team visit farrowers between two and five times a year for relationship management purposes (Wever and Wognum, 2007, p. 15).

✧ **Stating clear specifications regarding product, process and contract**

On one expert's opinion, although this practice is acceptably done, it can be further improved. He doubts whether farmers really understand key messages that come from breeders and feeding companies.

✧ **Making promptly payment**

This practice is widely observed.

✧ **Appliance of equal policies and treatment among suppliers, unless as recognition of improvement or better performance**

In the case of commercial relations between fatter and herds' multipliers preference will be within members of the same cooperative. As already mentioned farmers are largely grouped in cooperatives and they are loyal to their members when selecting a supplier. Supplier members of the same cooperative will be suppliers type A or key suppliers.

✧ **Providing support/training on quality or other relevant processes**

Support or training goes from suppliers towards farmers rather than in the opposite direction. Especially the feeding industry has taken over the role of providing information to farmers that governmental agencies had in the past. The commercial sector appeared to better comply with farmer information needs than the governmental sector (Wognum et al., 2007, p. 9). On the other hand, farmer's organization has a study evening where farmers can learn from each other problems.

✧ **Evaluate and process suggestions quickly and likewise provide feedback**

A fast provision of feedback on the link breeder-producer is limited by the time lapse of the biological cycle. Multipliers have to evaluate the performance of sows after seeing results. They buy sows approximately every 4 months. There is low rotation on the type of breed per farm because it is not so easy to change from a specific breed to another one since it needs

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especial adaptations. Farmers get used to the way a certain type of sow functions best. The same happens with the fattening herds.

Another reason for the low rotation on the type of breed per farm is that by law, farmers are not allowed to have piglets that come from more than three multiplying herds. This is due to hygienic and bio-security reasons.

On the opinion of one expert, there is a trend on working more with a long-term approach; with this approach feedback is better accepted because both parties are working in building a relation. This depends on the customers because there are farmers that want more information and more frequent visits to discuss progress etc., while others just want the delivery of the product. In general, breeding and feeding companies are willing to deliver more than just the product to farmers but what they deliver depends on each particular farmer manifested needs.

✧ **Maintain the confidentiality of secret information, such as cost, technology and performance information**

There is insight information but is not so highly confidential e.g. information about prices.

It is important to maintain the confidentiality of secret information especially to build trust and it is a key practice for buyers and traders.

The breeding stage is formed by big companies that are in the stock exchange and they have internal rules to maintain confidential information. For salesmen, advisors or technical experts it is clear which type of information is confidential.

✧ **Following contract obligations fully**

This is essential to continue on the business in the long term. Although the pork industry at this stage is not characterized by formal contracts, there is a trend towards formalization due to bio-security reasons over the last ten years. At the moment almost all deliveries in the food sector require two signatures.

It is also an important component to build trust.

✧ **Long-term contract govern alliance (often 1-5 years)**

There are no long term contracts for buying and selling piglets or pigs because of the high variability on the prices of the pig in the market that makes farmers prefer to sell on the spot. Despite of this characteristic, stability of the sector is maintained: few choices of buyers and suppliers in the sector have increased dependency of one another, and buyers and suppliers are not highly differentiated (Wognum et al., 2007).

Longer terms relationships at this stage are the ones that exist through membership of cooperatives. Other contracts are in terms of QSSs.

✧ **Confidentiality agreements**

It is not an extended practice in this link to have confidentiality agreements. If there is a common project on which different parties participate, there could be confidentiality agreements to protect the benefits of the output, but these are very specific cases.

✧ **Exit criteria are spelled out at the beginning of the relationship**

There is the ending of a commercial relationship when there is not compliment with requirements (e.g. IKB requirements) and there is a third party who certifies this fulfillment of requirements. When there is not compliment with safety or legal requirements then enforcement takes place by Dutch authorities.

✧ **Joint teams**

Teams are formed more on a sector level together with farmers unions like LTO, to work together in projects and research. Teams like these ones are considered important as a way to get commitment in changes.

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❖ **Technology linkages are established to make information exchange routine**

Information technology is mainly on usage of computers, internet and mobile phones.

❖ **There is mutual problem resolution**

Depending on the type of relationship. There would be mutual problem resolution when there is a long relationship.

❖ **Performance measures to evaluate their own and each other's performance are aligned**

As part of competitive information performance measures are aligned between the customer and its breeding provider and the customer and its feeding provider.

According to Q-Porkchains (Wognum et al., 2007, p. 20), in the primary production process, performance measures are not used extensively. Some indicators that are used are: growth of pigs per day, number of piglets per sow, number of piglets per sow per year, profit per sow place, profit per pig place, costs per pig, cost per kg of meat, turnover/profit division per chain link and number of pig delivered to slaughterhouse.

❖ **Relation is characterized by trust**

Open, timely and relevant information sharing depends on trust. When there is trust between multipliers and fattening farmers they share information about the conditions of the pig they are delivering. This willingness to share information is based on trust, it is not required by law or by a QS and it is not in contract.

★ **Quality assurance of purchased products**

Variable	Indicator
Quality assurance of purchased products	❖ Criteria are established for selecting, evaluating and re-evaluating suppliers
	❖ Approval of product requirements, procedures, processes, equipment, qualification of personnel and QMS are established and efficiently communicated to the supplier
	❖ Inspection procedures are implemented to make sure that purchased product meet requirements

❖ **Criteria are established for selecting, evaluating and re-evaluating suppliers**

The selection of the breeder is based on performance and price. The trend is on evaluating based on cost-benefit criteria rather than on price, but this is something that not all farmers do. The developing farms are evaluating the inputs based on the added value they bring to the results. The change towards this way of thinking in The Netherlands is something that is improving, especially in the younger generation and in the bigger farms.

❖ **Approval of product requirements, procedures, processes, equipment, qualification of personnel and QMS are established and efficiently communicated to the supplier**

Establishment and communication of customer requirements are evaluated in *effective communication of quality attributes* and in *customer satisfaction* variables. It is a constructive feature to be evaluated by individual companies but in this research, where evaluation is presented for linkages in the chain, it turns out to be repetitive.

As for QMS requirements, in the opinion of one expert, requirements of the chain on QS are better fulfilled by the breeding and feeding industry than by the rest of the chain. Slaughterhouses and processors follows, and farmers are the last ones.

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- ◇ **Inspection procedures are implemented to make sure that purchased product meet requirements**

There is an increasing trend in demands imposed to suppliers with respect to measures to take, to provide information etc., which have also increased costs. One expert questions whether all demands are worthwhile and thinks it is possible to rebalance towards what is really necessary.

On the other hand, organized companies that can comply with this challenge are showing a competitive advantage among other suppliers.

3.3 Chain third stage: Slaughtering

✿ Customer orientation

- ★ **Effective communication aligned through connectivity and willingness**

Variable	Indicator
Effective communication	There is effective transfer of the following information:
	◇ Traceability
	◇ Extrinsic and intrinsic quality attributes
	◇ Company information on inventory levels
	◇ Information on company's capacity and capability
	◇ Information of order status for tracking/tracing
	◇ Data to monitor changes in customer satisfaction
◇ Customer feedback including complaints	

- ◇ **Traceability**

IKB traceability requirements oblige that delivery document from the pig fattener includes: a declaration that the batch of IKB slaughter pigs satisfies the requirements of the IKB pigs scheme, identification and registration forms in which the slaughter pigs are identified separately, and a declaration that the pigs are fasted (Kalathas, 2007, pp. 62–63). The slaughterhouse relays health inspection data to the pig farm (possibly via the trader) itemized per individual pig.

Difficulties arise in the traceability following postmortem. Many pigs are slaughtered every day and, because of the high amounts, those pigs come from different farms. Selection of pigs for the batch to slaughter has to be done according quality characteristics (e.g. leanness), so there is uniformity in the product to be supplied to customers. When the slaughter is done it is difficult to trace back the different parts because of the many origins that are present on a batch of slaughtered meat.

The discussion on this point is weather that represents a problem. There is a postmortem inspection of the carcass where a veterinarian does a clinical analysis together with tests for antibiotics and other prejudicial substances. In this examination the most important risk is expected to be controlled so that there is certain warranty on safety in the rest of the process and the meat can be incorporated to bigger batches. If the risk is well managed there is a low probability there will be a need to trace back for safety reasons.

Although the traceability system in this part of the chain could be improved, it seems too costly to be viable. Apparently the cost-benefit analysis of acquiring more sophisticated methods for traceability does not signify positive results in the current situation: when comparing the costs of traceability to the estimated risk of recalls, the recalls risk is too low to justify higher investments in traceability refinement. It would be worth to improve traceability if there was a return in the investments, e.g. some companies use traceability for marketing.

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Another reason to have a good traceability system is to assure the customer the source of the meat. This is the case when the customer has requirements on the manufacturing practices such as organic meat or welfare farming demands.

✧ **Extrinsic and intrinsic quality attributes**

VION manages three quality lines: IKB (bottom line of the Dutch system), good farming welfare (also complies with UK welfare requirements; not obligatory practices within the EU), and organic.

VION has contact with clients on a daily base. They are developing technical management by building closer relationships with the quality departments of those customers that have higher quality requirements, rather than maintaining exclusive contact with the buying department.

✧ **Information on inventory levels, Information on company's capacity and capability, and Information of order status for tracking and tracing**

For a large slaughterhouse like VION to share this information with customers is very important because they understand the need of their customer to plan their production capacity based upon their supplies.

✧ **Data to monitor changes in customer satisfaction**

Changes in consumer behavior are monitored mainly by the retailer which in turn transmit the information upstream the chain. One of consumer's behavioral changes is to acquire meat products from supermarkets, originating a reduction on the number of butchers. The trend is also in convenience food and lower prices. Requirements have also become more diverse, complicating the situation for an organization like VION that sells its products globally. On the other hand a large organization is the only alternative to be able to cope with the high investments required to satisfy the different markets. Small changes in customer behavior level each other when producing for a big market.

For major changes in the consumer preferences or in legal requirements, Qs such as IKB work as a tool to incorporate the new requirements and will assure that the companies (IKB has 95% coverage in the Dutch pork industry) adopt the new demands by carrying out regular inspections.

✧ **Customer feedback including complaints**

VION analyzes data of complaints and sales, minimum once per period (month) and works on the results. In the case of VION, that has large organized companies as customers, a periodic and thorough evaluation of their suppliers is part of their quality management systems. Together they work on continual performance rather than only focusing on corrective actions after incidents.

