



Requirements of supply chain management in differentiating European pork chains



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ARTICLE INFO

Article history:

Received 5 July 2012

Received in revised form 22 March 2013

Accepted 27 March 2013

Keywords:

Supply chain management

Pork production

Quality attributes

Quality management system

Governance

Information system

ABSTRACT

This paper summarizes results obtained by research into pork chain management in the EU Integrated Project Q-Porkchains. Changing demands for intrinsic and extrinsic quality attributes of pork products impact the way supply chain management should be organized from the farmer down to the consumer. The paper shows the importance of Quality Management Systems for integrating supply chains and enhancing consumer confidence. The paper also presents innovations in information system integration for aligning information exchange in the supply chain and logistics concepts based on innovative measurement technologies at the slaughterhouse stage. In the final section research challenges towards sustainable pork supply chains satisfying current consumer demands are presented.

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1. Introduction

This paper summarizes insights gained from research into management of pork supply chains in Europe and beyond, through the EU funded Integrated Project Q-Porkchains.¹ The starting point of the paper is that changing consumer and societal demands for pork products not only affect the companies that are the direct suppliers of consumers, like retailers or restaurants, but also companies upstream the supply chain, including processors, slaughterhouses, traders, farmers, feed suppliers. Therefore, a chain management approach to analyse impacts of these different stages in production on end products seems to be essential. Such an approach has been recognized in the last decade, by industry, government as well as research, as vital for industry competitiveness and consumer satisfaction. The focus of chain management is explicitly on finding the most effective and efficient way of adding value with the aim of meeting consumer requirements at minimal costs.

Because of food safety concerns and concerns on how food is produced or where it originates from, attention for integrated chain quality management systems has seen a large increase in the last two decades. Information system designers increasingly try to build systems that connect various stages in the chain, not only for communicating quality and safety data but also for the sake of traceability of the food products

as well as for logistic optimization of processes. In addition, new technologies encourage companies to pay more attention to the environmental load of their businesses. New technologies also enable companies to better differentiate the products they produce, thereby enlarging their product assortment and improving market opportunities.

This paper will investigate how market demands translate to the different stages of the pork supply chain. In addition, integrated quality management systems, new forms of organisation, and quality differentiation will be discussed that can cope with these demands from a chain management perspective.

Section 2 of this paper addresses changing consumer and societal demands for pork products. Section 3 shows how these demands translate into demands for the different chain stages. In Section 4 two main coordination mechanisms are analysed: quality management systems and (related) governance mechanisms. In Section 5 three main opportunities for pork chain management are discussed: balanced supply chain contracts, integrated chain information systems and quality differentiation. Section 6 concludes the paper.

2. Changes in demands for pork production

In the last years requirements from different stakeholders to pork production have increased considerably. Due to several crises, for example the dioxin crises in various European countries (Plaggenhoef, 2007; Wognum, Bremmers, Trienekens, van der Vorst, & Bloemhof, 2011), consumers demand for more stringent regulations and control systems with regard to food safety. At the same time, because of increasing welfare in Western economies, demands towards higher and more consistent quality have increased, at affordable price levels, though. Tendencies to mass-customization lead to more differentiated products and innovative packages, while at the same time societal concerns related

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¹ The EU-FP6-036245-2 Project Q-Porkchains was performed from January 2007 to December 2011. The work presented in this paper was part of Module IV. The authors acknowledge the EU for providing the funding for the work performed. The results presented in the paper are the responsibility of the authors.

to bio-industrial and mass production ask for more attention to ethical issues such as animal welfare and energy and waste management (Verdouw, Beulens, Trienekens, & Wolfert, 2010).

The tasks of the governments in this respect focus on safety of products and public health issues through legislation and public control instruments (e.g., meat inspection at slaughterhouses), conservation of public goods like local environment, nature and soil (manure surplus), encouragement of low ecological foot prints, integrity in food product labelling (Trienekens, Wognum, Beulens, & van der Vorst, 2012) and information provision on origin of the foods and characteristics of production processes (Meulen & Velde, 2011). Industries throughout the pork supply chain have to comply with these demands by producing through efficient (low cost) processes while at the same time producing high quality and differentiated products. In line with this, economies of scale considerations lead to business concentration in all stages of the pork supply chain (Trienekens, Petersen, Wognum, & Brinkmann, 2009). Moreover, societal concerns have penetrated deep in many industries, leading to the fast evolution of traceability systems, integrated chain quality and health management systems and energy and waste management systems.

