



Review

Determinants for conducting food safety culture research



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ABSTRACT

Background: Foodborne outbreaks continue to occur regardless of existing food safety measures indicating the shortcomings of these measures to assure food safety. This has led to the recognition of food safety culture as a key contributory factor to the food safety performance of food establishments.

Scope and approach: The aim of this paper is to identify determinants for conducting food safety culture research, using the systems approach as the underlying philosophy to guide the structured reconsideration of national, organisational and safety culture literature, in view of food safety.

Key findings and conclusions: Food safety culture is complex and many interlinking factors are at play. The analysis of 'culture' literature showed that food safety culture research should acknowledge the impact of national culture, specify hierarchical level(s) (strategic, tactical, and operational), establish underlying mechanisms, and consider the company's food risks and context characteristics. Major elements to be considered in food safety culture research include organisational and administrative characteristics (i.e. food safety vision, communication, commitment, leadership, training), technical facilities/resources (i.e. food hygiene/safety tools, equipment, & facilities), employee characteristics (i.e. attitudes, knowledge, perceptions and risk awareness), group characteristics, crucial FSMS characteristics, and actual food safety performance. Methodological requirements for food safety culture research include use of the systems approach, measurable indicators, classification systems for differentiated assessment, and use of multiple methods to enhance research validity. The identified food safety culture research determinants provide an underpinned and transparent starting point to the common understanding and research of food safety culture.

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1. Introduction

Existing measures to secure flawless production of safe food products have proven to be insufficient by recurring foodborne outbreaks. This has resulted in a unanimous global objective and initiative within the food industry (Consumer Goods Forum (CGF) (2011), to adopt Food Safety Management Systems (FSMS), which have been extensively and markedly acknowledged as measures to assure food safety. Although the food industry, third party auditors and regulators have placed substantial effort on implementing (EC, 2004; FDA, 2011; CFIA, 2012; Powell et al., 2013; Luning et al., 2015; Global Food Safety Initiative (GFSI) (2016) and improving FSMS, incidences of foodborne illnesses still continue to be reported

(Rapid Alert System for Food & Feed, 2014; Crim et al., 2015).

The continued occurrence of foodborne illnesses coupled with inconsistencies in food safety indicates the shortcomings of current FSMS, raising questions on the adequacy of these systems to fully guarantee food safety as evidenced by recent papers (e.g. Kirezieva, Jaxsens, Uyttendaele, Van Boekel, & Luning, 2013a; Onjong, Wangoh, & Njage, 2014). The shortcomings could be because FSMS are elaborated differently in practice (FAO, 2007; Kirezieva et al., 2015b) and are not always well adapted to cope with the risks inherent to the companies' context characteristics (Luning et al., 2011b; Kirezieva et al., 2013b). The shortcomings could also be attributed to neglecting the impact of different food safety enforcement philosophies and practices, which differently influence the implementation of and adherence to public and private standards and guidelines by the organisations (Pederson & Hernández, 2014; Kirezieva et al., 2015a). Moreover, due to globalisation, multiple national cultures often exist in organisations,

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which increases the complexity of the organisation's culture and could have a significant bearing on the effectiveness of FSMS (Pederson & Hernández, 2014).

Above observations led to the supposition that food safety culture (FS-culture) might be contributing to food safety performance (Yiannas, 2009; Griffith, Livesey, & Clayton, 2010b; Ungku Fatimah, Arendt, & Strohhahn, 2014a). Evidence presented from a number of industries (e.g. Pennington, 2009; Powell, Jacob, & Chapman, 2011) suggested that an organisation's FS-culture is an "emerging risk factor" (Griffith et al., 2010b; CGF, 2011) when inadequate, and that there is a link between food safety and the prevailing FS-culture (Powell et al., 2011; Ijabadeniyi, 2013; Ungku Fatimah, Strohhahn, & Arendt, 2014b). The most cited cases of John Tudor & Sons, Maple Leaf Foods Inc. and the Peanut Corporation of America, in which foodborne illness outbreaks were attributed to the existence of a poor FS-culture stress the importance of FS-culture (e.g. Powell et al., 2011; Ijabadeniyi, 2013). To achieve a good food safety performance organisations therefore need to have a well-elaborated FSMS and a positive FS-culture in place (Powell et al., 2011; De Boeck, Jaxsens, Bollaerts, & Vlerick, 2015). Food industries have thus taken a profound interest in the concept of FS-culture to reduce the potential for food safety failures (Yiannas, 2009; Griffith, Livesey, & Clayton, 2010a; CGF, 2011). However, the FS-culture concept is still built on limited conceptual foundations and has been far less investigated compared to organisational and safety culture (Griffith et al., 2010a; Ungku Fatimah et al., 2014a).

Recent studies developed tools to measure FS-culture (e.g. Wright, Leach, & Palmer, 2012; Ungku Fatimah et al., 2014a; De Boeck et al., 2015), maturity models (Jespersen, Griffiths, Maclaurin, Chapman, & Wallace, 2016) and FS-culture concepts (Taylor, 2011). However, the studies used differing approaches and

concepts from various disciplines (e.g. Griffith et al., 2010b; Taylor, 2011; Jespersen et al., 2016). The aim of this study is therefore to identify the determinants for conducting food safety culture research, using the systems approach as the underlying philosophy to guide the structured reconsideration of national, organisational and safety culture literature as presented in Fig. 1 and sections 3–7. National culture literature is discussed first to set the context and elaborate its role in organisational, safety and FS-culture. Organisational culture literature is discussed to provide a deeper understanding of culture concepts. Safety culture literature is examined to provide insight in typical safety related issues in high risk fields. FSMS principles are described since they are crucial to the existence of a positive FS-culture (Powell et al., 2011). An evaluation of current FS-culture concepts provides an overview of the current understanding of FS-culture and its role in food safety performance. The paper concludes with research recommendations.

2. Approach and literature search strategy

2.1. Approach

The systems approach was used to position food safety culture (Fig. 1) and to guide the literature reconsideration in the different 'culture' research fields with the intention to identify the "determinants" (Table 4) for conducting FS-culture research. The systems approach is a structured way to study the interdependence and relationships of system components (Arnold & Wade, 2015), and recognises the synergy of elements in systems and the hierarchy of systems where subsystems participate in a bigger hierarchy of systems (Skyttner, 2005). The approach transcends and links numerous disciplines (Arnold & Wade, 2015). Fig. 1 presents the

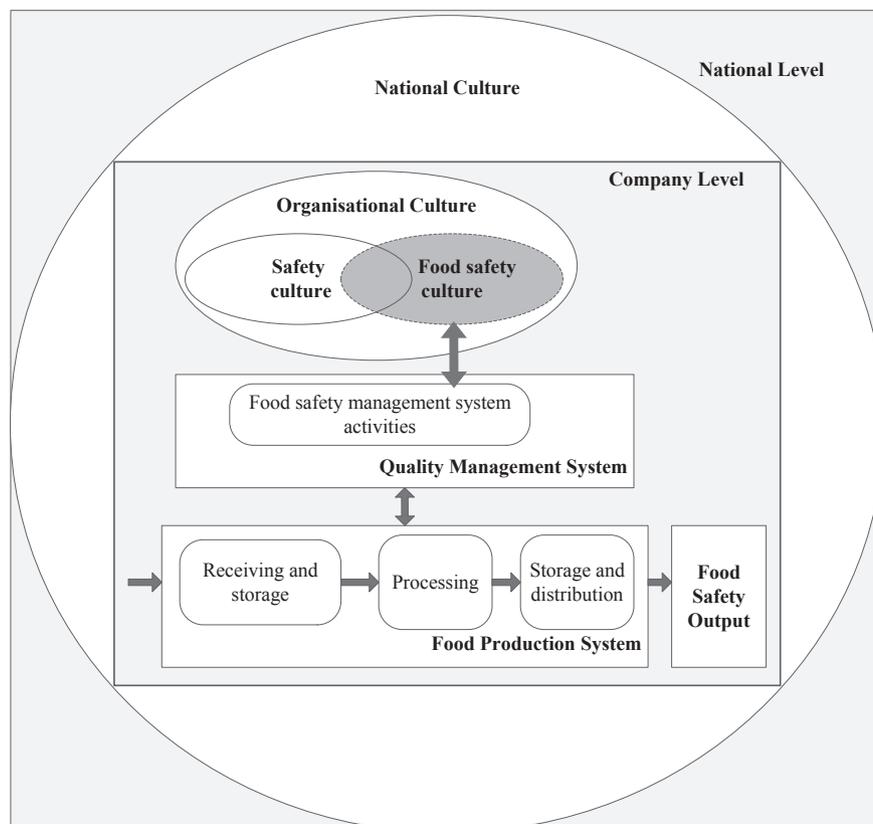


Fig. 1. Proposed positioning of food safety culture from a systems perspective (adapted from Luning & Marcellis, 2007) The arrows in the figure show the direction of influence. The figure shows that national culture is the overarching culture and that FS-culture can be analysed at both the company and national level.