★ **Oriented practices towards fulfilling and enhancing customer satisfaction**

Variable	Indicator
Customer satisfaction	<ul style="list-style-type: none"> ✧ Customer requirements are determined and are reviewed ✧ There is review of information on customer feedback as input to take decisions ✧ There is monitoring of customer satisfaction. Methods for obtaining and using this information are determined ✧ There is understanding of downstream requirements ✧ Training is provided to customers

✧ **Customer requirements are determined and are reviewed**

Requirements of customers on guarantee of origin of the meat and uniformity are sometimes hard to satisfy because to guarantee the origin of the meat to a specific farm and to provide a uniform product could be two requirements difficult to obtain simultaneously. This is due to the many production suppliers that are needed in the procurement of uniform meat. For a large organization such as VION that sells its products globally it is more difficult to deal with

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traceability of all their different products, and to comply with higher standards for specific small niches.

When the customers have special production requirements, the slaughterhouse pays a premium rate to the production suppliers, so they can make the investments needed when producing for a specific niche. Animal welfare, health, environment, and safety are central issues nowadays for consumers (Task 4.1. pg 6 consumption).

✧ Review information on customer feedback as input to take decisions

If the tendency of complaints is increasing, they take corrective actions or do projects to improve their status. Sometimes they create projects together with big customers e.g. development of new technologies.

Requirements imposed by specific markets (e.g. good farming welfare standard of UK market developed in 1998) are sometimes difficult to accomplish and some negotiation takes place in the satisfaction of requirements.

✧ There is monitoring of customer satisfaction. Methods for obtaining and using this information are determined

Monitoring on customer satisfaction is obtained by having regular feedback on company's supply performance. VION ask their customers to grade them on different aspects such as: delivery performance, efficiency in handling complaints, food safety, performance in crisis (i.e. epidemics and food safety), packaging and labeling, technical communication. The resulting data is analyzed per customer and opportunities for improvement are derived.

✧ Understanding of downstream requirements

Consumer requirements in the meat industry are not clear because end-consumer does not possess much information. It is basically the retailer who imposes the requirements to the rest of the chain and its main focus is on price. Retailer position in the channel is growing stronger due to globalization and its own interest of becoming the leading chain. Most of pork meat is sold to the customers through supermarkets; this is also due to changes in consumer behavior. Not much information on meat production and meat specifications is shared within retailers and end-consumers. End-consumer's requirements are minimal: first focus is on price, they also expect the meat not to contain external substances, not to be hazardous for health, and if there are welfare practices those are added values.

✧ Training provided to customers

In the case of VION, they do not provide training to customers but they let their customers know how their quality system e.g. HACCP works and how they do their best to meet customers' requirements.

★ Provision of resources to fulfill and enhance customer satisfaction

Variable	Indicator
Provision of resources	✧ There is determination and provision of the resources needed to enhance customer satisfaction
	✧ There are resources shared with customers
	✧ The strategies to invest in information technology and tools for diagnosing and solving quality improvement problems are considered

✧ Determination and provision of resources to enhance customer satisfaction

In principle all the investments that are done in the company under study are to satisfy customers and market. Current investments are e.g. improving animal welfare requirements in the slaughterhouse, participation in Q-Porkchains project (this is a long-term investment), and equipment to predict meat quality and supply customers with better meat.

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◇ **There are resources shared with customers**

There is sharing of knowledge in the form of advices on quality or logistics. There is the policy of creating benefits for both parts. Refer to resources shared with customers on 3.1 Chain first stage.

There are some alliances within customers that are global food processors and pig retailers. With these clients they make some contracts for a certain amount of time with clear targets. These are key clients with whom it is convenient to have cooperation beyond commercial level, like on technical or innovation development.

◇ **Investments in information technology and in tools for diagnosing and solving quality improvement problems**

VION has implemented a system accessible via internet in the link www.farmingnet.nl, which is one of the successful examples of information sharing throughout the chain. It was developed with the help of research institutes like Wageningen University and LEI and it is updated monthly.

Data about the pigs that are delivered to the slaughterhouse such as health status and production performance is made available to the rest of the chain through this system. It can be used for farming management, feed management and breeding management.

Farmingnet puts the information back in the chain. It is an example of gathering and analyzing data. For making it useful to other links of the chain, users would have to select what is of importance for them, analyze it and use it for their own management. VION sees in this system a solution for the chain to be able to work closer together and improve continuously. They also use it for internal share of data and benchmarking within the slaughterhouses.

As for investments in other tools such as measurement and control technologies, VION started a research in development measures this year. The challenge they face in investments like R&D or marketing, is that the margins in the meat industry are not very high. VION has the advantage of having skills to start this type of investments, but for a smaller company in the meat industry it is very difficult to start projects with universities or incur in high investments.

★ **Care for customer property**

Refer to *care for customer property* on 3.1 Chain first stage.

✿ **Supplier management activities**

★ **Supplier categorization**

Producer suppliers of slaughterhouses are farmers mainly organized into various cooperatives. In 2005 there were 3940 farms where 55% controlled 83% of production. Refer to *supplier categorization* on 3.2 Chain second stage.

★ Appropriate practices held for each type of supplier

Variable	Indicator
<p>There are appropriate practices held for each type of supplier</p>	<p>The following general practices are held:</p> <ul style="list-style-type: none"> ✦ Maintain personal contact ✦ Stating clear specifications regarding product, process and contract ✦ Making promptly payment ✦ Appliance of equal policies and treatment among suppliers, unless as recognition of improvement or better performance ✦ Providing support/training on quality or other relevant processes ✦ Evaluate and process suggestions quickly and likewise provide feedback ✦ Maintain the confidentiality of secret information, such as cost, technology and performance information ✦ Following contract obligations fully ✦ Long-term contract govern alliance (often 1-5 years) ✦ Confidentiality agreements ✦ Exit criteria are spelled out at the beginning of the relationship ✦ Joint teams ✦ Technology linkages are established to make information exchange routine ✦ There is mutual problem resolution ✦ Performance measures to evaluate their own and each other's performance are aligned ✦ Relation is characterized by trust

✦ **Maintain personal contact**

Maintaining a personal contact for the link fattening-slaughtering is very important. For VION it is of the highest importance to know if farmers are satisfied with them in aspects like performance. For the farmers that supply pigs through a trader, this personal contact reduces. Around 60% of pig supply is supplied directly and 40% through traders. The usage of magazines is one solution to have closer contact with farmers and to have a good feedback.

✦ **Stating clear specifications regarding product, process and contract**

Although without the usage of contracts, for slaughterhouses is of great importance to be supplied with uniform pigs. The way of communicating specifications and payment of incentives such as a premium price for the delivery of pigs within a certain amount of weight, is made through magazines, press release or agricultural newspapers. This is a key issue for the slaughterhouse, because by defining and communicating the required specifications at a given point and the rewards and/or penalties that apply for compliance or non compliance with those, they work on better performance of suppliers.

✦ **Making promptly payment**

The payment between farmers and slaughterhouses is agreed to be within 48 hours due to competition between slaughterhouses.

✦ **Appliance of equal policies and treatment among suppliers, unless as recognition of improvement or better performance**

It is important to have equal treatment among suppliers but depending on their performance. Equal treatment is done but with incentives for right weight and other desired quality attributes. Price also varies depending on the size of the delivery because for logistics of transportation it is cheaper to transport big amounts of pigs per farm.

On the other hand, VION belongs to ZLTO cooperative, and as mentioned for the producing stage, members of the same cooperative are preferred among the others. VION is compelled to buy pigs from farmers members of ZLTO.

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✧ **Providing support/training on quality or other relevant processes**

VION has field officers that are especially helpful when there is a change in preferences in the market like the transition from IKB to welfare.

They provided training to farmers for the use of farmingnet, to make sure that farmers could work on that system.

The chain is now working on new initiatives regarding castration with anesthetics: retailers pay a premium during a certain amount of time to the slaughterhouse. The slaughterhouse saves the money in a fund that goes to the farmers that start working with CO₂ anesthesia because they need to invest in anesthetic equipment for CO₂. Other examples of this nature are the incentives paid to the farmers for working on higher requirements of organic production.

✧ **Evaluate and process suggestions quickly and likewise provide feedback**

In the case of slaughterhouse–producer relation, this depends on whether the farm is open for suggestions. VION does evaluate farmer’s progress.

✧ **Maintain the confidentiality of secret information, such as cost, technology and performance information**

On the link slaughterhouse–producer there is not much secret information, but it is considered a very important practice. Privacy legislation also prevents to share supplier’s secret information with third parties.

✧ **Following contract obligations fully**

Contracts on this link are mainly on quality aspects, but not on amounts or frequency of supplies. Agreements and quality contracts are complied.

✧ **Long-term contract govern alliance (often 1–5 years)**

There are not long term contracts in the link slaughterhouse–producer but verbal agreements. Long contracts are not common in the meat industry. Flexibility is required to survive in the market.

About relations upper–stream in the chain, VION has alliance with genetic companies. In the past they owned a breeding company that was taken over by Topigs with whom they have a strategic alliance.

✧ **Confidentiality agreements**

There are not confidentiality agreements in use for the link slaughterhouse–producer.

✧ **Exit criteria are spelled out at the beginning of the relationship**

Refer to *exit criteria* on 3.2 Chain second stage.

✧ **Joint teams**

Refer to *joint teams* on 3.2 Chain second stage. The studied slaughterhouse is owned by ZLTO and so there is close collaboration within its members.

✧ **Technology linkages are established to make information exchange routine**

Information technology is mainly on usage of farming net.

✧ **There is mutual problem resolution**

A joint problem resolution is not always possible because not all farmers are open for it. The slaughterhouse tries to give all the relevant information to farmers who are also advised by feed companies and by veterinarians. Health status of pigs has improved and that is beneficiary for all the parties.

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❖ **Performance measures to evaluate their own and each other's performance are aligned**

For the quality of pigs delivered to the slaughterhouse they measure weight, leanness, slaughter defects (to check health status), clinical signals of diseases, weight of the package of the intestines and stomach, among others. The slaughterhouse gives feedback on this information to the supplier.

❖ **Relation is characterized by trust**

VION considers having a good level of trust with its suppliers but it believes that can be improved by giving transparency and explaining the reasoning behind the requirements. Recent improvements in that respect are for example making the prices of pigs completely transparent.

