

Certification Schemes, Quality-Related Communication in Food Supply Chains and Consequences for IT-Infrastructures

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Abstract

Information sharing between supply chain partners is considered essential, not only for improving the competitiveness and innovativeness of agribusiness firms but also food safety and traceability. In this paper we analyze the state of the art of certification schemes in the European agrifood sector, determine which quality-related information must be stored and exchanged according to these schemes and examine the consequences for chain-wide information technology infrastructures. The paper presents initial results of a research project on IT-supported agrifood chains for improved traceability of meat products (IT FoodTrace) financed by the German Federal Ministry of Education and Research (code: 0330761).

Key words: certification schemes; quality-related communication; IT-supported agrifood chains.

1 Introduction

In recent years, certification schemes have been widely introduced into the European agrifood sector (Schiefer and Rickert 2004; Hatanaka, Bain and Busch 2005; Theuvsen *et al* 2007). The reasons for this were the growing quality demands of customers, particularly large retailers, and several food crises, which undermined consumers' trust in food safety and revealed a lack of transparency in food supply chains. Furthermore, systematic quality assurance and improved traceability are considered cornerstones for improving the competitiveness of European agribusiness (Bogetoft and Olesen 2002; Theuvsen and Hollmann-Hespos 2007). The European Union strongly supports this trend through legislative actions, such as the introduction of EU-wide certification systems, for instance, in the organic farming sector or in the form of the PDO, PGI and TSG systems, the establishment of European food safety agencies and passing demanding food safety and hygiene rules. All in all, EU activities seek to establish a "quality-driven single market in foodstuffs" (Verhaegen and Van Huylenbroeck 2002).

A strong market orientation that directs all of a firm's efforts towards meeting customer demands is often considered a prerequisite for successful business operations (Kohli and Jaworski 1990; Martin and Grbac 2003). In food supply chains many firms do not have direct relationships with consumers. For these firms dissemination of information through communication between supply chain partners is an absolute condition for market orientation (Mohr and Nevin 1990) and an important driver of product and process innovations (Dyer and Singh 1998). Furthermore, in the agribusiness sector improved documentation and information sharing are important building blocks for quality assurance and food safety (Windhorst 2004).

In this paper we analyze the prevalence and characteristics of certification schemes in the European agriculture and food industry, their effects on quality-related communication between supply chain partners and their consequences for IT infrastructures. In doing so, we focus on the meat industry, especially business relationships between farmers and abattoirs, but neglect certification systems implemented in upstream industries, such as the GMP+ and the Fami-QS (European Feed Additives and

Premixtures Quality System) standards, which have been widely implemented in the animal feed industry.

2 Certification schemes

“Certification is the (voluntary) assessment and approval by an (accredited) party on an (accredited) standard” (Meuwissen *et al* 2003, 172). Neutral and independent third-party audits by a certifying party with the aim of assessing the compliance of a certifiable party—a farm or a firm—with a standard typically laid down in a systems handbook are at the heart of certification procedures. Firms successfully passing the audit procedure receive a certificate that can be used as a quality signal in the market to reduce the quality uncertainty of buyers and, thereby, lower transaction costs (Luning, Marcelis and Jongen 2002). Certification has to be distinguished from the activities of public surveillance and control authorities that control fulfillment of legal requirements and from second-party audits by, for instance, customers checking compliance with their own standards (Meuwissen *et al* 2003).

The ISO 9000 family once triggered the increasing prevalence of industry-neutral certification standards. Agriculture and the food industry turned back the clock by establishing industry and, in some cases, even product-specific standards. This resulted in a large number of certification standards. Although the sometimes cited number of more than 380 certification schemes in the EU (Wesseler 2006) is presumably somewhat exaggerated, in Germany alone about 40 different such schemes are used for certifying farms and firms in the agribusiness. A closer look at the systems implemented in the EU reveals a broad spectrum that can be organized along different dimensions (Spiller 2004; DG JRC/IPTS 2006): standard setter, addressees, foci, objectives, geographical coverage, number of participants and supply chain coverage. (In the following, examples are given in brackets.)