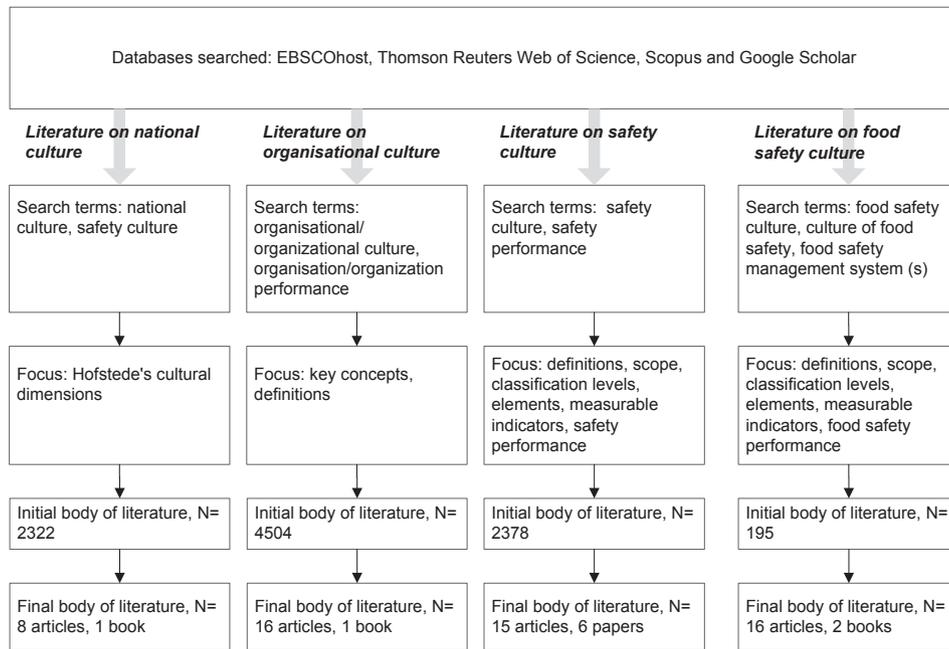


Fig. 2. Data collection process based on searches in EBSCOhost, Thomson Reuters Web of Science, Elsevier-Scopus and Google Scholar.

Table 1

Key aspects derived from national culture literature essential to establish food safety culture research determinants.

Definitions/Key aspects	References
<p>Definitions</p> <ul style="list-style-type: none"> •“Central organising principle of employees' understanding of work, their approach to it, and the way in which they expect to be treated” •“Profound beliefs, values and practices shared by the vast majority of people belonging to a certain nation and are reflected in the ways people behave at school, in the family, on the job, etc., and they are reinforced by national laws and governmental policies with respect to family life, business, etc.” •“Collective programming of the mind that distinguishes the members of one group or category of people from others” •“Collective mental programming specific to inhabitants of a particular geographic region” <p>Key aspects</p> <ul style="list-style-type: none"> • National culture shapes an organisation's culture. • Hofstede defined six cultural dimensions that differentiate national cultures: <ul style="list-style-type: none"> - power distance - individualism vs collectivism - masculinity vs femininity - uncertainty avoidance - long vs short term orientation - indulgence vs restraint • Cultural dimensions influence: <ul style="list-style-type: none"> - risk and safety perceptions - values and attitudes of personnel in organisations - management commitment and employees' participation - risk taking behaviour - safety management systems - organisational safety performance 	<ul style="list-style-type: none"> • Newman & Nollen, 1996 • Van Oudenhoven, 2001 • Hofstede et al., 2010 • Casey, Riseborough, & Krauss, 2015 • Newman & Nollen, 1996; Mearns & Yule, 2009; Seymen & Bolat, 2010; Starren, Hornikx, & Luijters, 2013; Casey et al., 2015 • Hofstede et al., 2010 • Newman & Nollen, 1996; Van Oudenhoven, 2001; Havold, 2007; Mearns & Yule, 2009; Seymen & Bolat, 2010; Lu, Lai, Lun, & Cheng, 2012; Starren et al., 2013; Casey et al., 2015

proposed positioning of FS-culture and the possible interplay between the broad national level (national culture), and the company level (organisational culture, FSMS, food production system and food safety output), in view of food safety. This positioning is derived from the food quality functions model, which identifies functions that contribute to the realisation of a desirable product output (Luning & Marcelis, 2007) and gives insight into components we propose to be interlinked when researching FS-culture and its relationship with food safety performance.

It is important to note that the figure is a simplified presentation

to enable conceptualisation of the proposed positioning of FS-culture. The reality is more complex as many organisations are multinational, are located in multiple geographical locations, and are confronted with different internal and external influences (e.g. operational characteristics, sector or market requirements).

2.2. Literature search strategy and results

A literature search was conducted in EBSCOhost and Thomson Reuters Web of Science platforms, Google Scholar and the Elsevier-

Scopus database using the following keywords: national culture, organisational culture, organisation performance, safety culture, safety performance, food safety culture, culture of food safety and food safety management system(s). The search strategy (Fig. 2) comprised the following inclusion criteria: (i) articles published in English, with preference for peer-reviewed articles, (ii) scope of the study, (iii) national, organisational and safety culture articles from 1990 onwards to obtain fairly recent articles and FS-culture articles spanning all years since there are limited studies. Titles and abstracts of retrieved articles were reviewed and screened for relevance based on whether articles covered the research objective and the inclusion criteria. If the abstracts provided insufficient information, the whole article was scanned and in some instances, cross-referenced articles were manually searched for. In other instances, selected keywords yielded broader, irrelevant publications, for example, for FS-culture, articles only focusing on microbiology were obtained. Upon careful consideration of the keywords and implications thereof, quotation marks were used to search for phrases and Boolean operators AND, OR used to obtain pertinent information. Full versions of the selected articles were screened to obtain useful articles based on the following criteria: national culture articles had to focus on Hofstede's cultural dimensions in organisations, organisational, safety and food safety culture on definitions, scope, classification levels, elements, and measurable indicators. The search results are shown in Fig. 2 and the findings are presented in sections 3–7.

3. National culture and its relationship with organisational culture

In general, culture is defined for a group of people and it is what differentiates one group from another (Ogbonna, 1992). At national level, culture is that “which distinguishes members of one group (nation/society) from those of another” (Hofstede, Hofstede, & Minkov, 2010). Table 1 shows key national culture definitions and key aspects derived from national culture studies that could be essential in FS-culture research.

Existing studies acknowledge national culture as part of an organisation's context that influences how organisations operate and perform (Fig. 1) (Lok & Crawford, 2004; Havold, 2007; Burke, Chan-Serafin, Salvador, Smith, & Sarpy, 2008; Mearns & Yule, 2009). This is because individuals bring values adopted from their national cultures to the workplace, which through socialisation (Mearns & Yule, 2009) influence the workplace culture (Newman & Nollen, 1996; Havold, 2007; Burke et al., 2008; Mearns & Yule, 2009; Seymen & Bolat, 2010). The extent to which individual values are influenced by the national culture and how well these values fit with the workplace culture could pose differences on the performance of organisations in different countries (Lok & Crawford, 2004; Newman & Nollen, 1996).