★ **Quality assurance of purchased products**

Variable	Indicator
Quality assurance of purchased products	❖ Criteria are established for selecting, evaluating and re-evaluating suppliers
	❖ Approval of product requirements, procedures, processes, equipment, qualification of personnel and QMS are established and efficiently communicated to the supplier
	❖ Inspection procedures are implemented to make sure that purchased product meet requirements

❖ **Criteria are established for selecting, evaluating and re-evaluating suppliers**

The selection of suppliers is based on their historical performance. There are not new farmers while the tendency is towards a reduction of them.

❖ **Approval of product requirements, procedures, processes, equipment, qualification of personnel and QMS are established and efficiently communicated to the supplier**

Refer to approval of requirements on 3.2 Chain second stage.

The communication channels to let the suppliers know their requirements are magazines, public food press, exhibitions, regular meetings, field officers and organized visits to the cutting plants or slaughterhouses where farmers can see what is being done with the product they supply.

As for QMS requirements, farmer's challenges on fulfillment of QSs requirements are due to their level of education, variation in the sector and the few time they have been working with these. While breeders and feeding companies incorporated QS since 1985, farm management and farm quality management started five years ago. Although the practice is recent they are evolving and performing adequately compared to other countries. They need to have a system such as ISO, HACCP, GMP or IKB. Formalization is required by the industry and by law.

❖ **Inspection procedures are implemented to make sure that purchased product meet requirements**

Recently increasing attention is being paid to inspection on chemical contaminants that could have been transmitted by feed. The goal is to reduce the impact or to detect the problem earlier, in such a way that the contaminated meat does not arrive to slaughterhouses where the problem is very difficult to detect. For this to happen, farmers or feed companies should be complying with specifications and legal requirements on food safety. This is a subject in which the chain has been working for the last years. A good example is the initiative TrusQ of the feed companies where they work together on building up food safety systems.

Classification of meat is currently done with an optical device which measures lean meat percentage, but other instruments are much more precise in predicting the quality of the different parts of the carcass and therefore they permit a better selection of the meat. For

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example in Germany they use an ultrasonic device to scan the whole carcass. To change the technology used in The Netherlands a national agreement is needed because a change in the classification method of the meat also changes the way farmers are paid for the meat and that cannot be different within slaughterhouses.

3.4 Conclusions

To give answer to research question II.a and II.b the model was tested on its suitability to the first stages of the pork sector of The Netherlands. In these conclusions main findings are summarized for each indicator especially on its viability.

The present section makes a reflection on the importance of each indicator to the model to assess whether the evaluated indicator should remain, should be modified or should be removed from assessment model based on its operability in the studied stages and on its significance for assessing performance of inter-enterprise quality management systems.

On the other hand, reflection on the amount and quality of the information gathered, is presented for each indicator. Where information is less available the reflection is less thorough or needs further research.

✿ Customer orientation

★ Effective communication aligned through connectivity and willingness

✧ Traceability

Challenges on traceability arise in the slaughterhouse after postmortem. Sophistication (in terms of reliability and promptitude) of traceability could be an opportunity to:

- Lower costs in case of recalls
- Align traceability systems throughout the chain (breeding and feeding traceability systems are more sophisticated)
- Improve image of the sector and consumer trust
- Marketing
- Assure customers with special manufacturing requirements about the origin of the meat they are buying

At the moment improvement does not seem feasible due to costs and variability of the meat.

On this indicator it was possible to gather considerable information especially from expert's interviews.

It is a crucial subject to fulfill final consumer requirements and food safety issues. Every member of the chain is concerned about alignment of traceability along the chain. For these reasons this indicator is considered operative and important for the assessment model.

✧ Extrinsic and intrinsic quality attributes

Many of the intrinsic quality attributes are imposed by law, i.e., those related to health and safety aspects. These are included in Qs such as IKB and are well known by each member of the chain. Some other aspects are imposed by each particular customer and are not necessarily known. Challenges arise in the understanding of end consumer requirements, slowness of the biological process and willingness and connectivity of the information.

This indicator embraces many different aspects, and for this reason, answers from the interviews were kept in a too general level.

This indicator evaluates the central information that has to be shared inter-organizationally. It is essential that is included in the assessment model.

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✧ Information on inventory levels and information on company's capacity and capability

There is not sharing of *information on inventory levels* and *Information on company's capacity and capability* in the links breeding–producer, and producer–slaughterhouse for different reasons on each as mentioned in the application of the assessment model. Because of the given reasons it does not seem currently feasible neither worthy to share these types of information. Opportunities arise in the creation of a chain-wide methodology to know how to proceed in the presence of sudden incidents.

Because of not application in reality not much information was possible to gather on this respect.

Despite it is not in place, theory and experts consider these indicators important especially for production planning. Adjustments to the indicators should be made to make them operative and will be discussed in section 4.1 Refinement of assessment model.

✧ Information of order status for tracking and tracing

There is not so much information available at this respect as its application merely reduces to compliance with legal requirements for the studied links.

Apart from the general legal requirements on track and tracing, stages in the chain can automatize this practice further. VION has an application in its FarmingNet system where farmers can inform date and quantity of delivery via internet, but not all farmers use this tool. Automating this practice will generate opportunities for better planning of processes in the slaughterhouse.

Although applicable to the model, at the moment the indicator does not seem to have big relevance in the stages under study. The practices that are in place seem to satisfy the current needs of the stages.

✧ Data to monitor changes in customer satisfaction

Changes in customer satisfaction are determined by changes in end consumer preferences. This information is not well communicated upstream the chain. On the other hand, changes have to take into account the biological cycle of the product.

Information for this indicator was scarcely available. There was a general answer for the chain more than for every stage.

Because the information comes from the lowest stages of the chain it is important information to be shared in the links. Therefore assessment on its effective communication should be included in the model.

✧ Customer feedback including complaints

Communication processes on this indicator were assessed jointly with indicator on customer satisfaction: *top management review information on customer feedback as input to take decisions*. These two indicators and the indicator on feedback from *supplier management activities* had repetitive answers. More detail on specific communication processes of feedback and complaints is missing for breeding and producing stages.

An assessment on this indicator is decisive because it is the channel to know customer real satisfaction and changes on its demands. Documentation of this information permits remembrance, objectivity and evaluation of improvement. A sophisticated system could create opportunities for joining efforts on the stage and being more effective in the solution of problems.

★ Oriented practices towards fulfilling and enhancing customer satisfaction

✧ Customer requirements are determined and are reviewed

The sector has the tool of alignment of requirements through Qs such as IKB. Beyond that, customer requirements are mainly agreed upon request of product. Use of magazines,

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agricultural press release and IT systems are other means to let the chain know actual meat requirements.

Assessment on this indicator is difficult to separate from indicator on communication of extrinsic and intrinsic quality attributes. It is important that they belong to different variables because effective determination and revision may differ from effective communication.

Inclusion of this indicator in the assessment model is of the highest importance for assessing real customer orientation.

✧ **Review information on customer feedback as input to take decisions**

Objective and relevant feedback is seen in the example of FarmingNet and works as a tool to monitor customer satisfaction. Opportunities arise in the incorporation of such practices chain wide. Feedback collection and usage enhance proactive relationship supplier–customer, bring them together and improve problem–solving methodology. Periodic feedback is recommended for working proactively and not only in fixing existent problems.

An important part of this indicator is on whether information on feedback is used to take decisions. Unfortunately not much information was gathered on this specific aspect.

It is a central indicator of customer orientation and to assess the principle of factual approach to make decisions. For all the previous reasons it should be included in the model.

✧ **There is monitoring of customer satisfaction. Methods for obtaining and using this information are determined**

Implementation in the sector was seen in the FarmingNet example.

The assessment of this indicator was combined with indicator on revision of feedback. Not much information on methodology was gathered.

It is important to include it in the model because it is an indicator of continuous improvement of QMSs.

✧ **Understanding of downstream requirements**

The challenges at this point are:

- To have clearer understanding of end consumer requirements.
- To distinguish between citizens (impose demands like welfare, environmental practices, etc.) and consumer (who buys the product) requirements.
- To determine the amount, quality and communication channel of the information that should be provided to the end consumer.

Opportunities arise on having each link more motivated towards working in aligned quality attributes of the meat. A consumer better informed on how food is being produced and what the industry is doing towards controls and food safety would have a better range of criteria on his buying decision than merely price.

Information for this indicator was not satisfactorily gathered. There was a general answer for the chain more than for every stage.

This indicator is of crucial importance to assess orientation towards enhancement of customer satisfaction.

✧ **Training provided to customers**

There is not so much information available at this respect as its application merely reduces to giving advice especially from other stages to producer stage. Real training to customers does not take place in the studied stages. There is transfer of knowledge from breeders and feeding companies to farmers. Breeders analyse, manage, monitor and give data to farmers. This practice varies depending on farmer's choice: some farmers do not want to receive much information from suppliers. Opportunities arise in making this practice more extended.

This practice should be important to enhance customer satisfaction but it does not seem to be of high importance in practice for the studied stages. Nevertheless it is operative and is

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recommended to be included in the model as indicator of improvement on customer orientation.

★ Provision of resources to fulfill and enhance customer satisfaction

◇ Determination and provision of resources to enhance customer satisfaction

Low margins of the sector represent a challenge for investments when required by new trends in the market, especially in the producer stage. Farmer's innovation approach is not enough to keep up with developments at other parts in the chain (Wever and Wognum, 2007). The answer on this indicator was concrete although more specific information for every stage can be gathered. It is crucial to assess possibilities of fulfilling customer requirements and improvement.

◇ There are resources shared with customers

Although sharing physical resources does not seem plausible due to hygienic reasons, opportunities may be encountered in the sharing of knowledge or in the creation of joint projects.

The answer on this indicator was concrete although more specific information for every stage can be gathered. This indicator is operative in the case of knowledge sharing and other resources when there is real commitment with customer as in the case of the creation of joint projects. The indicator should be included in the model to assess further customer orientation.

◇ Investments in information technology and in tools for diagnosing and solving quality improvement problems

The good example of FarmingNet system with an estimate of 8 million yearly yield for farmers supplying to VION due to costs reduction and income improvement (Wognum et al., 2007, p. 23), sets a benchmark of the opportunities that IT can represent to the sector. Challenges at this point are on willingness to share information, on connectivity of systems and on training. Low margins of the sector also undermine further investments on IT and related tools for continuous improvement.

