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Exploring the influence of context on food safety management: Case studies of leafy greens production in Europe

Klementina Kirezieva [a,*], Liesbeth Jacxsens [b], Geoffrey J.L.F. Hagelaar [c], Martinus A.J.S. van Boekel [a], Mieke Uyttendaele [b], Pieternel A. Luning [a,*]

[a] Food Quality and Design Group, Department of Agrotechnology and Food Sciences, Wageningen University, P.O. Box 17, 6700AA Wageningen, The Netherlands
[b] Department of Food Safety and Food Quality, Laboratory of Food Preservation and Food Microbiology, Faculty of Bioscience Engineering, University of Ghent, Coupure Links, 653, 9000 Ghent, Belgium
[c] Management Studies Group, Wageningen University, Hollandseweg 1, 6706 KN Wageningen, The Netherlands

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ABSTRACT

Fresh produce companies operate their food safety management systems (FSMS) in a complex context. On the one hand, during setting and operating their FSMS activities, companies need to consider the riskiness of the 'FSMS context' of the company, including the risk of product and production, and the limitations and opportunities of the organisational and chain characteristics. On the other hand, companies with their narrow 'FSMS context' and actual FSMS, can be influenced by the 'broad context' in a country and sector.

This paper presents an analytical framework with operational tools that enable assessment of the status of FSMS in view of the context riskiness at company level, and exploration of the influence of the 'broad context' in a country and sector. The latter was defined to include: food safety governance, agro-climatic, market, and public policy environment. Empirical data from three case studies of leafy greens production, intentionally chosen to represent three European regions with their specific contexts, was used to validate the analytical framework. As a conclusion, we postulate that the FSMS output is a function of the broad context in a country and sector, the 'FSMS context' in a company, and implemented food safety management system. The model is a first step towards conceptualisation of the complex systems influencing FSMS implementation and operation in companies.

Introduction

Many efforts have been put into implementing food safety management systems (FSMS) in companies in the food production chain (Konecka-Matyjek et al., 2005; Fotopoulos et al., 2010; Mensah and Julien, 2011). In scientific research the focus was largely on investigating the status and effectiveness of FSMS in the animal sector (i.e. dairy and meat) (Jacxsens et al., 2010a, 2011; Sampers et al., 2012; Luning et al., 2015). More recently, incidences of foodborne illnesses have triggered the attention of the public to safety of fresh produce such as leafy greens (Lynch et al., 2009; Altmann et al., 2011; Baert et al., 2011). These outbreaks have been occurring worldwide and due to the large volume of international trade with these commodities, several of them involved multiple countries (e.g., Greig et al., 2007; Lynch et al., 2009; Gajraj et al., 2011). Furthermore, pesticide residues are still an important issue (Chen et al., 2011; Hjorth et al., 2011), and the risk is perceived as high by consumers (Cerroni et al., 2013; Van Boxstael et al., 2013).

To mitigate the risks to food safety, companies have put efforts into upgrading their food safety management systems (FSMS). These systems at primary production are commonly based on good agriculture and good hygiene practices, however, no special provisions or guidelines are yet elaborated regarding their actual implementation within the European Union (EU). The EU policies are following the principles of subsidiarity and multi-level governance, which aim at distributing the policy responsibility among different governmental levels, and among the public and private sector, as decision-making takes place at the lowest possible level (Bernauer and Caduff, 2004). These principles are enforced differently in each member state by following different public strategies to induce compliance and often leaving a lot of room for industrial self-regulation (Caduff and Bernauer, 2006; Havinga, 2006). This niche is covered by various private standards (e.g., GlobalGAP, IFS, Marks & Spencer's Field-to-Fork, Tesco Nature's Choice),

* Corresponding authors. Tel.: +31 7482087; fax: +31 7483669.
E-mail addresses: Klementina.Kirezieva@gmail.com (K. Kirezieva), Pieternel.Luning@wur.nl (P.A. Luning).

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commonly imposed by the retailers. *De jure* they are voluntary, but *de facto* food business operators need to conform with them to gain market access (Humphrey, 2005; Fulponi, 2006; Henson, 2008). This whole set of legislation and standards, organisations (public and private) and processes involved in their enforcement, are described by the term food safety governance (Renn et al., 2011).

Food safety governance is part of the broader context of a sector and country that can have an influence on FSMS. Primary production of fresh produce is particularly vulnerable to contextual influences such as contamination from people and environment, including agricultural workers, irrigation water, manure, surroundings, wild life, etc. (FAO, 2008b; Berger et al., 2010). Furthermore, fresh produce and leafy greens are increasingly traded globally, grown and processed under diverse conditions, following different legislation and standards (Powell et al., 2009). They are mostly consumed raw, and there is limited possibility to apply intervention for elimination of any contamination, even further down in the chain for derived products, such as fresh-cut salads. Moreover, fresh produce is susceptible to climate change impacts (Liu et al., 2013; Kirezieva et al., 2014).