To assess national differences in values, Hofstede defined six cultural dimensions (Table 1) (Hofstede et al., 2010). The first dimension, *power distance* distinguishes between high power distance cultures where decision-making is centralised and employees are barely involved in decision making (are expected to do “what the boss says should be done”) (Nakata & Sivakumar, 1996) and low power distance cultures where decision-making is decentralised and employees expect to be consulted (Hofstede et al., 2010). The second dimension focuses on *individualism vs collectivism* and distinguishes individualistic cultures where people are expected to look after their self-interests and achievement is based on personal merit rather than on group effort, and collectivistic cultures where group interests prevail over individuals' (Hofstede et al., 2010). The third dimension is *masculinity vs femininity* where masculine cultures have people that are assertive and

are unlikely to assist others unless they get credit, whereas in feminine cultures people assist others and value relationships and other people over material success (Hofstede et al., 2010). For *uncertainty avoidance*, individuals in a culture high in uncertainty avoidance are expressive and avoid ambiguous situations, whereas individuals in low uncertainty avoidance cultures are less expressive and feel secure (Hofstede et al., 2010). The fifth dimension is *long vs short-term orientation* where long-term oriented cultures are typified by patience, long-term goals and future rewards, and short-term oriented cultures focus on prevailing issues (Hofstede et al., 2010). The sixth dimension is *indulgence versus restraint* where indulgent cultures are typified by free gratification, whereas restraint cultures are typified by suppressed gratification (self-control) regulated by social norms (Hofstede et al., 2010). These dimensions have been extensively used as they are comprehensive, relevant, acceptable and convenient when assessing the role of national culture in organisational/safety culture and safety performance (e.g. Mearns & Yule, 2009; Newman & Nollen, 1996; Seymen & Bolat, 2010; Van Oudenhoven, 2001).

From a food safety perspective, Wallace (2009) and Taylor (2011) proposed that the dimensions could potentially influence the effectiveness of FSMS and the organisation's FS-culture. For example, both studies suggested that in individualistic cultures, personnel prefer individual recognition for their effort and in collectivistic cultures, personnel strive to achieve food safety goals by working together as a team. Wallace (2009) hypothesised that personnel in feminine cultures are likely to assist each other to achieve food safety requirements and in masculine cultures, personnel focus on getting the job done. Furthermore, in low uncertainty avoidance cultures, personnel are “more receptive of new ideas and will likely take on new responsibilities” and organisations in long-term oriented cultures focus on having well established and comprehensive food safety policies/systems (Wallace, 2009). In short-term oriented cultures organisations may provide temporary measures to address food safety concerns (Taylor, 2011).

In addition to the cultural dimensions, national cultural differences are observed in a country's food safety governance philosophy, strategies and practices (e.g. legislation, public and private standards, and enforcement practices) (Kirezieva et al., 2015a). Food safety governance is aimed at assuring organisation's compliance to food regulations and standards and influences the organisation's FSMS (Rouvière & Caswell, 2012; Kirezieva et al., 2015a) and FS-culture depending on the positioning of the country on the cultural dimensions scores. For example, some countries have enforcement practices that are reactive (punitive) and others have proactive approaches (preventive). Some countries have legislation in place (e.g. CFIA, 2012; EC, 2004; FDA, 2011) whilst others do not have/outdated legislation (FAO, 2007; Kussaga, Jacxsens, Tiisekwa, & Luning, 2014). Countries can have different enforcement strategies, which can vary from self-regulation to direct command and regulation from the government and enforcement philosophies that are either systematic or facilitative (Kirezieva et al., 2015a). This observation could be a result of and explain differences in national cultures towards food safety.

Moreover, with globalisation, companies are increasingly becoming multinational thus increasing the complexity of an organisation's culture (Seymen & Bolat, 2010; Van Oudenhoven, 2001). These companies are confronted with multiple national cultures in their daily operations. An understanding of the culture where the company operates and the differences in culture of the members in the organisation is required in order to apply the appropriate research approach to the individuals in the firm and to the cultural context the organisation operates in (Ghemawat & Reiche, 2011). In this paper, we point out the need to take into

Table 2

Key aspects derived from organisational culture literature essential to establish food safety culture research determinants.

Definitions/Key aspects	References
Definitions <ul style="list-style-type: none"> • “An outcome of how people relate and interact with one another” • “The sum total of the values, beliefs, and ideologies of the people who make up an organisation” • “Product of both group dynamics and internalised norms” • “The result of the interaction between the individual and organisational processes” • “An emergent property of that organisation’s constituent parts” • “The emergent result of the continuing negotiations about values, meanings and properties between the members of that organisation and its environment” • “Collective programming of the mind that distinguishes the members of one organisation from another” • “Expression of the values or social ideals and shared beliefs, which are manifest in the specialised language unique to each organisation and which are a product of the history and operational experience within the organisation” • “Deeply seated (often subconscious) values and beliefs shared by personnel in an organisation” • “Shared perceptions of organisational work practices within organisational units that may differ from other organisational units” 	<ul style="list-style-type: none"> • Goffee & Jones, 1996 • Thompson et al., 1996 • Bloor, 1999 • De Witte & van Muijen, 1999 • Davies et al., 2000 • Seel, 2000 • Hofstede, 2001 • Maull et al., 2001 • Martins & Terblanche, 2003 • Van den Berg & Wilderom, 2004
Key aspects <p>Organisational culture</p> <ul style="list-style-type: none"> • is developed through socialisation • includes multiple levels: <ul style="list-style-type: none"> - visible symbols and artefacts - underlying assumptions and values • can have multiple subcultures • evolves over time • operates at different hierarchical levels (e.g. senior management, middle management, operational level) • contributes to an organisation’s overall performance • influences employee behaviour • encompasses: <ul style="list-style-type: none"> - shared values, attitudes, knowledge and perceptions - vision, leadership and management style, and communication system - availability of facilities and resources - organisation’s context factors (e.g. national culture) • needs both top-down and bottom-up approaches to change • necessitates a system approach and use of a triangulated methodology 	<ul style="list-style-type: none"> • Goffee & Jones, 1996; Bloor, 1999; Balmer & Wilson, 2001; Martins & Terblanche, 2003; Clark, 2002; Alvesson, 2012 • Bloor, 1999; Davies et al., 2000; Balmer & Wilson, 2001; Martins & Terblanche, 2003; Alvesson, 2012 • Goffee & Jones, 1996; Thompson et al., 1996; Bloor, 1999; Davies et al., 2000; Sadri & Lees, 2001; Clark, 2002 • Bloor, 1999; De Witte & van Muijen, 1999; Sadri & Lees, 2001; Balmer & Wilson, 2001 • Goffee & Jones, 1996 • Sadri & Lees, 2001; Martins & Terblanche, 2003; Alvesson, 2012 • Line, 1999; Maull et al., 2001; Martins & Terblanche, 2003; Van den Berg & Wilderom, 2004 - Thompson et al., 1996; Hofstede, 1998; Bloor, 1999; Parker & Bradley, 2000; Maull et al., 2001; Sadri & Lees, 2001; Martins & Terblanche, 2003; Van den Berg & Wilderom, 2004; Alvesson, 2012 - De Witte & van Muijen, 1999; Bloor, 1999; Sadri & Lees, 2001; Balmer & Wilson, 2001; Martins & Terblanche, 2003 - Martins & Terblanche, 2003 - Thompson et al., 1996; De Witte & van Muijen, 1999; Cooper, 2000; Martins & Terblanche, 2003; Van den Berg & Wilderom, 2004 • De Witte & van Muijen, 1999 • Hofstede, 1998; Bloor, 1999; Martins & Terblanche, 2003

account national cultural differences (cultural dimensions and food safety governance) when conducting organisational culture/FS-culture research. Understanding these cultural differences enable the right research approach to be taken because an approach which is effective in one culture might not be effective in another culture due to differences in risk and safety perceptions, management/leadership style, values and attitudes, to mention a few (Ghemawat & Reiche, 2011).

4. Key aspects of organisational culture useful in FS-culture research

In organisations, culture is that which distinguishes organisations and shapes them into what they are (Ashkanasy, Wilderom, & Peterson, 2000). Schein (2010), one of the principal experts in organisational culture (e.g. Denison, 1997) defines organisational culture as “a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way you perceive, think, and feel in relation to those problems”. Schein’s

work has been commonly used as a theoretical foundation to characterise organisational culture in various researches (e.g. Balmer & Wilson, 2001; Bloor, 1999; Martins & Terblanche, 2003).

As expressed in Fig. 1, organisational culture is shaped by national culture (Seymen & Bolat, 2010), thus it differs within an organisation (multinationals), within a country and from country to country (Van Oudenhoven, 2001). Table 2 shows key organisational culture definitions and aspects, which permeate organisational culture literature that would be useful in FS-culture research. When describing organisational culture, two distinct approaches (functionalist and interpretive) are predominantly used. The functionalist approach assumes organisational culture as the ideal an organisation must achieve and describes what an organisation “has” (tangible) (e.g. policies, procedures and structures). The interpretive approach assumes organisational culture as an emergent social entity and describes what an organisation “is” (intangible) (e.g. shared beliefs, assumptions, values, and attitudes) (Davies, Nutley, & Mannion, 2000; Glendon & Stanton, 2000). Most studies (Table 2) implicitly imply what an organisation is. To understand organisational culture both approaches should be synthesised as what an organisation “is” assists in understanding the

Table 3
Key aspects derived from safety culture literature essential to establish food safety culture research determinants.