Due to its importance, relatively ample information is available on this indicator. It should be included in the assessment model.

★ Care for customer property

It is not a practice in the studied pork chain to give property or other assets to suppliers for incorporation into the final product. It is not operative in the assessment model.

● Supplier management activities

★ Supplier categorization

Key suppliers according to the criterion of purchases volume, importance of the purchased product and advantages of having closer collaboration, are the suppliers that belong to the primary process. Therefore, in general, key suppliers for producers are breeders and key suppliers for slaughterhouse are producers. The present research evaluates these two links specifically, and therefore, practices to be held with general suppliers and those to be held with key suppliers are assessed all together. Not further differentiation of individual suppliers was made in the study, although main players of each stage were mentioned.

★ Appropriate practices held for each type of supplier

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✧ **Maintain personal contact**

It is the preferred practice to communicate within the studied linkages and according to experts it functions quite well. Direct contact diminishes when there is a trader in between the purchase process. This is tried to be compensated with other types of communication like magazines.

✧ **Stating clear specifications regarding product, process and contract**

There is not usage of contracts. Opportunities for improvement arise on improving the system to assure that producers understand specifications thoroughly. Information with more detail for different products and processes, depending on the supplier can be gathered at this respect.

✧ **Making promptly payment**

There is hardly possible an improvement on this practice. Due to competition, payment to farmers is done within 48 hours.

✧ **Appliance of equal policies and treatment among suppliers, unless as recognition of improvement or better performance**

Because of the constitution of cooperatives in the sector, there are inevitable preferences within members of the same cooperative. Information gathered at this respect was vague. Experts consider this indicator to be in place in the studied stages but further insight is desirable.

✧ **Providing support/training on quality or other relevant processes**

Guidance is provided to producers from up and downstream: feeding companies, breeders, veterinarians, traders and slaughterhouses all give advice to farmers. There is no information about support or training giving from producers to other stages in the chain. The importance of this indicator may vary for the type of supplier.

✧ **Evaluate and process suggestions quickly and likewise provide feedback**

Development of this practice is limited by the willingness of producers to receive feedback and by the time lapse of the biological cycle of the product. Further information can be gathered for link breeding-producer.

✧ **Maintain the confidentiality of secret information, such as cost, technology and performance information**

There was a concrete answer on this indicator from expert's interviews. General information was gathered for the studied stages. It is not a frequent practice in the studied links to have key confidential information. The existent one is properly preserved. Privacy legislation also prevents to share supplier's secret information with third parties.

✧ **Following contract obligations fully**

General information was gathered for the studied stages: there is not an extended use of having contracts but mainly on quality aspects. It is not significant to talk about contracts but more about agreements. Agreements are followed as an important component to build trust in the sector.

✧ **Long-term contract govern alliance (often 1-5 years)**

It does not seem feasible nor desirable the existence of long term contracts between the studied stages of the sector (more information on this indicator is needed for the link breeder-producer). Although more formal agreements on quality, amount and status of the delivery are preferred, as well as stable supplies, flexibility is required to survive in the market. Opportunities might exist when increasing the formality of short term negotiations but

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not when maintaining bonds of long-term between links of the primary process of the studied stages. For these reasons this indicator is not operative.

✧ **Confidentiality agreements**

Confidentiality agreements are only in place for specific cases such as output of a common project. This practice is not operative for general practices in the studied sector.

✧ **Exit criteria are spelled out at the beginning of the relationship**

More than criteria from specific relationships it is a tacit agreement: there is the ending of a commercial relationship when there is not compliment with requirements. When there is not compliment with legal requirements enforcement takes place by Dutch authorities. There is not applicability of this feature in the assessment model.

✧ **Joint teams**

In the sector, cooperatives would be these dedicated teams to foster personal relationships and establish continuity between alliance partners.

✧ **Technology linkages are established to make information exchange routine**

Information technology is mainly on usage of computers, internet and mobile phones. Farming net is the sector highlighted example of advantageous usage of IT.

IT practices are discussed in Customer Orientation activities. This should be a more intense practice to be carried out with key suppliers but because the present research evaluates suppliers of the primary process in general, the study of this feature in Supplier Management Activities turned out to be repetitive.

✧ **There is mutual problem resolution**

The organization of the chain has not gone as far as developing a methodology to resolve misunderstandings and breakdowns, and between individual companies joint teams are only seen in cooperatives.

In case of the occurrence of breakdowns, opportunities arise on the creation of a plan of action that allows the sharing of reliable information to the right stakeholders, thus reducing the impact of the incident and consequently reducing costs. More information on this indicator is needed for the link breeder-producer. Nevertheless it is operative and should be included in the assessment model as indicator of better practices to carry out with key suppliers.

✧ **Performance measures to evaluate their own and each other's performance are aligned**

Although not used extensively in the producer stage, they are aligned between the studied linkages. It is a highly important indicator to be included in the assessment model.

✧ **Relation is characterized by trust**

The assessment of this indicator was done through different indicators because it was related to them. Opportunities for improvement were found out in the studied stages:

- To provide more transparent information to key suppliers
- To maintain the confidentiality of secret information
- To explain requirements as clear as possible
- To fulfill agreements, contracts and guaranties
- To give a fast and proper answer in the case of complaints or emergencies
- To refine the traceability system

It is possible to evaluate this indicator compliance more in depth for every relationship.

Although trust assessment is subjective and therefore difficult, it is consider an important component of business relationships by literature and by experts. Trust building is a practice that gives competitive advantage because it facilitates the information sharing process. It will

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also allow the creation of joint projects or alliances. Further operationalization of this indicator is possible to have a more operative indicator.

*** Quality assurance of purchased products**

✧ Criteria are established for selecting, evaluating and re-evaluating suppliers

Selection criteria are based on historical performance and on price. Important aspects to evaluate are loyalty, value and quality.

Opportunities of improvement arise in adjusting the evaluation criteria to a cost-benefit analysis of suppliers. This gives a clear view of final value of purchases. Suppliers that sell their products competing on performance also provide knowhow, support, innovation, analysis of data and are capable of demonstrating with data the added value they provide.

Not enough information was gathered at this respect. Gathered information is too general and only for the link producer-slaughterhouse.

✧ Approval of product requirements, procedures, processes, equipment, qualification of personnel and QMS are established and efficiently communicated to the supplier

Requirements of product are evaluated earlier in the model in customer orientation and customer satisfaction, therefore assessing the first part of this indicator turned out repetitive when the assessment is done in the stages in general, as it is the case of the present research. On the other hand, requirements on QMs are well known by the chain, being IKB the basic imposer of regulations. There is the practice of incorporating new demands through QMs.

Due to longer experience with quality systems, more opportunities of improvement are present in the primary production process stage than in breeding and slaughtering stages when it comes to implementation of QMs. Requirements on QMS can simplify requirements impose to suppliers.

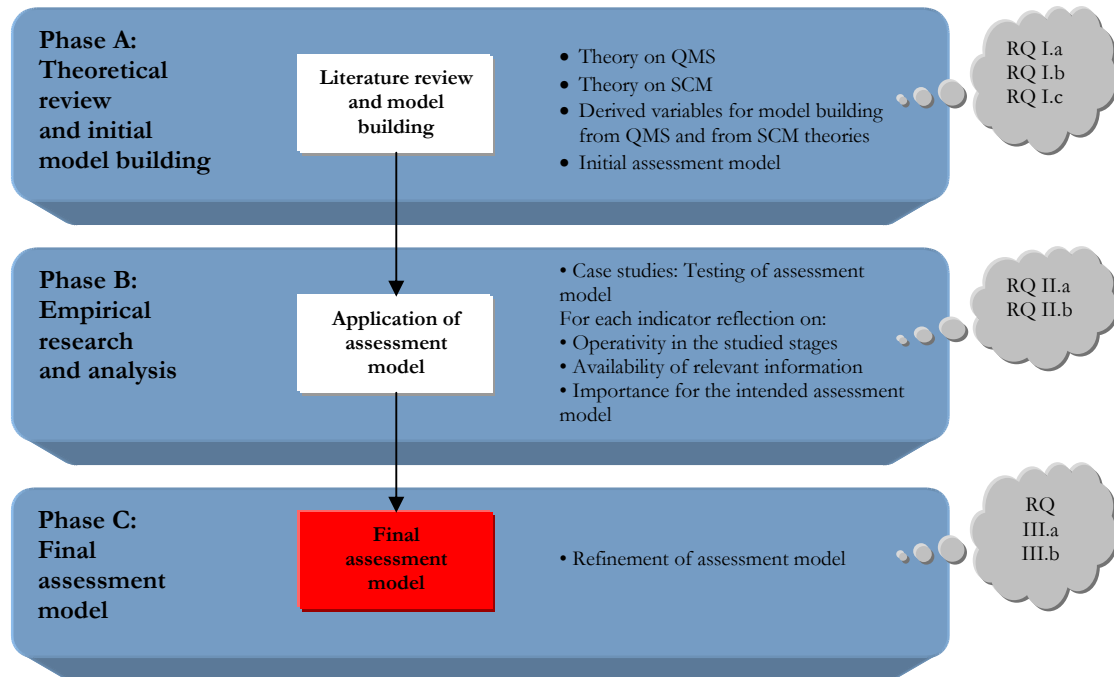
More information on this indicator is needed. Information gathered was too general.

✧ Inspection procedures are implemented to make sure that purchased product meet requirements

More in depth evaluation can be done specially for the link breeding-producer.

Opportunities arise in the utilization of better technology e.g. better instruments are available for the measurement of lean meat percentage.

4 Final assessment model



The present chapter will incorporate the findings of chapter 3 in a final assessment model and will give answer to the third research question:

RQ III. What can be deduced from the results of testing the model in the stages under study, to make recommendations for improving the assessment model for inter-enterprise quality management?

- What adjustments can be made to the model after its application to the stages under study?
- What improvements can be done to the initial assessment model?

Based on the final conclusions of chapter 3 a refinement of the original assessment model is done in section 4.1; in section 4.2 a final model is presented as output of section 4.1 and as conclusions of the findings.

4.1 Refinement of assessment model

The present section refines the assessment model after reviewing information on the particular stages under study for the pork sector of The Netherlands. Every variable component that has special remarks or need changes to better adjustment to the studied stages is explained as follows.