Previous research described the relationships between the context and quality and food safety management systems and their output (Spiegel et al., 2006; Luning et al., 2011b; Kirezieva et al., 2013b). Empirical studies showed that companies working in a high risk context need more advanced FSMS activities to be able to achieve a good output (Sampers et al., 2010; Luning et al., 2011a, 2015; Osés et al., 2012). However, these studies focused on the context of FSMS on a company level and the broad environment of the country and sector was not taken into account. The latter has been partly addressed in political economy research investigating the food safety governance and the mechanisms behind public and private enforcement (e.g., Stuart, 2010; Rouvière and Caswell, 2012; Richards et al., 2013). These studies, however, do no investigate the effect of food safety governance on FSMS implemented in companies. The study of Jacxsens et al. (2015) investigates the influence of a public standard on food safety management systems on a company level, but without analysing the underlying governance mechanisms. No research yet explores the elements of the broad context in a country and a sector that can affect the actual implementation of FSMS in companies.

Therefore, the objective of the study was twofold: (1) to assess the status of FSMS in the leafy greens sector; (2) to explore the 'broad context' and the mechanisms through which it can influence the 'FSMS context' in a company, FSMS activities and the system output. This paper presents an analytical framework with operational tools that enables assessment of the status of food safety management systems in view of the context riskiness at company level, and exploration of the possible influence of the 'broad context' in a country and sector. The latter included food safety governance, agro-climatic, market, and public policy environment. The model is a first step towards conceptualisation of the complex systems influencing FSMS implementation and operation in companies. It builds on previously developed theories about status of FSMS in fresh produce companies in view of their company specific FSMS context (Kirezieva et al., 2013a,b).

Analytical framework

The analytical framework (Fig. 1) shows a schematic representation of the FSMS as influenced by their narrow and broad context. The analytical framework is grounded on the systems thinking approach aimed to study how systems behave, interact with their context and influence each other (Von Bertalanffy, 1969). The general systems theory describes that all systems constitute of elements, have a structure of sub-systems and participate in bigger hierarchy of systems (Skyttner, 2005). In the analytical framework were considered two hierarchical system levels: (1) the companies with their unique FSMS and context, and (2) the broad context in which they operate with its sub-systems including food safety governance, agro-climatic, market and public policy environment. To assess the FSMS and their context, we used a previously developed diagnostic tool (Kirezieva et al., 2013a,b). This tool was embedded in the analytical framework aimed to explore the broad context with its sub-systems, and their possible influence on the FSMS.

Diagnostic tool for assessing status of FSMS in fresh produce

In the lower level of our hierarchy we have considered the food companies with their FSMS. To collect information we have used a diagnostic tool which allows assessment of the 'FSMS context', FSMS activities and the FSMS output (Kirezieva et al., 2013a,b). The 'FSMS context' consist of the product, production, organisation and chain characteristics of the company that can create riskiness to the decision-making process during the set-up and operation of the FSMS with its control and assurance activities, and thus their final FSMS output. Riskiness is created by the *vulnerability* of the products, *uncertainty* due to lack of information and *ambiguity* due to lack of understanding (Luning et al., 2011b). Companies can reduce the riskiness of the 'FSMS context' by addressing it in the FSMS activities with systematic methods and independent positions, adequate and science-based information (Luning et al., 2011b).

To allow for measurement, indicators with corresponding stereotypical situation descriptions, in which companies have to position themselves, were defined in the diagnostic tool. For each context indicator three situational descriptions represent low (situation 1), moderate (situation 2), and high risk (situation 3) to decision-making during setting and operating the FSMS activities. For the context factors product and production characteristics, the low, moderate, and high risk situation represent, low, potential, and high chance of microbial or chemical contamination, growth, and or survival of pathogens, and other undesired microorganisms. The low, moderate, and high risk situations for organisational characteristics respectively correspond with supportive, constrained (restricted), and lack of administrative conditions for appropriate decision-making during set-up and operation of FSMS. For the chain characteristics, the descriptions for low, moderate, and high risk situation correspond to low, restricted, and high vulnerability to safety problems or dependability on other chain actors (Luning et al., 2011b; Kirezieva et al., 2013b).

For each control and assurance activity indicator three stereotypical descriptions represent basic (situation 2), average (situation 3), and advanced situation (situation 4) (Luning et al., 2008, 2009; Kirezieva et al., 2013a). Situation 1 is given when an activity is not possible in the given production circumstances, it is not applied, although it is possible, or no information is available. The basic situation (2) for control activities represents standard equipment, unknown capability, use of own experience/general knowledge, incomplete methods, restricted information, lack of critical analysis, and non-procedure-driven activities. For assurance, the basic (2) is typified by problem driven, only checking, scarcely reported, not independent positions. The average situation (3) for control activities represents activities that are based on the following aspects: expert (supplier) knowledge, use of (sector, governmental) guidelines, best practices, standardised, generic information and sometimes problems. The average situation for assurance activities represents active translation of requirements, additional analysis, regular reporting, and experts support. The advanced situation (4) for control and assurance activities represents the use of specific information, scientific knowledge, critical