Table 1 underlines the variety and number of requirements of consumers and government towards industry. The challenges industry has to cope with are even further intensified through the specific characteristics of food supply chains and pork supply chains in particular (Vorst, 2000, Wognum et al., 2009, Trienekens et al., 2012). These are:

- Fluctuations in yields at farm level (number of piglets per sow, feed conversion rate, etc.), due to unpredictable natural influences
- Variations in quality of the animal. Even within one breed and one farm quality variation between animals can be high
- Cross-contamination of animal diseases (e.g. salmonella) because of mixture of lots in transportation and slaughtering stages. Globalisation leads to an increase in international transports and therewith in infection routes
- Diverging production chain. One pig delivers many parts, which all have to be marketed
- At the slaughtering stage, where animals are decomposed in many

Table 1
Requirements on food products from different stakeholders.

Consumer	
	Safe products
	High quality products
	Affordable prices
	Differentiated products/ broad assortment
	Innovative packages
	Animal welfare
	Low ecological food print
Government	
	Assurance of safe food and public health
	Control of livestock diseases (outbreaks)
	Conservation of public goods like local environment, nature and soil
	Assurance of low ecological food prints
	Provision of adequate consumer information (labelling) about authenticity of food
	Provision of adequate societal information
Industry	
	Compliance to legislation
	High added value and high margins
	Low processing costs
	Market segmentation and internationalization
	Product and packaging innovations
	Traceability and fast recalls
	Low ecological food print
	Good relationships with NGOs

- parts and combined with other ingredients in the processing stage again, traceability of pork is no longer possible to an individual animal or individual farm, but to day batches. Information is lost at this stage
- Perishability of (fresh) meat products (shelf-life constraints)
- Special demands to storage and transportation of live animals and pork products.

3. Pork attributes

A pork supply chain delivers products to consumers who are at the downstream end of the supply chain. These consumers have differentiated demands with respect to the attributes of the products they consume. In general we distinguish intrinsic and extrinsic product attributes. Intrinsic attributes can be measured on the product itself and are typical search and experience attributes (Grunert, 2005; Steenkamp & van Trijp, 1996; Verbeke, Van Oeckel, Warnants, Viaene, & Boucqué, 1999). Classes of intrinsic characteristics are sensory characteristics such as tenderness, health characteristics such as safety of the product and convenience characteristics such as type of packaging. Extrinsic product characteristics are linked to the production process and in general cannot be measured (by consumers) on the product itself. Typical classes of extrinsic attributes of pork products relate to animal welfare in various stages of the chain, ecological aspects like waste management and origin and authenticity of the products (Grunert, Wognum, Trienekens, Veflen Olsen, & Scholderer, 2011; Trienekens et al., 2009, 2012; Wognum et al., 2009, 2011)

Table 2 gives an overview of major intrinsic and extrinsic attributes of pork production.

3.1. Translation of intrinsic quality attributes throughout the supply chain

An interesting question is, whether all stages in the pork supply chain are directed at the achievement of the product attributes that are requested by consumers, of the market segment that the final products are sold in. A feed producer is mainly interested in selling feed mixtures with high added value. A breeder will focus more on pig genetics for achieving high growth rate and optimal feed conversion. A farrowing farmer is interested in sow performance and mother behaviour. A finishing farmer is also interested in pig characteristics like growth rate, feed conversion and specific characteristics like meat percentage and muscle structure, because these are the characteristics that he is paid for by the slaughterhouse. However, although the payment system of slaughterhouses is based on these carcass characteristics, the payment of further downstream stages in the supply chain is largely based on process qualifications like weight, size, fat layer, and

Table 2
Intrinsic and extrinsic pork product attributes.

Intrinsic		Extrinsic	
Sensory	Tenderness	Animal welfare	Farm production system
	Colour		Transportation
	Marbling		Slaughter
Health	Safety (zoonosis)	Ecological food print	Farm manure and waste management
	Food additives		Transportation
	Antibiotics		Slaughter products (high and low value)
Convenience	Residues	Origin and authenticity	Production location
	Packaging		Community impact
	Shelf life		Farm production system
	Preparation characteristics		Processing system

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