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● Customer orientation

★ Effective communication aligned through connectivity and willingness

◇ Traceability

Legal requirements of being able to identify any person and/or business that provide pigs for slaughter are complied. Identification and registration regulations in the Netherlands, regarding movement of each pig from birth until they arrive to the slaughterhouse is well arranged and it is manifest compared to other European countries and outside Europe. For this reason, in the assessment model more attention should be drawn to traceability beyond regulations and how this practice is aligned with the rest of the chain.

◇ Extrinsic and intrinsic quality attributes

The indicator is composed from at least as many aspects as shown in appendix VI where intrinsic and extrinsic attributes of the pork meat are described for each stage of the chain. For better assessment on this indicator effective communication of each of these attributes for each link of the chain should be evaluated. It could be divided into more specific indicators for a more profound assessment. Improvement will be also in the inclusion of requirements of other interested parties.

◇ Information on inventory levels and Information on company's capacity and capability

These types of information are not being shared in the current situation and they seem not to be necessary. What is of greater significance for the planning of processes and sales, is obtaining anticipated information on potentially provided product quantities classified by quality. Therefore a better indicator for our assessment model would be to evaluate effective transfer of information on *forecasted levels and quality of product to be provided*.

◇ Information of order status for tracking and tracing

Once assessed compliment with legal requirements this indicator does not seem to go further in the studied stages. Indicator can be improved into assessing atomization of the practice or further development beyond legal requirements.

◇ Data to monitor changes in customer satisfaction

This indicator should be assessed also on its agility because in the pork sector it needs to overcome the biological lapse. Other improvement will be in the evaluation on the satisfaction of other interested parties.

★ Oriented practices towards fulfilling and enhancing customer satisfaction

◇ Training provided to customers

Although it was recognized as a non relevant practice in the studied stages it is recognized in theory as an indicator of a successful strategy to enhance customer satisfaction. There are many forms of training as well as degrees of efficiencies among them. To improve operability of the indicator specific training can be assessed.

★ Care for customer property

Not operative for the studied stages. What it is more applicable to the chain is the sharing of knowledge or advice within links. Training provided to customers and to suppliers are evaluated in other indicators of the model and should be used preferably to assess any interchange of knowledge customer-supplier in the chain.

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• Supplier management activities

★ Appropriate practices held for each type of supplier

✧ Following contract obligations fully

In the current situation it is more applicable to talk about commercial agreements than about contracts.

✧ Long-term contract govern alliance (often 1–5 years)

There are long term contracts when talking about innovation and information sharing, e.g. Q-Porkchains is a project of five years. Due to the few alliances that are in place in the studied linkages, it is better to evaluate the nature of the agreements rather than contracts within formal alliances. This indicator should not be included in the assessment model.

✧ Confidentiality agreements protect proprietary technologies and properties. How jointly developed technology will be used in the future is specified.

This practice does not apply for general practices in the studied sector but only in specific cases such as output of a common project. Therefore, this feature should be removed from the assessment model.

✧ Exit criteria are spelled out at the beginning of the relationship

Because exit criteria are more of a sector commonly known criteria, it should be removed from the assessment model.

4.2 Conclusions

Results of case studies pointed out that not all the selected indicators to assess performance on the variables of the assessment model were viable for the actual status of the chain. Other indicators were refined to become more applicable.

After the remarks made in section 4.1 based on the results of the analysis of case studies, the complete assessment model to be used to assess the performance of inter-enterprise QMS on the first stages of the pork chain is presented in table 4.1. The changes or additions are presented in bold letters.

Although the developed assessment model is general for all industries and sectors, special characteristics of the pork sector made some features not completely feasible.

The causes for refining indicators of the model are due to:

- Especial current characteristics of the sector make some practices not to be relevant for better quality performance, e.g. sharing information on inventory levels.
- Some indicators (e.g. effective communication to allow *traceability* and *tracking and tracing*) are met for legal purposes or for compliance with existing quality systems. Improvement on those indicators can be done in assessing their development beyond basic requirements and focusing more in alignment and real added-value to the chain.
- Indicators were adjusted to specific conditions of the sector, e.g. instead of evaluating the compliance with contracts it should be evaluated the compliance with commercial agreements.

Fundamentals	Variable	Indicator
Customer orientation	Effective communication	There is effective transfer of the following information: <ul style="list-style-type: none"> ✦ Traceability (also beyond regulations) ✦ Extrinsic and intrinsic quality attributes ✦ Forecast on levels and quality of product available to be provided ✦ Information of order status for tracking/tracing (also beyond legal requirements) ✦ Data to monitor changes in customer satisfaction ✦ Customer feedback including complaints
		Customer requirements are determined and are reviewed
	Customer satisfaction	There is review of information on customer feedback as input to take decisions
		There is monitoring of customer satisfaction. Methods for obtaining and using this information are determined
		There is understanding of downstream requirements
		Training is provided to customers
	Provision of resources	There is determination and provision of the resources needed to enhance customer satisfaction
		There are resources shared with customers
		The strategies to invest in information technology and tools for diagnosing and solving quality improvement problems are considered
	Supplier categorization	Key suppliers are identified of for the stages from breeding to slaughtering, according to: <ul style="list-style-type: none"> ✦ Purchases volume: 10% to 20% of the commodities represent 80% of the total spend ✦ Amount of share that the supplier represents for the company's business ✦ Supplier's possession of unique skills, technology or other aspect required by the company ✦ Influence that the supplier can have on a strategic component, service or upstream/downstream relationship ✦ Potential scarcity of the product/service delivered by the supplier ✦ Advantages that an intensive collaboration with the supplier can signify
Supplier management activities	Practices with suppliers	The following general practices are held: <ul style="list-style-type: none"> ✦ Maintain personal contact ✦ Stating clear specifications regarding product, process and contract ✦ Making promptly payment ✦ Appliance of equal policies and treatment among suppliers, unless as recognition of improvement or better performance ✦ Providing support/training on quality or other relevant processes ✦ Evaluate and process suggestions quickly and likewise provide feedback ✦ Maintain the confidentiality of secret information, such as cost, technology and performance information ✦ Following commercial agreements obligations fully
		The following practices with key suppliers are held: <ul style="list-style-type: none"> ✦ Joint teams ✦ Technology linkages are established to make information exchange routine ✦ Mutual problem resolution ✦ Performance measures to evaluate their own and each other's performance are aligned ✦ Relation is characterized by trust
	Quality assurance of purchased products	There are established criteria for selecting, evaluating and re-evaluating suppliers
		Approval of product requirements, procedures, processes, equipment, qualification of personnel and QMS are established and efficiently communicated to the supplier
		There have been established and implemented inspection procedures to make sure that purchased product meet requirements

Table 4. 1 Final assessment model

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The causes for removing variables or indicators off the model are due to:

- One practice did not take place in the industry; therefore requirements on it were not needed: incorporation of customer property into the product.
- Especial current characteristics of the sector make some practices not feasible, e.g. long-term contracts, confidentiality agreements and specification of exit criteria.

Other considerations were:

- Some indicators apply for assessment on individual companies, but for a general view of performance of the stages they turn out to be repetitive, especially because indicators on customer orientation and supplier management activities may overlap when studied for suppliers and customers at the same time, e.g. communication to suppliers on approval of requirements and effective determination of customer requirements.
- Categorization of key suppliers within the primary process was not made and therefore some indicators lost validity e.g. technology linkages for information exchange shall be more intense with key suppliers.

5 Conclusions, discussion and recommendations

This chapter signals the answers of all research questions (section 5.1), presents general conclusions and discussion on the results of the research (section 5.2), enumerates limitations of the study (section 5.3), and suggests recommendations for further research (section 5.4).

5.1 Research questions

The present research aimed at developing an assessment model to evaluate inter-enterprise quality management systems in the pork industry of The Netherlands. To accomplish that aim a study case was carried out centered in investigating the particular chain linkages of fresh pork meat industry in The Netherlands in the stages from breeding to slaughtering.

The investigation started with literature review on theories and relevant information for the area of study, beginning with QMS theory with special attention in ISO 9000:2000 norm. From QMS theory, variables were developed to give an answer to the first research question point a: ***What variables can be derived from theory in Quality Management Systems?*** Variables were encountered applicable to assess quality management performance on links in the studied stages in two areas: customer orientation and supplier management activities. However, the norm ISO 9000:2000 does not make special emphasis on supplier management activities and certainly not with a chain wide view. On this particular area supply chain management was encountered more useful. This way studying the theory of SCM it was possible to answer point b of the first research question: ***What variables can be derived from Supply Chain Management theory?***

After reviewing QMS and SCM theories, it was concluded that both theories agreed upon customer and supplier oriented practices as essential areas to be evaluated in an assessment model for quality management with an inter-organizational focus. Each theory offered different indicators to assess quality performance of these areas in the companies (in our case in the linkages between companies).

The way of assessing performance on the selected areas, according to the proposed theories, was included as indicators of performance in the assessment model built in chapter 2. In this chapter, research question number one: ***What is a suitable model for assessing the performance of a Quality Management System for companies in the Netherlands in production stages from breeding to slaughter?***, was answered along with its sub-questions.

As result, the assessment model consists in two big areas or fundamentals as already mentioned: customer orientation and supplier management activities. To evaluate their performance in the studied linkages, these areas were divided into variables as originally proposed in the research questions. To evaluate more concise practices, each variable is developed into indicators. The indicators were also taken from theoretical study and are the final elements of the assessment model.

To test the applicability of the assessment model, cases studies were developed for each of the studied stages. The case studies consisted on interviews with experts of the area, study of preliminary research of Q-PorkChains project and study of other literature about breeding, finishing, farrowing and slaughtering stages in the pork chain. With this information and a subsequent analysis it was possible to answer research question number two: ***What limitations***

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can be observed when applying the assessment model to the stages under study? To answer sub-research question a: *Is the model suitable to the stages under study?*, an application of the assessment model is presented in sections 3.1, 3.2 and 3.3 for each stage of the chain. To answer research question b: *Under what conditions are the encountered variables operative?*, a reflection on the importance, operativity and amount of relevant information gathered is done in the conclusions of the chapter, section 3.4.

In chapter 4 research question III *What can be deduced from the results of testing the model in the stages under study, to make recommendations for improving the assessment model for inter-enterprise quality management?*, and its sub-questions were answered and conclude that assessment model presented in table 4.1 is recommended for inter-enterprise quality management in the pork industry of the Netherlands with the realization and alignment throughout the chain of at least its component elements. Indicators to assess correct performance of the developed variables may vary within stages and within countries. The ones encountered applicable to the specific case of fresh pork meat in The Netherlands for stages breeding, producers and slaughtering are the ones presented in table 4.1.