Field	Definitions/key aspects	References
^a Definitions	<ul style="list-style-type: none"> • “That assembly of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance” • “Enduring characteristic of an organisation reflected in its consistent way of dealing with critical safety issues” • “Set of values, perceptions, attitudes and patterns of behaviour with regard to safety shared by members of the organisation; as well as a set of policies, practices and procedures relating to the reduction of employees’ exposure to occupational risks, implemented at every level of the organisation, and reflecting a high level of concern and commitment to the prevention of accidents and illnesses” • “A specific aspect of organisational culture regarding the organisation’s shared beliefs, values, and attitudes that contribute to ensuring safe operations” 	<ul style="list-style-type: none"> • INSAG., 1991 • Wiegmann et al., 2004 • Fernández-Muñiz et al., 2007 • Morrow et al., 2014
Key aspects	<p>Safety culture</p> <ul style="list-style-type: none"> • is a subcomponent of organisational culture • should be top priority and the dominating culture in high risk industries • evolves gradually • operates at different hierarchical levels (e.g. strategic/corporate, tactical/middle management, operational) • is influenced by the organisation’s context (e.g. national culture, operational characteristics) • can be affected by demographic variables (e.g. educational background, employment status) of personnel in the organisation • influences safety behaviour and the organisation’s safety performance • is reflected in the organisation’s safety management systems • is composed of several interacting elements: <ul style="list-style-type: none"> - human/personal characteristics such as risk awareness/perception, commitment to safety, personnel involvement/participation, safety values, safety attitudes and safety behaviour - organisation’s characteristics such as safety vision, policy and goals, leadership/management style, communication style on safety issues, shared responsibility/accountability, safety procedures and safety facilities/resources, work pressure, safety training, incentives • requires the following methodological requirements: <ul style="list-style-type: none"> - methodological triangulation - indicators to assess the degree/extent to which a certain measure reflects safety culture - scoring/classification system to assess existing safety culture 	<ul style="list-style-type: none"> • Glendon & Stanton, 2000; Cooper, 2000; HSE., 2005; Wiegmann et al., 2004; Guldenmund, 2010; Fernández-Muñiz et al., 2007 • INSAG., 1991; HSE., 1999; Fleming & Lardner, 1999; Cooper, 2000; Hudson, 2001; Clark, 2002; Wiegmann et al., 2004 • Reason, 1998; Cooper, 2000; Hudson, 2001; Hudson, 2007 • INSAG., 1991; Cooper, 2000; Glendon & Stanton, 2000; Clark, 2002; Guldenmund, 2010 • Cooper, 2000; Clark, 2002; Clarke, 2003; Wiegmann et al., 2004; Hudson, 2007; Guldenmund, 2007 • Fleming & Lardner, 1999; Clarke, 2003; Morrow et al., 2014 • Reason, 1998; Fleming & Lardner, 1999; Clark, 2002; Clarke, 2003; Wiegmann et al., 2004; HSE., 2005; Hudson, 2007; Fernández-Muñiz et al., 2007; Guldenmund, 2010; Foster & Hout, 2013; Morrow et al., 2014 • Cooper, 2000; Fleming, 2000; Clarke, 2003; HSE., 2005; Fernández-Muñiz et al., 2007; Guldenmund, 2007; Foster & Hout, 2013 - INSAG., 1991; Fleming & Lardner, 1999; HSE., 1999; Fleming, 2000; Hudson, 2001; Cooper, 2002; Clark, 2002; Clarke, 2003; Wiegmann et al., 2004; HSE., 2005; Singla et al., 2006; Guldenmund, 2007; Fernández-Muñiz et al., 2007; Foster & Hout, 2013; Morrow et al., 2014 - INSAG., 1991; Reason, 1998; Fleming & Lardner, 1999; HSE., 1999; Glendon & Stanton, 2000; Cooper, 2000; Fleming, 2000; Hudson, 2001; Clark, 2002; Clarke, 2003; Wiegmann et al., 2004; Singla et al., 2006; Parker et al., 2006; Hudson, 2007; Fernández-Muñiz et al., 2007; Guldenmund, 2007; Foster & Hout, 2013; Morrow et al., 2014 - Fleming & Lardner, 1999; Cooper, 2000; Wiegmann et al., 2004; HSE., 2005 - HSE., 1999; Wiegmann et al., 2004; Singla et al., 2006; Fernández-Muñiz et al., 2007; Morrow et al., 2014 - Westrum, 1993; Fleming, 2000; Cooper, 2002; Parker et al., 2006; Hudson, 2007; Foster & Hout, 2013

^a For exhaustive list of definitions refer to reviews such as done by [Wiegmann et al., 2004](#).

organisation and helps to provide appropriate and specific interventions in positively changing what an organisation “has” ([De Witte & van Muijen, 1999](#); [Davies et al., 2000](#); [Mauil, Brown, & Cliffe, 2001](#)). Moreover, both approaches help in understanding organisational culture and its subcomponents.

When describing an organisation’s culture, key elements found in literature are values, assumptions, beliefs, artefacts, and symbols. Theoretically, values, assumptions, and beliefs, assist in understanding an organisation’s culture but because they are intangible, they are difficult to assess empirically and are of little value when evaluating an organisation’s prevailing culture. However, these values, assumptions and beliefs can be indirectly deciphered through tangible and observable manifestations (artefacts and symbols) such as layout of an organisation and protective clothing ([Bloor, 1999](#); [Martins & Terblanche, 2003](#); [Schein, 2010](#)). An

example is that of values, which are presumed to be reflected in work practices ([Hofstede, 2001](#); [Van den Berg & Wilderom, 2004](#)). To measure them and derive meaning, the values should be operationalised and work practices (perceived and actual) should be evaluated as they are more demonstrable ([Van den Berg & Wilderom, 2004](#)) and provide insight into the underlying values to execution of work activities in a certain manner.

Organisational culture studies acknowledge the existence of different subcultures between and within organisations (e.g. [Thompson, Stradling, Murphy, & O’neill, 1996](#); [Davies et al., 2000](#)). However, a dominant culture may exist and how this culture is expressed varies within different hierarchical levels, different departments and with cultural differences among employees ([Thompson et al., 1996](#); [Bloor, 1999](#); [Cooper, 2000](#); [Sadri & Lees, 2001](#)). One department may value production over safety, profit

over safety and vice versa. Likewise, senior management could have different priorities and cultures when compared to middle management and the operational level (Goffee & Jones, 1996). The dominant culture should therefore be evident, so that employees identify with it, accept and embrace it (Sadri & Lees, 2001). This non-homogeneity and complexity of an organisation's culture should be acknowledged. As such, a system approach is required to get an understanding of the prevailing culture. Moreover, based on organisational literature analysed, there is need to identify crucial elements, to use a triangulated methodology, to acknowledge the organisation's context, and to establish the mechanisms with which an organisation's culture influences personnel behaviour and the organisation's performance when evaluating an organisation's culture, and for meaningful FS-culture research to be conducted.

5. Safety culture and its relationship with safety performance

As highlighted in Fig. 1, safety culture is a subcomponent of organisational culture, which focuses on and influences the safety performance of an organisation (Cooper, 2000). It refers to individuals', organisations' (characteristics of an organisation's arrangement e.g. procedures aimed at supporting personnel to appropriately execute work tasks) and work characteristics that influence safety (Cooper, 2002; Fernández-Muñiz, Montes-Peón, & Vázquez-Ordás, 2007; Luning & Marcelis, 2009) and provides “contextual cues” which affect the way employees behave (Morrow, Koves, & Barnes, 2014). These “contextual” cues could be whether; management “walks the talk”, a positive culture exists and safety is prioritised (Morrow et al., 2014).

Table 3 presents key definitions and key aspects in safety culture research that could be essential in FS-culture research. Safety culture is commonly defined as a social phenomenon (Clarke, 2003; Glendon & Stanton, 2000), which focuses on human factors (Fleming & Lardner, 1999; Guldenmund, 2010; Morrow et al., 2014) and technical aspects are regarded separately from safety culture (Guldenmund, 2010). However, a system approach (Skyttner, 2005), which considers human factors, technical aspects (INSAG, 1991; Reason, 1998; Cooper, 2000; Fernández-Muñiz et al., 2007), the processing operations (as shown in Fig. 1), and the context within which an organisation operates should be adopted.