With regard to the **standard setter**, we can roughly distinguish between private and public standards (Jahn, Peupert and Spiller 2003). Public standards can be laid down by the EU (Regulations (EC) 2092/91 and 510/2006) or by national or regional governments (BQ and BQM standards in the German state of Saxony-Anhalt). Private standards can be laid down by customers (BRC Global Standard, International Food Standard), suppliers (Assured Farm Standards in the UK), norming institutions (ISO 9001, ISO 22000), inspection and certification institutes (Food TUEV Tested; Fresenius Quality Seal) or nongovernmental organizations interested in, for instance, fair trade (TransFair) or higher animal welfare standards (Freedom Food, Neuland). Furthermore, combinations are possible, as in the case of the German Q&S system where industry associations representing different stages of the supply chain have joined to set a standard. The French Label Rouge standard is an example of a public-private partnership in which the French government, consumer organizations and producers collaborate for the production of high quality food products.

Addressees of the certificates can be either other businesses or consumers or—in some cases—both. Business-to-Business (B2B) standards are not communicated to the final consumers, who are often unaware of the existence of standards, such as EurepGAP, BRC Global Standard, International Food Standard, ISO 22000 or IKB. B2B standards seek to reduce quality uncertainties in food supply chains and, in that way, serve as quality signals, reduce transaction costs and liability risks and favor spot market transactions (Schulze, Spiller and Theuvsen 2006). They typically represent major parts of an industry, for instance, more than 90 % of the Dutch pork market (Schouwenburg 2004). Business-to-Consumer (B2C) schemes address the final consumer, typically by displaying a logo on the products produced by certified farms and firms (Freedom Food, Neuland, Label Rouge, PDOs, PGIs, TSGs). The B2C standards represent the majority of certification schemes in the EU but often (although not always) operate in market niches. Some schemes have a B2B as well as a B2C focus. Examples are the German Q&S system and the British Assured Food Standards (with the well-known Little Red Tractor logo). Since these schemes address not only consumers but also other businesses, they typically represent major parts of the market, for instance, Q&S accounts for about 80 % of the German pork market and Little Red Tractor for 65 % (beef) to 90 % (pork, poultry) of the British meat market (<http://www.defra.gov.uk>). In acquiring high market shares, the B2B as well as the mixed standards benefit from the bottleneck function of large processors or retailers who often threaten to delist non-certified producers and processors. In this respect, large retailers act as the “new masters of the food system” (Flynn and Marsden 1992) and, by doing so, make participation of food farms and food manufacturers in certification schemes “quasi-voluntary” (Meuwissen *et al* 2003, 172).

Certification schemes can have very diverse **objectives**, which can be roughly described as the improvement of food safety by guaranteeing compliance with minimum standards and differentiating food products. Minimum standard schemes reduce quality uncertainties, especially with regard to credence attributes, such as freedom from microbiological risks. Often these schemes confine themselves to systematically compiling legal rules, norm standards (governing, for instance, cleaning and disinfection) and industry guidelines (such as good hygiene practices) but largely refrain from defining higher standards. Enforcing compliance with minimum standards is typical of many large B2B schemes, like the BRC Global Standard, EurepGAP and the International Food Standard, but also of some smaller standards, for example, the BQ and BQM standards established by the regional government of Saxony-Anhalt in Germany. The private enforcement of legal rules prior to certification often only incompletely controlled by public authorities might be an explanation why many certified farms and firms perceive even the minimum standard schemes as additional burdens (Gawron and Theuvsen 2007).

Differentiation strategies seek to create product offerings that are perceived as superior by customers. Differentiated products enjoy higher prices and higher customer loyalty than undifferentiated products, which compete only on price (Porter 1980). Product differentiation is typical of the vast majority of schemes addressing the final consumer. Differentiation can be based on compliance with above-average process standards, such as organic farming (Bioland, Demeter) or animal welfare (Freedom Food, Neuland), guaranteed region-of-origin (Regulation (EC) 510/2006), freeness from genetically modified organisms (as in the case of the German Wiesenhof concept's non-GMO guarantee) or higher organoleptic qualities (Label Rouge). Often two or more differentiating aspects are combined, for instance, as in the case of many PDOs and PGIs, region of origin, traditional production methods and higher organoleptic qualities.

The **focus** of certification schemes can be systems, processes or products (Pfeifer 2002). Quality management system audits are typical of schemes seeking to guarantee minimum standards in an B2B environment (ISO 9001, ISO 22000 EurepGAP, International Food Standard, BRC Global Standard, Q&S, IKB). Production processes are the main focus of, for instance, organic farming labels and the EU egg classification system. A product focus is often characteristic of PDOs, PGIs and TSGs or product awards based on sensory tests (CMA gepruefte Markenqualitaet). Combinations can also be found, for instance, when some process characteristics, like those pertaining to animal husbandry, are added to a process standard such as Q&S to form a regional quality initiative.