5.2 Conclusions and discussion

In order to develop the former variables an international recognized and sector-independent management framework like ISO 9000:2000 was the baseline, as proposed at the beginning of the research. With the special characteristic of being a research oriented to inter-enterprise quality management, other elements were needed to be added to ISO 9000:2000 norm selected indicators. Therefore following the historical line of evolution of quality systems the missing elements were selected from theories on supply chain management. Variables from the two mentioned theories are recommended to be used in the creation of an assessment model for inter-enterprise quality management.

Implementation of other quality systems, less managerial but with more specific practices and procedures, have proved to be extremely useful in facilitating many of the managerial requirements. This is the case of IKB system in The Netherlands.

The developed assessment model presented in section 4.2 can be used to evaluate inter-enterprise quality management of the first stages of the fresh pork meat supply chain of The Netherlands as done in the study cases. Nevertheless, to evaluate other stages further down in the chain or other pork chains it may be that some of the elements left behind after the refinement could be applicable taking into account the following considerations:

- Care for customer property: it was considered an exemption in the present research because there is no customer property provided for incorporation into the product in none of the studied stages. But it may be the case for stages down the chain or for other chains (i.e. non fresh meat chain or chains in other countries) where e.g. ingredients, packaging materials or customer intellectual property, are under control or in use by the organization. In this case there should be care for this property as proposed in the original assessment model of chapter 2.
- For a deeper evaluation on individual companies' performance on inter-enterprise quality management, a categorization of suppliers should be done. When key suppliers are identified, appropriate practices for these suppliers should be assessed separately from evaluation on general practices for all kind of suppliers. Better practices with key suppliers will have bigger impact than with transactional suppliers especially when higher

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commitment of resources is needed as it is the case for indicators of *mutual problem resolution* and creation of *joint teams* for problem solving and other activities.

Most of the indicators were thoroughly evaluated and selected based on theory review and then tested on applicability to the studied stages. Therefore most of them are considered to have the highest relevance in our assessment model.

It is not likely to find an element of ISO 9001:2000 not applicable to a company because the Norm was made for all kinds of companies and exclusions are not accepted to claim conformity with ISO 9001:2000. The only exclusions accepted are those requirements within clause 7 that do not affect organization's capability of providing a product that meet customer and regulatory requirements (ISO, 2000c, p. 1). This is the case of *customer property* (clause 7.5.4 of ISO 9001:2000 norm). Other variables and elements from the first assessment model that were not included in the final assessment model belong to SCM theory.

Some indicators i.e. of *order status for tracking and tracing*, *training to customers* and *resources shared with customers* (except knowledge), were considered not so important in practice. Improvement in these areas could have interesting results as affirmed in theory. Therefore further study on their importance is recommended before removing them from the model.

On the other hand, as mentioned on the introductory chapter of the present research, the problem statement relies on the search of a QMS that holds a holistic approach of the needs of the chain. Likewise, in the project definition it was stated the intention that the model evaluated whether existing QMSs solved quality problems and satisfied the need of having a general, standard, trustworthy, integrated and holistic quality system that could ensure coordination throughout the whole chain. Conclusions on these matters will be covered as follows.

The developed assessment model is based largely on ISO 9000:2000 guidelines. ISO 9000:2000 is a general management system applicable to all sectors, all economical activities and any company's size. A study on the performance of quality management systems following ISO standards will give a broad view of the quality management status of the pork chain. Nevertheless, the researcher considers that the merely implementation of such a system does not guarantee the *solution of quality problems* for the following reasons:

- Being a general QMS, ISO 9000:2000 norm has as many different ways of being implemented as companies, therefore its implementation does not automatically mean *alignment* of quality practices in the chain.
- As argued in literature research, showing compliance with ISO 9001:2000 requirements does not necessarily mean that there will be improvement on quality performance, but creates a company-wide culture that seeks continual improvement.
- Finally, a more technical approach is necessary to guarantee quality and smooth functioning between stages. Aligned implementation of systems such as HACCP and IKB, would be of greater help to guarantee quality as generally defined: meeting or exceeding of customer expectations (Luning et al., 2002, p. 8). Additionally, a QS with more specific requirements will give better guaranties of trustworthiness and integration for the chain.

SCM theory, on the other hand, complements QMS theories with a holistic approach of the chain and its interrelationships. This way, the proposed assessment model included elements of SCM where a subject was not sufficiently covered in the ISO 9000:2000 norm.

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The developed assessment model will help to evaluate:

- Orientation of the company towards quality and supply chain practices
- Whether quality problems that arise from inter-enterprise practices are being solved by existing quality management systems
- Whether in place QMSs hold a holistic view of the chain by studying the alignment of proposed inter-enterprise quality practices

In other words, high compliance with all indicators of the model would indicate the existence in the sector of QMSs that are quality and supply-chain oriented, that seek for integration and alignment of chain-wide quality better practices and consequently would be trustworthy and more agile in the solution of quality problems.

5.3 Limitations

Some limitations of the study have to be taken into account and are enumerated in the present section:

- A more in-depth case study with key companies from the stages, where interviews were held with employees and other stakeholders would have been preferable, in order to give more validity to the results.
- Interview(s) with expert(s) or stakeholders from the second stage (farrowing and fattening) was missing and therefore, the data gathered to assess this stage was mainly collected from experts from the other stages, outsiders and literature study. Hence, the thoroughness of these results can be improved.
- Due to the length of the assessment model, questions and answers from interviews were sometimes necessary to keep in a general level. More in depth assessment is in most of the cases necessary to have a better idea on the functioning of the model on the studied linkages.
- When indicators were not in practice information was not possible to gather. Therefore usefulness of their implementation is not clear.
- Some indicators that were apparently similar but had a different scope had repetitive results. It is important, for further research to make sure that the scope of each indicator is understood.
- In supplier management activities a deeper evaluation for each type of supplier, as recommended in initial model, is necessary to assess performance. Some of these indicators are only worth to apply on relationships with key suppliers.
- Time was a limiting factor in the development of the empirical research. A more in depth study would have been convenient for the development of variables that were more oriented to the specific sector, for a higher degree in the operationalization of this variables and for better results in the analysis of the applicability of the model.

5.4 Recommendations for further research

The present research wants to make a contribution to Q-PorkChains project in the development of an assessment model for inter-enterprise quality management. The project scope is broad: its purpose is to design criteria for chain-wide quality management systems for differentiated chain scenarios for various European pork chains.

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The present study only included a study of the fresh pork meat chain of The Netherlands. External validity for other European pork chains was beyond the possibilities. Hence, study cases in other European pork chains are needed to prove validity of the refined assessment model.

Fresh pork meat chain of the Netherlands has some particularities that do not necessarily apply to chains of other countries. As an example, the present research studied farrowing and fattening as a consolidated stage instead of assessing the link between them. It was done in this way because in The Netherlands there is a trend towards integration of these two activities. Considerations of this type should be taking into account in the study of other chains.

On the other hand the studied links correspond to the first stages: breeding, producing and slaughtering. Further research is needed for the latest stages in the chain.

Recommendations to improve internal validity of the research are on the development of the limitations numerated in the previous section. Other recommendations are:

- Not all elements of SCM were included in the assessment model but attention was drawn to those elements of inter-organizational focus where ISO 9000:2000 was not thorough enough i.e. in building solid supplier relationships. Nonetheless, other elements of SCM theory may be included to optimize the study on quality performance.
- Analysis on the alignment of the practices for every link of the chain should be made after application of the model in order to assess integration of quality systems in the chain.
- Further operationalization of variables is possible and is recommended in order to evaluate more concrete aspects. For example *communication, determination and revision of customer requirements* and *monitoring of customer satisfaction*, were encountered to be too broad. For improvement they can be divided into sub-indicators that assess performance in a more thorough way. For this kind of improvement some guidelines are presented in appendixes. Norm ISO 9004 is an important document to improve indicators that are based on ISO 9001:2000 requirements.
- General improvement for indicators on customer orientation is in the inclusion of other interested parties in their evaluation. Other parties include owners, people inside the organization, bankers, unions or society. This is also the extended scope for continuous improvement stated in ISO 9004 (ISO, 2000a).
- For the variable *practices with suppliers* it is a constant recommendation to assess the different indicators for every type of supplier. The more important the purchased product is for the quality of the final product the better should be the performance for the evaluated indicator.

In any case, the developed assessment model together with the considerations given throughout the present chapter is useful to evaluate inter-enterprise quality management systems on the pork meat chain and for further creation of assessment models for chain-wide quality management systems.

Glossary

Fresh pork meat chain:

As described in Q-PorkChains Deliverable 4.1.1: is the mainstream pork meat chain in which about 98% of all Dutch pork meat is produced (Wever and Wognum, 2007).

Primary process:

In accordance with Q-porkChains Task 4.1: pork chain consisting of breeding, farrowing, finishing, slaughtering, processing, customer channels and consumption.

Primary production process:

Consistent with Q-PorkChains Task 4.1: The part of the chain producing and fattening pigs (Wognum et al., 2007).

Process:

Set of interrelated or interacting activities which transforms inputs into outputs (ISO, 2000b, p. 10).

Quality:

Meeting or exceeding customer expectations (Luning et al., 2002, p. 8).

Quality assurance:

Part of quality management focused on providing confidence that quality requirements will be fulfilled (ISO, 2000b, p. 8).

Quality control:

Part of quality management focused on fulfilling quality requirements (ISO, 2000b, p. 8).

Quality Management:

Coordinated activities to direct and control an organization with regard to quality (ISO, 2000b, p. 8).

Quality Management System:

System to establish policy and objectives and to achieve those objectives to direct and control an organization with regard to quality (ISO, 2000b, p. 8).

Quality Systems:

Set of interrelated or interacting elements that take place in a company to obtain quality.

The Norm:

ISO 9000:2000 norm.

Traceability:

Ability to trace the history, application or location of that which is under consideration (ISO, 2000b, p. 12).

Validity:

Internal: Extent to which the structure of a research design enables us to draw unambiguous conclusions from our results, and

External: Extent to which results from a study can be generalized beyond the particular study (de Vaus, 2001, p. 28).