Various studies developed safety culture **classification levels**, which range from simple (e.g. good/poor, negative/positive) (HSE, 1999; Wiegmann, Zhang, Thaden, Sharma, & Gibbons, 2004) to comprehensive (e.g. a five stage classification: pathological, reactive, calculative, proactive and generative) safety culture (Parker, Lawrie, & Hudson, 2006; Hudson, 2007). The levels enable organisations to evaluate their prevailing safety culture and to implement appropriate interventions (Fleming, 2000; Foster & Houl, 2013). However, different parts of an organisation could possibly have different levels of culture at the same time (Fleming & Lardner, 1999), which pose hurdles if an overall safety culture is to be established and if generic interventions are to be applied.

Understanding the crucial safety culture **elements** and defining **measurable indicators** is necessary to evaluate the prevailing safety culture. Common safety culture elements have been identified despite variations in wording. However, large variations are found in existing indicators (e.g. Singla, Kitch, Weissman, & Campbell, 2006; Wiegmann et al., 2004) posing challenges in synthesising indicators most suitable to measure safety culture. Moreover, most indicators do not clearly define what is being measured and do not clearly show how their assessment can depict safety culture (Fleming & Lardner, 1999) creating the need to formulate indicators, which give a true reflection of the prevailing safety culture.

Ultimately, the goal for assessing safety culture is to give an indication of and to improve the organisation's safety performance (Morrow et al., 2014). Nevertheless, mixed reactions on the link between safety culture and safety performance exist (Mearns & Flin, 1999; Morrow et al., 2014). However, Morrow, et al. (2014), found a statistically significant correlation between safety culture, actual and self-reported behaviours and an organisation's safety performance, when measured concurrently and argued that clear-cut safety performance indicators are useful to measure safety performance. Various authors also proposed that a positive safety culture results in better employee and organisational performance (Fleming, 2000; Wiegmann et al., 2004; Parker et al., 2006; Fernández-Muñiz et al., 2007). It is therefore imperative to investigate the correlation of an organisation's safety culture with safety performance. However, this correlation is dependent upon how safety performance is defined, how and when safety culture and safety performance are measured, aspects of safety culture measured (Morrow et al., 2014), and the organisation's context and safety management system (Cooper, 2000; HSE, 2005). As such, the mechanisms with which safety culture relates to safety performance should be clear if a relationship between safety culture and safety performance is to be inferred. Since safety culture has been well investigated in other high risk fields such as occupational health and safety (e.g. HSE, 1999; Halligan & Zecevic, 2011) and used as a basis for studying FS-culture (Griffith et al., 2010b) key safety culture aspects (Table 3) are highly useful to establish determinants for FS-culture research.

6. Food safety management systems and food safety culture

Food safety management systems are defined in this study as “that part of a company's quality management system that is specifically aimed at controlling and ensuring that food safety requirements are met” (Luning & Marcelis, 2009; Jaxsens et al., 2010). Such systems are based on multiple public and private standards and are an important tool in realising safe and reliable food products. A FSMS can range from basic to comprehensive (FAO, 2007; Luning, Bango, Kussaga, Rovira, & Marcelis, 2008; Luning et al., 2009), and from “end-of-pipeline” (reactive) approaches (as is evident in many transitioning countries) to “prevention-oriented” (proactive) approaches as is within the EU (Luning et al., 2015; Pederson & Hernández, 2014) and Canada (e.g. the food safety enhancement program) (CFIA, 2014). For instance, food safety concerns in some transitioning countries are insufficiently addressed and enforced, multiple food safety control systems exist, and proper scientific risk assessments are lacking (e.g. FAO, 2007; Kussaga et al., 2014). In comparison, FSMS within the EU, Canada and the USA, are comprehensive and are a legal requirement (CFIA, 2012; EC, 2004; FDA, 2011).

At organisational level, a challenge faced by companies is on translating requirements of the public/private standards, and tailoring them for the company's specific context and production circumstances to assure food safety (FAO, 2007; Luning et al., 2011b; Sampers, Toyofuku, Luning, Uyttendaele, & Jaxsens, 2012; Kirezieva et al., 2013b). FSMS are therefore elaborated differently within each organisation leaving room for “self-regulation” (Sampers et al., 2012; Kirezieva et al., 2015a). Moreover, the FSMS are enforced differently due to the different requirements of the public and private certification schemes. How the FSMS are elaborated and enforced results in variable performance of the implemented system (Sampers et al., 2012; Kirezieva et al., 2015a).

However, De Boeck et al. (2015), emphasised that a “well elaborated and fit for purpose FSMS does not always guarantee the highest level of food safety and a stable food safety output”. This is because other FS-culture factors (e.g. enabling conditions such as

technological advancement, legal frameworks), actual employee behaviour, and other technological and managerial conditions within the establishment could influence the system safety output as well (FAO, 2007; Sawe, Onyango, & Njage, 2014). Furthermore, the character or status of an implemented FSMS is rooted in the prevailing FS-culture and a good FS-culture is key to the effectiveness of FSMS (Hayburn, 2014; Powell et al., 2011). The actual effectiveness is reflected in the ultimate system output i.e. safe and reliable foods (Sampers et al., 2010; Luning et al., 2011a). As such FS-culture research should consider FSMS characteristics and the concurrent analysis of food safety performance to understand the role of FS-culture on the system output.

7. Current understanding of food safety culture

FS-culture is a subcomponent of organisational culture that focuses on food safety and should be the dominating culture in food establishments (Yiannas, 2009; Griffith et al., 2010b; Powell et al., 2011; Ungku Fatimah et al., 2014b). Although no common definition has been established, Griffith et al. (2010b) defines FS-culture as the “aggregation of the prevailing constant learned shared attitudes, values and beliefs contributing to the hygiene behaviours used within a particular food handling environment”. Various studies view FS-culture as how a group or an organisation handles food safety issues and considers the system as a whole (Yiannas, 2009; Powell et al., 2011). Studies therefore analyse behaviours that are demonstrated/practiced by employees (Nickell & Hinsz, 2011; Wright et al., 2012; De Boeck, Jaccsens, Bollaerts, Uyttendaele, & Vlerick, 2016), individual characteristics (e.g. values, attitudes, perceptions) (Griffith et al., 2010b; Ungku Fatimah et al., 2014b; Taylor, Garat, Simreen, & Sarieddine, 2015), group characteristics (alignment in values, shared perceptions) (Powell et al., 2011) and the system output (e.g. De Boeck et al., 2015; De Boeck et al., 2016).

FS-culture studies identified common elements, which permeate FS-culture research. These elements include leadership, commitment, knowledge, training/competence, risk awareness, perceptions, employee confidence, management systems, employee involvement, accountability, communication, work pressure, environmental factors (e.g. infrastructure, equipment, tools), values and behaviour (e.g. Yiannas, 2009; Ball, Wilcock, & Colwell, 2010; Ungku Fatimah et al., 2014b; De Boeck et al., 2015). These elements are interdependent (Taylor, 2011; Wright et al., 2012). A few studies (e.g. Wright et al., 2012; De Boeck et al., 2015) established indicators, which aim to outline the extent/degree to which a given element reflects FS-culture. Limited research suggested classification levels, which range from a negative to a positive FS-culture and indicate the level of maturity of the FS-culture (e.g. Wright et al., 2012). However, no research has evaluated whether FS-culture evolves through these levels. Jespersen et al. (2016) further developed a behaviour-based food safety maturity model, which measures the status of an organisation's FS-culture, and according to the authors, needs further validation.

In overall, FS-culture studies acknowledge the use of different disciplines to study FS-culture (e.g. Taylor, 2011; Jespersen et al., 2016). An analysis of existing FS-culture literature revealed the need to define key determinants required for conducting FS-culture research, if FS-culture research is to realise its potential.

8. Overall discussion

Analysis of existing literature revealed that FS-culture research is still fragmented and unsystematic and that there is need to establish a systematic way to conduct FS-culture research. By synthesising the findings from the literature reconsideration, we

proposed FS-culture research determinants, listed in Table 4, with the effort to provide a foundation upon which FS-culture research can be built.