The **geographical coverage** of the certification schemes implemented in the EU is very diverse. Local standards admit only local producers and processors as partners, as is the case in many PDOs and PGIs. Regional certification schemes are often founded by regional governments or medium-sized processors. Q&S in Germany and IKB in the Netherlands are mainly national systems. Both are also used outside their home countries, but the vast majority of the farms and firms they certify are in Germany and the Netherlands, respectively. International schemes have been broadly implemented in two or more countries. Examples are the International Food Standard (France and Germany), EurepGAP and ISO 9001 and 22000.

The **number of participants** varies considerably. The smallest certification schemes currently operated in Germany have hardly more than 130 (Unser Land) or 140 (Gepmuefte Qualitaet Thueringen) members. Medium-sized schemes have a few thousand farm and firm members, for instance, the organic farming labels Demeter (3,200 farms and firms) and Bioland (4,540 farms and firms). One of the largest systems is the German Q&S system, with more than 83,000 participating farms and firms.

Supply chain coverage is also diverse. Some schemes focus only on one stage of the supply chain, for example, agriculture (EurepGAP) or processors (International Food Standard). Other standards include several or all stages, for instance, KAT (animal feed industry, laying farms and packing) and Q&S (animal feed industry, agriculture, processors, retailers).

3 Certification schemes and quality-related communication in food supply chains

The prevalence of certification schemes in today's food supply chains raises the question of the extent to which they contribute to information sharing between suppliers and customers and advance quality-related communication in food supply chains. Other potential drivers of information exchange are legislation (like the so-called EU hygiene package), firm-specific requirements (such as documents

required to accompany products) and managerial information needs (on prices and available quantities and qualities, for example).

One current controversy in agricultural economics circles around the question whether higher food quality and safety standards can be met in traditionally organized food supply chains (Windhorst 2004). Some authors identify the increasing requirements of consumers, large retailers and fast-food companies concerning product quality and traceability as important drivers towards more integrated food supply chains. Den Ouden *et al* (1996), for instance, identify customers' growing quality requirements as a major impetus behind contracts and vertical integration. In particular, product differentiation in order to meet changing consumer demands regarding credence attributes, such as animal welfare, food safety and environmental issues, are considered important drivers of closer ties in the meat supply chain. Transmitting changing demands to farmers is considered more transaction cost efficient under contracts and in vertically integrated systems. Lawrence *et al* (1997) offer a similar explanation for the changing organization of US meat supply chains. They argue that long-term contracts allow abattoirs transaction cost savings compared to traditional marketing channels when securing their slaughterhouses a consistent supply of high quality slaughter pigs in adequate quantities. Hornibrook and Fearn (2005) found similar results in the British beef market. They observed that retailers put greater emphasis on product safety and quality after suffering several food crises, strengthening their influence on meat supply chains and largely refraining from spot market transactions.

Obviously, food quality and safety are expected to influence the organization of food supply chains, especially in the meat sector, which is susceptible to food hazards and confronted with growing and sometimes contradictory consumer demands. Strengthening market orientation by more efficiently communicating consumer demands to all supply chain partners seems paramount. If it turns out that certification schemes contribute to the spread of quality-related information in food supply chains, this could have far-reaching effects and even make it possible to forgo the fundamental redesign of meat supply chains. Because of its importance, we will analyze the effect of certification schemes on information sharing in greater detail.

We choose three very different German certification schemes as research objects: Q&S, Boeseler Goldschmaus (referred to below as Goldschmaus) and Bioland. Q&S is the leading German certification scheme in the meat sector. Goldschmaus is a comparatively small, farmer-owned scheme in one of Europe's leading pork production areas in Northwestern Germany; it is noteworthy that Goldschmaus also includes the Q&S standard and, thus, allows combined audits. Bioland is one of Germany's leading privately organized organic farming schemes covering all farm and food products. To simplify comparison between the schemes under analysis, Bioland has been analyzed with regard to meat production only. Table 1 describes these schemes in more detail with reference to the classification criteria introduced above.