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Appendices

Appendix I. Saraph et al., (1989) items used for measuring the critical factors of quality Management.

Factor 1: Role of divisional top management and quality policy

- Extent to which the top division executive assumes responsibility for quality performance.
- Acceptance of responsibility for quality by major department heads within the division.
- Degree to which divisional top management is evaluated for quality performance.
- Extent to which the division top management supports long-term quality improvement process.
- Degree of participation by major department heads in the quality improvement process.
- Extent to which the divisional top management has objectives for quality performance.
- Specificity of quality goals within the division.
- Comprehensiveness of goal-setting process for quality within the division.
- Extent to which quality goals and policy are understood within the division.
- Importance attached to quality by the divisional top management in relation to cost and quality objectives.
- Amount of review of quality issues in divisional top management meetings.
- Degree to which the divisional top management considers quality improvements as a way to increase profit.
- Degree of comprehensiveness of the quality plan within the division.

Factor 2: Role of the quality department

- Visibility of the quality department.
- Quality department's access to divisional top management.
- Autonomy of the quality department.
- Amount of co-ordination between the quality department and other departments.
- Effectiveness of the quality department in improving quality.

Factor 3: Training

- Specific work skills training given to hourly employees throughout the division.
- Quality-related training given to hourly employees throughout the division.
- Quality-related training given to managers and supervisors throughout the division.
- Training in the "total quality concept" throughout the division.
- Training in the basic statistical techniques in the division as a whole.
- Training in advanced statistical techniques in the division as a whole.
- Commitment of the divisional top management to employee training.
- Availability of resources for employee training in the division.

Factor 4: Product/service design

- Thoroughness of new product/service design review before the product/service is produced and marketed.
- Co-ordination among affected departments in the product/service development process.
- Quality of new products/services emphasized in relation to cost or schedule objectives.
- Clarity of product/service specifications and procedures.

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- Extent to which implementation/producibility is considered in the product/service design process.
- Quality emphasis by sales, customer service, marketing, and PR personnel.

Factor 5: Supplier quality management

- Extent to which suppliers are selected based on quality rather than price of schedule.
- Thoroughness of the supplier-rating system.
- Reliance on reasonably few dependable suppliers.
- Amount of education of supplier by division.
- Technical assistance provided to the supplier.
- Involvement of the supplier in the product development process.
- Extent to which longer-term relationships provided to suppliers.
- Clarity of specifications provided to suppliers.

Factor 6: Process management/operating procedures

- Use of acceptance sampling to accept/reject lots or batches of work.
- Amount of preventive equipment maintenance.
- Extent to which inspection, review, or checking of work is automated.
- Amount of incoming inspection, review, or checking.
- Amount of in-process inspection, review, or checking.
- Amount of final inspection, review, or checking.
- Stability of production schedule/work distribution.
- Degree of automation in the process.
- Extent to which process design is “fool-proof” and minimizes the chances of employee errors.
- Clarity of work or process instructions given to employees.

Factor 7: Quality data and reporting

- Availability of cost of quality data in the division.
- Availability of quality data.
- Timeliness of the quality data.
- Extent to which quality data are used as tools to manage quality.
- Extent to which quality data are available to hourly employees.
- Extent to which quality data are available to managers and supervisors.
- Extent to which quality data are used to evaluate supervisory and managerial performance.
- Extent to which quality data are displayed at employee work stations.

Factor 8: Employee relations

- Extent to which quality circle or employee involvement type programmes are implemented in the division.
- Effectiveness of quality circle or employee involvement type programmes in the division.
- Extent to which employees are held responsible for error-free output.
- Amount of feedback provided to employees in their quality performance.
- Degree of participation in quality decisions by hourly/non-supervisory employees.
- Extent to which quality awareness building among employees is ongoing.
- Extent to which employees are recognized for superior quality performance.
- Effectiveness of supervisors in solving problems/issues.

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Appendix II. Survey questionnaire on quality management practices in Singapore SMEs (Quazi and Padibjo, 1998)

Please circle the appropriate option in the right hand column. Legend: 1= Strongly disagree, 2= Disagree, 3= Not sure, 4= Agree, 5= Strongly agree, NA= Not applicable.

Leadership

1. I personally conduct regular reviews of quality performance on my product/service 1 2 3 4 5 NA
2. I always maintain close contact with customers. 1 2 3 4 5 NA
3. I enforce total quality commitment to all my staff in all operations 1 2 3 4 5 NA
4. I give quality issues top priority as criteria when making decisions. 1 2 3 4 5 NA
5. I am trained in total quality management 1 2 3 4 5 NA

Information and analysis

6. I carefully collect data on all facets of my business 1 2 3 4 5 NA
7. I analyze all the work processes in my business 1 2 3 4 5 NA
8. Key performance figures are always available to my managers for decision making 1 2 3 4 5 NA

Strategic planning

9. I do regular strategic planning. 1 2 3 4 5 NA
10. My business has clear quality goals 1 2 3 4 5 NA
11. My strategic plan is linked to quality values 1 2 3 4 5 NA
12. My planning process includes continuous quality improvement 1 2 3 4 5 NA

Human resource utilization

13. We work as a team with clear goals 1 2 3 4 5 NA
14. My staff is aware of my long-term business goals 1 2 3 4 5 NA
15. I encourage personal growth of my staff 1 2 3 4 5 NA
16. I reward staff who help improve my product and service quality 1 2 3 4 5 NA
17. Each member in my business is encouraged to develop new ways to do their job better 1 2 3 4 5 NA
18. All staff in my business understand how their tasks fit into an overall plan of things 1 2 3 4 5 NA
19. I ensure that all my staff are focused on continuous improvement effort in all areas 1 2 3 4 5 NA
20. All my staff receive appropriate training and are able to do more than one task 1 2 3 4 5 NA

Management of process quality

21. I continually make improvements in my products and services 1 2 3 4 5 NA
22. In the past year I have introduced at least one new product/service to my customers 1 2 3 4 5 NA
23. I have improved at least one feature of my product/service in the past year 1 2 3 4 5 NA
24. I monitor all production processes and introduce continuous improvement whenever possible 1 2 3 4 5 NA
25. I use statistical process control to monitor my production processes 1 2 3 4 5 NA
26. I always incorporate quality factors in my product/service design 1 2 3 4 5 NA
27. I make sure that the integration of prevention and correction is always included in my daily business operations 1 2 3 4 5 NA

Quality results

28. I can document the technical quality of my product/service as compared to other competitors 1 2 3 4 5 NA

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29. If we implement a new business/operational procedure, we collect and monitor information to determine the extent to which it is better than the previous procedure 1 2 3 4 5 NA
30. We have information on which suppliers always deliver on time and always fill orders correctly 1 2 3 4 5 NA
31. I can document the financial performance of my business compared to other businesses in the same industry 1 2 3 4 5 NA

Customer satisfaction

32. I collect data to monitor changes in my customer satisfaction. I systematically ask a customer what they expect in my product/service 1 2 3 4 5 NA
34. I systematically ask my customers if they are satisfied with the product/service they purchased from me 1 2 3 4 5 NA
35. We record all customers' complaints 1 2 3 4 5 NA
36. I look for the cause when I lose a customer 1 2 3 4 5 NA
37. A customer is adequately satisfied if they continue to use my product/service 1 2 3 4 5 NA
38. I know what my customers expect from me 1 2 3 4 5 NA
39. I use customer complaints to improve my product/service 1 2 3 4 5 NA

Business outcome comparative

40. The profitability of my business has increased in the past three years primarily due to our quality consciousness 1 2 3 4 5 NA
41. Owing to our quality improvement effort the revenue dollars from my business have increased in the past three years 1 2 3 4 5 NA
42. The number of customers in my business has increased in the last three years, primarily because our product/service quality has improved 1 2 3 4 5 NA

Appendix III. ISO 9001:2000 requirements synthesized and ordered into its four major components (ISO, 2000c)

Management responsibility

- Customer requirements (including legal requirements) are determined and their importance is communicated to the organization.
- A quality policy that is in agreement to organization's purpose, is defined, communicated and understood within the organization and is adapted when necessary
- Quality objectives are defined and established for each function and level, and are measurable and coherent with quality policy
- Resources required to achieve quality objectives are available
- Responsibilities and authority within the organization are defined and communicated
- There is a management representative that ensures implementation and maintenance of quality requirements
- There is appropriate communication processes within the organization
- There is periodical review of QMS by top management

Resources management

- The organization has appropriate resources to sustain QMS, to improve continuously its efficiency and to increase customer satisfaction
- Personnel is competent on base on their education, training, abilities and experience
- Needed infrastructure to accomplish product requirements is determined, proportionate and maintained.
- Work environment needed to achieve product requirements is determined and managed

Product realization

- Processes needed for product realization are planned and developed and are consistent with QMS requirements
- Requirements related to the product (specified or not specified by the customer, regulatory and organizational) are determined and reviewed.
- Effective communication with customer is determined and implemented.
- The design and development of the product is planned and control
- Purchased products (specially those affecting quality of the final product) conform specified requirements
- Production and service provision are planned and carried out under controlled conditions
- Product is able to be identified throughout product realization
- Customer property is identified, verified, protected and safeguarded
- Product conformity is preserved during internal processing and delivery to intended destination, including activities such as identification, handling, packaging, storage and protection
- Monitoring and measurement and needed devices for this activities are determined to provide conformity with determined product requirements

Measurement, Analysis and Improvement

- Monitoring, measurement analysis and improvement process are planned and implemented in order to demonstrate conformity of the product, of the QMS and continuous improvement of its effectivity.
- Customer perception about product conformance with requirements is monitored and methods for obtaining this information are determined.
- QMS is internally audited as to ensure effectively implementation and maintenance
- Organization apply suitable methods for monitoring and measuring QMS processes

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- Organization makes sure that product requirements are met by monitoring and measuring its characteristics
- Product that does not conform to requirements is identified and controlled
- The organization determine, collect and analyse data regarding to customer satisfaction, conformity to products requirements and suppliers
- The organization continually improve the effectiveness of the QMS through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and management review

Appendix IV. Critical factors or variables for SCQM (Lin, et al., 2005)