Current FS-culture research does not yet consider the national culture. FS-culture research therefore needs to investigate the influence of national culture on the prevailing FS-culture and should establish relevant national culture elements and their mechanisms of influence on the prevailing FS-culture. Moreover, to be able to generalise on what constitutes a good FS-culture, there is need to address the fit of the FS-culture research strategies within different national cultures, since different cultures require different approaches, and different research tools are effective in different cultures/environments. We acknowledge that national culture is not the only context factor and that other external drivers such as sector values, customer/market requirements, economic climate and shareholder risks, influence an organisation's FS-culture, and research should be done on how these drivers affect an organisation's FS-culture.

Furthermore, FS-culture research needs to recognise and be specific to the hierarchical level(s) (e.g. the strategic, tactical and operational) being evaluated because personnel working at these levels are confronted with different food safety/hygiene tasks, responsibilities and decisions. For example, top management is responsible for defining the food safety vision, policy, and strategies and they decide on resource investments; quality assurance managers are responsible for designing, implementing and maintaining the FSMS; the shop floor, operators need to comply with food safety and hygiene procedures and rules. Actual decisions and behaviours at all levels contribute differently to actual product safety. Moreover, the evaluation (what and how should be measured?) of FS-culture and type of interventions that are applied will differ with the hierarchical level.

As emphasised in safety culture studies (e.g. Halligan & Zecevic, 2011), FS-culture research should consider the company's food production context (also shown in Fig. 1). This is because different products put different demands on an organisation's FS-culture depending on the production processes, company environment characteristics, and vulnerability of products to contamination. As such, FS-culture research should be adapted to the organisation's food risks and context characteristics rather than making sweeping generalisations across all food establishments. Although current FS-culture research addresses multiple FS-culture elements and acknowledges the interdependence of the elements, the possible causal relationships between the elements are not yet explicit. Moreover, the mechanisms with which FS-culture influences personnel behaviour and food safety performance, and whether and how FSMS reflect/influence the FS-culture of the organisation is not yet clear. In the available literature, considerable variance was found on current indicators. The indicators should clearly show how they depict an organisation's FS-culture. Moreover, the indicators should focus on the crucial aspects in the given context and must be evaluated (validated) on how well they give a measure of the prevailing FS-culture and food safety performance of the organisation, in view of the organisational hierarchical level being evaluated. Griffith (2013) suggested that indicators should be formulated in a way that they give a measure of how much food safety is prioritised, embedded, practiced, and shared among the staff.

This reconsideration revealed that culture evolves over time; is time-dependent. For this reason, FS-culture research should analyse the prevailing FS-culture, and this should be measured periodically. Research methodologies should therefore enable a structured analysis and a differentiated assessment of the prevailing FS-culture. As such, classification levels should be included in FS-culture research to enable a proper evaluation of

Table 4

Proposed determinants of food safety culture research.

Proposed determinants to be taken into account in FS-culture research
<p>FS-culture research should:</p> <ul style="list-style-type: none"> • acknowledge the national culture that an organisation operates in and the national cultures of the members in the organisations • acknowledge that FS-culture influences food handler behaviour, which in turn influences the food safety performance of the organisation; focus on understanding the mechanisms • recognise that FS-culture assessments should be adapted to the company's food risks and context • recognise the hierarchical levels and FS-culture scopes that exist in organisations; food safety tasks and responsibilities differ at strategic, tactical and operational level • include crucial elements in FS-culture assessments: <ul style="list-style-type: none"> - employee characteristics, which include attitudes, perceptions, knowledge, risk awareness - group characteristics, which include analysis of shared perceptions - organisational and administrative characteristics, which include food safety vision, leadership, commitment, communication style, food safety/hygiene procedures, training, work pressure - technical/technological facilities/resources, which include personal hygiene facilities, zoning, food safety and hygiene tools, equipment and facilities, sanitation, and maintenance - food safety management system characteristics; design and assurance of crucial controls • methodologically assess FS-culture by: <ul style="list-style-type: none"> - using a systems approach; acknowledging the various sub-systems and the interlinks - using indicators that focus on crucial aspects to be measured - developing a classification system to enable differentiated assessment of the prevailing FS-culture - using multiple methods (triangulated methodology) to enhance assessment validity • measure the prevailing FS-culture since FS-culture evolves over time. • measure FS-culture elements and actual food safety performance concurrently • include evaluation of demographic variables

the prevailing FS-culture and to establish specific interventions/roadmaps to improve an organisation's FS-culture. The levels should specify the scope, and the organisation's hierarchical level being evaluated. Furthermore, demographic variables (e.g. age, experience, qualifications) should be included in FS-culture research as they are part of the organisation's context that shapes an organisation's FS-culture. The literature analysed in this paper converges to the same message that a systems approach is necessary and should be adopted as it offers a holistic approach to FS-culture research and to the evaluation of the interaction, interdependence and interrelationships between FS-culture research elements.

9. Conclusion and research recommendations

This study derived key aspects from national, organisational and safety culture, and FSMS needed to identify the “determinants” for conducting FS-culture (Fig. 1) research by drawing lessons from existing literature (synthesised in Tables 1–3). Against the background of Fig. 1, the study discussed the positioning of FS-culture within different disciplines resulting in the establishment of FS-culture research determinants from a broad, overall viewpoint. Major elements to consider in FS-culture research include organisational and administrative characteristics, technical facilities/resources, employee characteristics, group characteristics, crucial FSMS characteristics, and actual food safety performance (Table 4), with a focus on understanding the underlying relationships and mechanisms. Furthermore, the impact of national culture, the influence of a company's food risks and other context characteristics, and the hierarchical level(s) should be considered. Methodological requirements for FS-culture research should encompass the use of a systems approach, definition of measurable indicators, development of classification systems, and the use of a triangulated methodology. Further research will focus on developing a comprehensive diagnostic tool, including indicators and assessment grids to enable differentiated assessment of the prevailing FS-culture. We acknowledge that the list of FS-culture research determinants is not complete and further research could build up on these determinants. Further research also needs to identify internal and external drivers/triggers, which influence the prevailing FS-culture. However, the complexity of FS-culture and its context

specificity is acknowledged and makes it a challenging task to capture pertinent aspects with a “manageable assessment instrument” (Ungku Fatimah et al., 2014a). Moreover, reaching a consensus on the definition, elements, indicators, classifications, methodology and on what implies FS-culture is still a challenge. However, having the established FS-culture research determinants could bring clarity in FS-culture research and provide a useful starting point to the common understanding and research of FS-culture.

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References

- Alvesson, M. (2012). In *Understanding organizational culture* (2nd ed., p. 1). London: Sage.
- Arnold, R. D., & Wade, J. P. (2015). A definition of systems thinking: A systems approach. *Procedia Computer Science*, 44, 669–678.
- Ashkanasy, N. M., Wilderom, C. P. M., & Peterson, M. F. (2000). *Handbook of organizational culture and climate*. SAGE Publications.
- Ball, B., Wilcock, A., & Colwell, S. R. (2010). Tool for measuring food safety climate. *Journal of Food Protection Supplement*, 73, 84–85.
- Balmer, J. M., & Wilson, A. M. (2001). Understanding organisational culture and the implications for corporate marketing. *European Journal of Marketing*, 35, 353–367.
- Bloor, G. (1999). Organisational culture, organisational learning and total quality management: A literature review and synthesis. *Australian Health Review*, 22, 162–179.
- Burke, M. J., Chan-Serafin, S., Salvador, R., Smith, A., & Sarpy, S. A. (2008). The role of national culture and organizational climate in safety training effectiveness. *European Journal of Work and Organizational Psychology*, 17, 133–152.
- Casey, T. W., Riseborough, K. M., & Krauss, A. D. (2015). Do you see what I see? effects of national culture on employees' safety-related perceptions and behavior. *Accident Analysis & Prevention*, 78, 173–184.
- CFIA. (2012). *Safe food for Canadians act* (S.C. 2012, c. 24).
- CFIA. (2014). In *Food safety enhancement program manual*.
- Clark, G. (2002). Organisational culture and safety: An interdependent relationship. *Australian Health Review*, 25, 181–189.
- Clarke, S. (2003). The contemporary workforce: Implications for organisational safety culture. *Personnel Review*, 32, 40–57.
- Consumer Goods Forum (CGF). (2011). *Creating a global food safety culture*. In *Global food safety conference*. London: United Kingdom.
- Cooper, M. D. (2000). Towards a model of safety culture. *Safety Science*, 36, 111–136.
- Cooper, D. (2002). Safety culture. *Professional Safety*, 47, 30–36.