	Q&S	Goldschmaus	Bioland
Standard setter	Private	Private	Private
Addressees	Businesses and consumers (B2B and B2C)	Consumers (B2C)	Consumers (B2C)
Objectives	Minimum standard	Differentiation	Differentiation
Focus	Quality management system	Quality management system + Process	Processes
Geographical coverage	National	Regional	National
Number of participants	About 83,000	About 265	About 5,270
Supply chain coverage	All stages	Farmers and processors	All stages

Table 1. Three German certification schemes (www.q-s.info; www.goldschmaus.de; www.bioland.de)

All three certification schemes require the exchange of information between supply chain partners. Interestingly, although they have quite different objectives and foci, all three schemes restrict obligatory communication mainly to those areas already mandated by legislation. The legal communication requirements are complemented by a few scheme-specific requirements on, for instance, pig-fattening farms' salmonella status, length of animal transport or animal feed used during the fattening period. Table 2 gives an overview of those quality-related information exchanges mandated in the certification schemes surveyed. In general, the level of quality-related communication in meat supply chains required by

certification schemes is low, irrespective of the nature of the schemes.

	Q&S	Goldschmaus	Bioland
Feed industry	- Q&S certified feed - information about feed ingredients	- GMP ⁺ or Q&S certified feed from contract mills - information about feed ingredients	- Bioland certified feed - information about feed ingredients
↓ ↑			
Pig-fattening farm	- animal number (VVVO) - duration of animal transport - salmonella status - slaughter documents	- animal number (VVVO) - length and duration of animal transport - salmonella status - slaughter documents	- animal number (VVVO) - length and duration of animal transport - salmonella status - slaughter documents
↓ ↑			
Slaughterhouse	- Q&S certified meat - batch number	- Q&S certified meat - batch number	- Q&S certified meat - batch number
↓ ↑			
Processor	- Q&S certified meat - batch number	- Q&S certified meat - batch number	- Q&S certified meat - batch number
↓ ↑			
Retailer	- Q&S certified meat - batch number	- Q&S certified meat - batch number	- Q&S certified meat - batch number

Table2. Mandatory information exchange in three German certification schemes

4 Consequences for IT Infrastructures

All three certification schemes so far mainly rely on analog communication technologies when sharing quality-related information between supply chain partners. Their preferred and regularly used data media are delivery notes, registered goods issue slips, transport certificates and slaughter documents informing farmers about the results of pig classification. Generally speaking, up to this point, information transfer and data media are strongly influenced by supplier-customer relationships and the flow of goods (in this case, slaughter pigs). Electronic communication is currently still in its infancy and mainly restricted to providing online access to or email transmission of slaughter documents. All in all, the current situation is characterized by media disruptions between the various stages of the supply chains. Against this background, several IT projects have been started or have already entered their implementation phases.

One of the most advanced approaches currently in use is the Farmer's Friend software developed by Hoffrogge & Doehring Consulting Company GmbH (www.farmersfriend.de). Farmer's Friend is a web-based software solution that addresses the documentation and communication needs of farmers, livestock traders and abattoirs. On the farm level, the system allows in-depth analyses and benchmarking of pig classification results and the financial success of the fattening period. With regard to quality-related communication, it is noteworthy that the software supports the mandatory information exchange between farmer and slaughterhouse according to Regulation (EC) 853/2004. Since January 1, 2006 (transition period until January 1, 2008), farmers have had to comply with the principles of food chain information, according to which certain information has to be transmitted to the slaughterhouse no less than 24 hours before the arrival of animals there. Livestock traders are also provided with software that supports financial settlements and analysis of pig classification results. Since most slaughter pigs are not directly sold to slaughterhouses but traded by livestock dealers, food chain information is generally their obligation. For this reason, Farmer's Friend also supports food chain information by livestock dealers. In slaughterhouses, Farmer's Friend supports upstream communication with farmers and livestock dealers (such as administering incoming food chain information and transmitting slaughter documents).

Compared to prevailing analog data media, Farmer's Friend represents a big step ahead. One of the remaining major shortcomings is that the software does not support upstream industries, like feed mills, or downstream processors, wholesalers or retailers. Therefore, it only partially solves the problem of media disruptions. This is the starting point of the IT FoodTrace project. This project represents a partnership between software firms, universities and processors financed by the German Federal Ministry of Education and Research as a building block of the German federal government's e-government 2.0 initiative. The project vision is ambitious: to create a chain-wide IT infrastructure that allows nonredundant data entry, open standards and interface solutions based on the latest web technologies. The

more demanding EU legislation on food hygiene becomes, the more probable it will be that the future of IT infrastructure resembles the IT FoodTrace vision.

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