QM practices

- Top management leadership: Top management provides the necessary leadership in enabling conditions for TQ
- Training: Job-related skills and TQC concepts are emphasized
- Product/service design: Consider the design side of the product cycle. Emphasis is on customers' needs and wants
- Supplier quality management: Emphasis is on quality, not on management price. Use joint problem solving approach
- Process management: Process improvement methods are used to ensure stable and capable processes
- Quality data reporting: Records about cost of quality, and other indicators are kept for analysis
- Employee relations: Empower employees. Reliance on awareness and efforts of all employees
- Customer relations: Best-in-class customer satisfaction is emphasized
- Benchmarking learning: Benchmarking is used to improve learning the enterprise's performance

Supplier participation

- Product design collaboration: Suppliers communicate and work with the enterprise on new product designs
- Joint kaizen projects/workshops: Suppliers communicate and work with the enterprise on continuous improvement projects and/or workshops

Supplier selection

- Quality oriented supplier selection: Suppliers are selected based on their capacity to meet the needs of the enterprise
- Cost-oriented supplier selection: Suppliers are selected based on the cost components

Appendix V. General Food Law requirements on traceability

Article 18

Traceability (European Parliament and Council of the European Union, 2002)

1. The traceability of food, feed, food-producing animals, and any other substance intended to be, or expected to be, incorporated into a food or feed shall be established at all stages of production, processing and distribution.
2. Food and feed business operators shall be able to identify any person from whom they have been supplied with a food, a feed, a food-producing animal, or any substance intended to be, or expected to be, incorporated into a food or feed. To this end, such operators shall have in place systems and procedures which allow for this information to be made available to the competent authorities on demand.
3. Food and feed business operators shall have in place systems and procedures to identify the other businesses to which their products have been supplied. This information shall be made available to the competent authorities on demand.
4. Food or feed which is placed on the market or is likely to be placed on the market in the Community shall be adequately labelled or identified to facilitate its traceability, through relevant documentation or information in accordance with the relevant requirements of more specific provisions.

Appendix VI. Intrinsic and extrinsic quality attributes of pork meat

1. General classification of perceived quality attributes (Luning et al., 2002):

- Intrinsic (physical product properties)
 - Safety and health aspects: product mustn't threaten human health (i.e. free of pathogenic micro-organisms, chemical toxic compounds and foreign objects) and should be as good for human health as possible (balanced diet).
 - Shelf life: time lag between delivered final product and moment until it is acceptable for consumption. It is desirable that the product preserves its required sensory properties as long as possible.
 - Sensory properties: sensitive attributes such as taste, odour, colour, appearance, and texture.
 - Convenience: adjusted to customer possibilities e.g. time and packaging.
 - Product reliability: compliance of actual product composition with product description e.g. correct weight, right composition.
- Extrinsic (can influence acceptance of products):
 - Production system characteristics: manufacturing practices that can affect the decision to purchase the product.
 - Environmental aspects: environmental implications of food products and their production.
 - Marketing: experience of the product by the customer after certain expectations have been raised via marketing.

2. Specific critical quality attributes of pork meat in The Netherlands (Kalathas, 2007):

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	Breeding	Finishing and farrowing	Slaughtering	End costumer
Intrinsic attributes	<ul style="list-style-type: none"> - Safety: introduction of diseases. - Safety: Introduction of traits as resistance to microorganism. - Introduction of genes that result in low quality meat characteristics: taste, color, fat content, weight (e.g. Halothane gene for PSE meat) - Introduction of genes that result in low processing yield meat (e.g. RN_gene) - Depigmentation can result in neurological problems. 	<ul style="list-style-type: none"> - Safety: residues of medicines that are not metabolized. - Castration can eliminate smell of final product. - General intrinsic qualities can be positively influenced by record keeping of results of past practices and information exchange of such practices along the chain. - Hygienic practices. 	<ul style="list-style-type: none"> - Pre-slaughter fasting may safeguard safety of final product and improve WHC (juicing) and color. - Pre-slaughter handling may alter stress levels on pigs, which may have influence on product quality (e.g. high pH, skin alterations, juicing, RSE and PSE). - Stunning techniques cause different levels of stress which influences quality of final product (muscle activity, blood splashes, taste, marbling, juicing, fat cover and color). - Chilling rate may influence final product quality. - Electrical stimulation and suspension of carcass from pelvis may improve tenderness. 	<ul style="list-style-type: none"> - Safety and health: Nutritional value, food composition and diet. - Sensory properties: taste, color, marbling, juiciness (drip loss) and fat in the area of the meat (fat cover).
Extrinsic attributes	<ul style="list-style-type: none"> - Production systems characteristics: Introduction of dangerous genetic traits for the public or the environment (e.g. genetically modified or biodiversity threatening) 	<ul style="list-style-type: none"> - Production systems characteristics: welfare space and temperature during gestation. - Farming in open. Guidelines for housing. - Sustainability, welfare and price: waste removal (manure, water, feed and gases) 	<ul style="list-style-type: none"> - Production systems characteristics: welfare of pigs during transportation, lairage, general handling and stunning. 	<ul style="list-style-type: none"> - Production systems characteristics: Quality certification like ISO or HACCP (1/5 of consumers). - Origin and retailing place. PDO and PGI. - Animal welfare and sustainability. - Marketing: e.g. price, brand name, packaging, labeling, shop product information.

Table I. Intrinsic and extrinsic critical quality attributes on each stage of the chain

► Breeding

In the breeding stage, introduction of genes have great impact on quality intrinsic and extrinsic attributes of the meat that affect the whole chain till the end consumer. What makes the selection of quality attributes complicated at this stage is the fact that manipulation of some genes turn into enhance of quality of some aspects but at the same time it results in detriment of other aspects of quality of the meat.

The critical points of quality presented in this appendix have been extracted from Kalathas (2007) . The ones that present controversy are:

- Introduction of genetic traits that look for resistance to microorganism can affect biodiversity of an ecosystem, and so, have negative influence in sustainability extrinsic quality attribute.
- Depigmentation that is desired by the slaughterhouse stage because it is considered to be easier to dehair white pigs, could have an impact in neurological problems for the animal.

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- Genes such as Halothane that improved feed conversion efficiency, reduced back-fat depth, increased loin muscle size and greater percent carcass lean (Rosenvold, et al., 2003 cited in Kalathas, 2007) is closely associated to development of pale, soft and exudative (PSE) meat.
- RN_gene (Rendement Napole) that resulted in leaner carcasses is associated with low processing yields of meat.

► **Finishing and farrowing (production)**

Again, conflict arises in the different practices for intrinsic and extrinsic attributes:

- Welfare on farming in open (free range) may cause less stress to the animal but increases price of care and facilities that will influence final price of meat. It also may affect safety of the animal as they are more exposed to outside factors.
- Castration goes against animal welfare that is a strong requirement for final Dutch consumer at this particular point but it also could eliminate smell in the final product.

► **Slaughtering**

Previous to slaughtering, this is, fasting, mixing of unfamiliar groups of pigs, loading, transportation, lairage, stunning and general handling of pigs, seems to have an influence on product quality as stress levels of pig on these stages may alter intrinsic quality of pork meat. On the other hand, after slaughtering, chilling rate seems to have a not so clear defined influence on WHC-juicing and color. Electrical stimulation to improve tenderness of the meat should be applied not earlier than 20 minutes after slaughter of pig. Practices of cutting and chilling should be carefully prevented from contaminating the product.

Appendix VII. Measurement and monitoring customer satisfaction (ISO, 2000a, pp. 35–56)

The collection of customer-related information may be active or passive. Management should establish effective and efficient processes to collect analyse and use this information for improving the performance of the organization. The organization should identify sources of customer and end-user information, available in written and verbal forms, from internal and external sources. Measurement of customer satisfaction should be used as a vital tool.

Examples of customer-related information:

- ⇒ Customer and users surveys
- ⇒ Feedback on aspects of product
- ⇒ Customer requirements and contract information
- ⇒ Market needs
- ⇒ Service delivery data
- ⇒ Information relating to competition

Processes for requesting, measuring and monitoring customer satisfaction should:

- ⇒ Provide information on a continual basis
- ⇒ Consider conformity to requirements, meeting needs and expectations of customers, price and delivery of product
- ⇒ Define and implement data-collection methods, including information sources, frequency of collection, and data analysis-review

Examples of sources of information on customer satisfaction:

- ⇒ Customer complaints
- ⇒ Communicating directly with customers
- ⇒ Questionnaires and surveys
- ⇒ Subcontracted collection and analysis of data
- ⇒ Focus groups
- ⇒ Reports from customer organizations
- ⇒ Reports in various media
- ⇒ Sector and industry studies

Appendix VIII. Purchasing (ISO, 2000a, pp. 29–30)

6.3.1. Purchasing process

To ensure the effective and efficient performance of the organization, management should ensure that purchasing processes consider the following activities:

- ⇒ Timely, effective and accurate identification of needs and purchased product specifications
- ⇒ Evaluation of the cost of purchased product, taking account of product performance, price and delivery
- ⇒ The organization's need and criteria for verifying purchased products
- ⇒ Unique supplier processes
- ⇒ Consideration of contract administration, for both supplier and partner arrangements
- ⇒ Warranty replacement for nonconforming purchased products
- ⇒ Logistics requirements
- ⇒ Product identification and traceability
- ⇒ Preservation of product
- ⇒ Documentation including records
- ⇒ Control of purchased product which deviates from requirements
- ⇒ Access to suppliers' premises
- ⇒ Product delivery, installation or application history
- ⇒ Supplier development
- ⇒ Identification and mitigation of risks associated with the purchased product

6.3.2. Supplier control process

The organization should establish effective and efficient processes to identify potential sources for purchased materials, to develop existing suppliers or partners, and to evaluate their ability to supply the required products in order to ensure the effectiveness and efficiency of overall purchasing processes.

Examples of inputs to the supplier:

- ⇒ Evaluation of relevant experience
- ⇒ Performance of suppliers against competitors
- ⇒ Review of purchased product quality, price, delivery performance and response to problems
- ⇒ Audits of supplier management systems and evaluation of their potential capability to provide the required products effectively, efficiently and within schedule
- ⇒ Checking supplier references and available data on customer satisfaction
- ⇒ Financial assessment to assure the viability of the supplier throughout the intended period of supply and cooperation
- ⇒ Supplier response to inquiries, quotations and tendering
- ⇒ Supplier service, installation and support capability, and history of performance to requirements
- ⇒ Supplier awareness of and compliance with relevant statutory and regulatory requirements
- ⇒ The supplier's logistic capability including locations and resources
- ⇒ The supplier's standing and role in the community, as well as perception in society