- Crim, S. M., Griffin, P. M., Tauxe, R., Marder, E. P., Gilliss, D., Cronquist, A. B., et al. (2015). Preliminary incidence and trends of infection with pathogens transmitted commonly through Food—Foodborne diseases active surveillance network, 10 US sites, 2006–2014. *MMWR. Morbidity and Mortality Weekly Report*, 64, 495–499.
- Davies, H. T., Nutley, S. M., & Mannion, R. (2000). Organisational culture and quality of health care. *Quality in Health Care*, 9, 111–119.
- De Boeck, E., Jacxsens, L., Bollaerts, M., Uyttendaele, M., & Vlerick, P. (2016). Interplay between food safety climate, food safety management system and microbiological hygiene in farm butcheries and affiliated butcher shops. *Food Control*, 65, 78–91.
- De Boeck, E., Jacxsens, L., Bollaerts, M., & Vlerick, P. (2015). Food safety climate in food processing organizations: development and validation of a self-assessment tool. *Trends in Food Science & Technology*, 46(2), 242–251.
- De Witte, K., & van Muijen, J. J. (1999). Organizational culture. *European Journal of Work and Organizational Psychology*, 8, 497–502.
- Denison, D. R. (1997). *Corporate culture and organizational effectiveness, denison consulting* (2nd ed.) (May 1997).
- EC. (2004). Regulation (EC) No. 853/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific hygiene rules for food of animal origin. *Official Journal of the European Union*, 139, 22–82.
- FAO. (2007). *In Bridging the gap between food safety policies and implementation*. Rome: Thirty fourth Session. C2007/JNF/19.
- FDA. (2011). Food safety modernization act (FSMA). *Public Law*, 111–353.
- Fernández-Muñiz, B., Montes-Peón, J. M., & Vázquez-Ordás, C. J. (2007). Safety culture: Analysis of the causal relationships between its key dimensions. *Journal of safety research*, 38, 627–641.
- Fleming, M. (2000). *Safety culture maturity model. OFFSHORE TECHNOLOGY REPORT-HEALTH AND SAFETY EXECUTIVE OTH*. 2000/049 <http://www.hse.gov.uk/research/otopdf/2000/oto00049.pdf> Accessed 16.11.15.
- Fleming, M., & Lardner, R. (1999). *Safety Culture- the way forward*. In *The chemical engineer*. Edinburgh, UK: The Keil Centre, Chartered Psychologists.
- Foster, P., & Houlst, S. (2013). The safety journey: Using a safety maturity model for safety planning and assurance in the UK coal mining industry. *Minerals*, 3, 59–72.
- Ghemawat, P., & Reiche, S. (2011). National cultural differences and multinational business. *Globalization Note Series*, 1–18.
- Glendon, A. L., & Stanton, N. A. (2000). Perspectives on safety culture. *Safety Science*, 34, 193–214.
- Global Food Safety Initiative (GFSI). (2016). In *Global food safety initiative*.
- Goffee, R., & Jones, G. (1996). What holds the modern company together? *Harvard Business Review*, 74, 133–148.
- Griffith, C. (2013). Advances in understanding the impact of personal hygiene and human behaviour on food safety. *Advances in Microbial Food Safety* (vol. 1., 401–416).
- Griffith, C. J., Livesey, K. M., & Clayton, D. (2010a). The assessment of food safety culture. *British Food Journal*, 112, 439–456.
- Griffith, C. J., Livesey, K. M., & Clayton, D. A. (2010b). Food safety culture: The evolution of an emerging risk factor? *British Food Journal*, 112, 426–438.
- Guldenmund, F. W. (2010). (Mis) understanding safety culture and its relationship to safety management. *Risk Analysis*, 30, 1466–1480.
- Guldenmund, F. W. (2007). The use of questionnaires in safety culture research – an evaluation. *Safety Science*, 45(6), 723–743.
- Halligan, M., & Zecevic, A. (2011). Safety culture in healthcare: A review of concepts, dimensions, measures and progress. *British Medical Journal quality & safety*, 20, 338–343.
- Havold, J. I. (2007). National cultures and safety orientation: A study of seafarers working for Norwegian shipping companies. *Work and Stress*, 21, 173–195.
- Hayburn, G. (2014). Challenges for auditing and food safety management systems: A point of view. *Perspectives in Public Health*, 134, 196–197.
- Hofstede, G. (1998). Attitudes, values and organizational culture: Disentangling the concepts. *Organization Studies*, 19(3), 477–493.
- Hofstede, G. H. (2001). *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations* (2nd ed.). London: Sage Publications.
- Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). *Cultures and organizations: Software of the mind* (3rd ed.). New York, USA: McGraw-Hill Education.
- HSE. (1999). *Reducing error and influencing behaviour* (2 ed.). Sheffield: HSE Books.
- HSE. (2005). Introduction to human factors. In *Inspectors toolkit: Human factors in the management of major accident hazards Health Safety Executive-HSE*.
- Hudson, P. (2001). In *Safety culture-theory and practice*. Defense Technical Information Center.
- Hudson, P. (2007). Implementing a safety culture in a major multi-national. *Safety Science*, 45, 697–722.
- Ijabadeniyi, O. A. (2013). Food safety culture paramount than traditional food safety system and food safety culture in South African food industries. *International Journal of Social, Management, Economics and Business Engineering*, 7, 446–450.
- INSAG. (1991). Safety culture: A report by the international nuclear safety advisory group (INSAG-4). In *Safety series* (vol. 75-INSAG-4). Vienna, Austria: International Nuclear Safety Advisory Group (INSAG).
- Jacxsens, L., Uyttendaele, M., Devlieghere, F., Rovira, J., Gomez, S. O., & Luning, P. A. (2010). Food safety performance indicators to benchmark food safety output of food safety management systems. *International Journal of Food Microbiology*, 141(Suppl), S180–S187.
- Jespersen, L., Griffiths, M., Maclaurin, T., Chapman, B., & Wallace, C. A. (2016). Measurement of food safety culture using survey and maturity profiling tools. *Food Control*, 66, 174–182.
- Kirezieva, K., Jacxsens, L., Hagelaar, G. J., van Boekel, M. A., Uyttendaele, M., & Luning, P. A. (2015a). Exploring the influence of context on food safety management: Case studies of leafy greens production in Europe. *Food Policy*, 51, 158–170.
- Kirezieva, K., Jacxsens, L., Uyttendaele, M., Van Boekel, M. A. J. S., & Luning, P. A. (2013a). Assessment of food safety management systems in the global fresh produce chain. *Food Research International*, 52, 230–242.
- Kirezieva, K., Luning, P. A., Jacxsens, L., Allende, A., Johannessen, G. S., Tondo, E. C., et al. (2015b). Factors affecting the status of food safety management systems in the global fresh produce chain. *Food Control*, 52, 85–97.
- Kirezieva, K., Nanyunja, J., Jacxsens, L., van der Vorst, J. G. A. J., Uyttendaele, M., & Luning, P. A. (2013b). Context factors affecting design and operation of food safety management systems in the fresh produce chain. *Trends in Food Science & Technology*, 32, 108–127.
- Kussaga, J. B., Jacxsens, L., Tiisekwa, B. P. M., & Luning, P. A. (2014). Food safety management systems performance in African food processing companies: A review of deficiencies and possible improvement strategies. *Journal of the Science of Food and Agriculture*, 94, 2154–2169.
- Line, M. B. (1999). Types of organisational culture. *Library management*, 20, 73–75.
- Lok, P., & Crawford, J. (2004). The effect of organisational culture and leadership style on job satisfaction and organisational commitment: A cross-national comparison. *Journal of Management Development*, 23, 321–338.
- Lu, C. S., Lai, K. H., Lun, Y. V., & Cheng, T. C. E. (2012). Effects of national culture on human failures in container shipping: The moderating role of Confucian dynamism. *Accident Analysis & Prevention*, 49, 457–469.
- Luning, P. A., Bango, L., Kussaga, J., Rovira, J., & Marcellis, W. J. (2008). Comprehensive analysis and differentiated assessment of food safety control systems: A diagnostic instrument. *Trends in Food Science & Technology*, 19, 522–534.
- Luning, P. A., Jacxsens, L., Rovira, J., Osés, S. M., Uyttendaele, M., & Marcellis, W. J. (2011a). A concurrent diagnosis of microbiological food safety output and food safety management system performance: Cases from meat processing industries. *Food Control*, 22, 555–565.
- Luning, P. A., Kirezieva, K., Hagelaar, G., Rovira, J., Uyttendaele, M., & Jacxsens, L. (2015). Performance assessment of food safety management systems in animal-based food companies in view of their context characteristics: A European study. *Food Control*, 49, 11–22.
- Luning, P. A., & Marcellis, W. J. (2007). A conceptual model of food quality management functions based on a techno-managerial approach. *Trends in Food Science & Technology*, 18, 159–166.
- Luning, P. A., & Marcellis, W. J. (2009). *Food quality management: Technological and managerial principles and practices*. Wageningen Academic Publishers.
- Luning, P. A., Marcellis, W. J., Rovira, J., van Boekel, M. A. J. S., Uyttendaele, M., & Jacxsens, L. (2011b). A tool to diagnose context riskiness in view of food safety activities and microbiological safety output. *Trends in Food Science & Technology*, 22(Suppl 1), S67–S79.
- Luning, P. A., Marcellis, W. J., Rovira, J., Van der Spiegel, M., Uyttendaele, M., & Jacxsens, L. (2009). Systematic assessment of core assurance activities in a company specific food safety management system. *Trends in Food Science & Technology*, 20, 300–312.
- Martins, E. C., & Terblanche, F. (2003). Building organisational culture that stimulates creativity and innovation. *European Journal of Innovation Management*, 6, 64–74.
- Maull, R., Brown, P., & Cliffe, R. (2001). Organisational culture and quality improvement. *International Journal of Operations & Production Management*, 21, 302–326.
- Mearns, K. J., & Flin, R. (1999). Assessing the state of organizational safety—culture or climate? *Current Psychology*, 18, 5–17.
- Mearns, K., & Yule, S. (2009). The role of national culture in determining safety performance: Challenges for the global oil and gas industry. *Safety Science*, 47, 777–785.
- Morrow, S. L., Koves, G. K., & Barnes, V. E. (2014). Exploring the relationship between safety culture and safety performance in US nuclear power operations. *Safety Science*, 69, 37–47.
- Nakata, C., & Sivakumar, K. (1996). National culture and new product development: An integrative review. *Journal of Marketing*, 60, 61–72.
- Newman, K. L., & Nollen, S. D. (1996). Culture and congruence: The fit between management practices and national culture. *Journal of International Business Studies*, 27, 753–779.
- Nickell, G. S., & Hinsz, V. B. (2011). Having a conscientious personality helps an organizational climate of food safety predict food safety behavior. *Food supplies and food safety: Production, conservation and population impact*, 189–198.
- Ogbonna, E. (1992). Part two: Dimensions of HRM 5 organization culture and human resource management: Dilemmas and contradictions. *Reassessing human resource management*, 74.
- Onjong, H. A., Wangoh, J., & Njage, P. M. K. (2014). Current food safety management systems in fish-exporting companies require further improvements to adequately cope with contextual pressure: Case study. *Journal of Food Science*, 79, M2031–M2039.
- Parker, R., & Bradley, L. (2000). Organisational culture in the public sector: Evidence from six organisations. *International Journal of Public Sector Management*, 13, 125–141.
- Parker, D., Lawrie, M., & Hudson, P. (2006). A framework for understanding the development of organisational safety culture. *Safety Science*, 44, 551–562.
- Pederson, R., & Hernández, G. (2014). *Food safety: State-of-play, current and future*

- challenges. Brussels: European Union. In P. D. A. E. a. S. Policy (Ed.).
- Pennington, H. (2009). *The public inquiry into the september 2005 outbreak of E. coli O157 in South Wales: Chairman: Professor Hugh Pennington*. Cardiff: Welsh Assembly Government.
- Powell, D. A., Erdozain, S., Dodd, C., Costa, R., Morley, K., & Chapman, B. J. (2013). Audits and inspections are never enough: A critique to enhance food safety. *Food Control*, 30, 686–691.
- Powell, D. A., Jacob, C. J., & Chapman, B. J. (2011). Enhancing food safety culture to reduce rates of foodborne illness. *Food Control*, 22, 817–822.
- Rapid Alert System for Food & Feed. (2014). *RASFF annual report 2014*. Luxembourg: Publications Office of the European Union.
- Reason, J. (1998). Achieving a safe culture: Theory and practice. *Work & Stress*, 12, 293–306.
- Rouvière, E., & Caswell, J. A. (2012). From punishment to prevention: A French case study of the introduction of co-regulation in enforcing food safety. *Food Policy*, 37, 246–254.
- Sadri, G., & Lees, B. (2001). Developing corporate culture as a competitive advantage. *Journal of Management Development*, 20, 853–859.
- Sampers, I., Jacxsens, L., Luning, P. A., Marcelis, W. J., Dumoulin, A., & Uyttendaele, M. (2010). Performance of food safety management systems in poultry meat preparation processing plants in relation to *Campylobacter* spp. contamination. *Journal of Food Protection*, 73, 1447–1457.
- Sampers, I., Toyofuku, H., Luning, P. A., Uyttendaele, M., & Jacxsens, L. (2012). Semi-quantitative study to evaluate the performance of a HACCP-based food safety management system in Japanese milk processing plants. *Food Control*, 23, 227–233.
- Sawe, C. T., Onyango, C. M., & Njage, P. M. K. (2014). Current food safety management systems in fresh produce exporting industry are associated with lower performance due to context riskiness: Case study. *Food Control*, 40, 335–343.
- Schein, E. H. (2010). *Organizational culture and leadership* (vol. 2). John Wiley & Sons.
- Seel, R. (2000). Culture and complexity: New insights on organisational change. *Organisations & People*, 7, 2–9.
- Seymen, O. A., & Bolat, O. (2010). *The role of national culture in establishing an efficient safety culture in organizations: An evaluation in respect of Hofstede's cultural dimensions*. Turkey: Balikesir University. <http://w3.balikesir.edu.tr/~seymen/SeymenBolatAtina.pdf> Accessed on 7 January 2016.
- Singla, A. K., Kitch, B. T., Weissman, J. S., & Campbell, E. G. (2006). Assessing patient safety culture: A review and synthesis of the measurement tools. *Journal of Patient Safety*, 2, 105–115.
- Skyttner, L. (2005). *General systems theory: Problems, perspectives, practice* (2nd ed.). Singapore: World Scientific Publishing.
- Starren, A., Hornikx, J., & Luijters, K. (2013). Occupational safety in multicultural teams and organizations: A research agenda. *Safety Science*, 52, 43–49.
- Taylor, J. (2011). An exploration of food safety culture in a multi-cultural environment: Next steps? *Worldwide Hospitality and Tourism Themes*, 3, 455–466.
- Taylor, J., Garat, J. P., Simreen, S., & Sarieedine, G. (2015). An industry perspective. *Worldwide Hospitality and Tourism Themes*, 7, 78–89.
- Thompson, N., Stradling, S., Murphy, M., & O'Neill, P. (1996). Stress and organizational culture. *British Journal of Social Work*, 26, 647–665.
- Ungku Fatimah, U. Z. A., Arendt, S. W., & Strohbahn, C. H. (2014a). Food safety culture in onsite foodservices: Development and validation of a measurement scale. *Journal of Foodservice Management & Education*, 8, 1–10.
- Ungku Fatimah, U. Z. A., Strohbahn, C. H., & Arendt, S. W. (2014b). An empirical investigation of food safety culture in onsite foodservice operations. *Food Control*, 46, 255–263.
- Van Oudenhoven, J. P. (2001). Do organizations reflect national cultures? a 10-nation study. *International Journal of Intercultural Relations*, 25, 89–107.
- Van den Berg, P. T., & Wilderom, C. P. (2004). Defining, measuring, and comparing organisational cultures. *Applied Psychology*, 53, 570–582.
- Wallace, C. A. (2009). *The impact of personnel, training, culture and organisational factors on application of the HACCP system for food safety management in a multinational organisation*. University of Central Lancashire.
- Westrum, R. (1993). Cultures with requisite imagination. In *Verification and validation of complex systems: Human factors issues* (pp. 401–416). New York, USA: Springer.
- Wiegmann, D. A., Zhang, H., Von Thaden, T. L., Sharma, G., & Gibbons, A. M. (2004). Safety culture: An integrative review. *The International Journal of Aviation Psychology*, 14, 117–134.
- Wright, M., Leach, P., & Palmer, G. (2012). A tool to diagnose culture in food business operators. In *Report from greenstreet Berman Ltd for the food standards Agency*. London, UK: Greenstreet Berman Ltd (R1 V6 ed.).
- Yiannas, F. (2009). *Food safety Culture: Creating a behavior-based food safety management system*. New York, USA: Springer.