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Prevailing food safety culture in companies operating in a transition economy - Does product riskiness matter?

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ABSTRACT

Food safety outbreaks are recurrent events, which regularly cost human lives. Food safety goes beyond food safety management systems; an organisation's prevailing food safety culture, and its internal and external environment must also be considered. This study introduces a research framework to analyse crucial food safety culture elements, and characteristics of the internal (i.e. food safety program, product riskiness, and vulnerability of food production system) and the external company environment (i.e. national values and food safety governance characteristics). We hypothesised that companies producing high-risk products are more likely to demonstrate a proactive food safety culture. We used the framework to assess nine companies producing low, medium, and high-risk products in Zimbabwe, as a case of a transition economy. Results showed no direct relationship between product riskiness and food safety culture, which negated our hypothesis. Other variables explored in this study could have moderated the relationship. We found that the vulnerability (i.e. susceptibility to microbial contamination) of the food production system could be associated with an organisation's food safety culture. Moreover, the external environment could have shaped the prevailing food safety culture. In particular, food safety governance and national values seem to be reflected in the way food safety was prioritised, food safety programs were designed and implemented, the prevailing food safety culture, and the observed food safety behaviour. Further research could investigate the role of the external environment in an organisation's food safety culture by evaluating companies in countries operating with different food safety governance approaches and national values.

1. Introduction

Food safety continues to be a challenge as demonstrated by recurring food safety outbreaks (Centers for Disease Control and Prevention, 2018; European Food Safety Authority and European Centre for Disease Prevention Control, 2018), despite investments in food safety management systems (FSMS) (i.e. in infrastructure, equipment and documentation), food safety regulations, training and auditing. The recurrence of these outbreaks is more prominent in transition economies (World Health Organization, 2015), where a third of the global foodborne-related deaths occur (WHO, 2016). These economies face difficulties in the adoption of FSMS (Griffith, Jackson, & Lues, 2017; Macheka, Manditsera, Ngadze, Mubaiwa, & Nyanga, 2013; Nanyunja et al., 2015) as well as in the assurance of food safety (Kussaga, Luning, Jacxsens, & Tiisekwa, 2013). In 2017–2018, a Listeriosis outbreak emanating from a meat processing company in South Africa resulted in 978 illnesses and 183 deaths, putting 15 countries at risk (World Health Organization, 2018), thus revealing deficiencies in the core control and assurance activities such as lack of preventive measures, monitoring systems to detect pathogens, verification activities, and lack of hygiene training (Boatemaa et al., 2019). Most outbreaks are anecdotal as there are often no structured systems to report cases (Kussaga, Jacxsens, Tiisekwa, & Luning, 2014; World Health Organization, 2015).

In addition to proper design and implementation of FSMS, the human dimension, e.g. perceptions, decision-making, and actual execution of food safety and hygiene tasks, has been found to influence the food safety performance of an organisation (e.g. De Boeck, Jacxsens, Bollaerts, & Vlerick, 2015; Fatimah, Strohbehn, & Arendt, 2014a; Griffith et al., 2017; Nyarugwe, Linnemann, Nyanga, Fogliano, & Luning, 2018). Recent studies have therefore stressed the importance of food safety culture (FS-culture) in food safety performance (De Boeck, Jacxsens, Mortier, & Vlerick, 2018a, De Boeck, Jacxsens, Vanoverberghe, & Vlerick, 2018b; Jespersen, MacLaurin, & Vlerick, 2017; Manning, 2018; Nayak & Taylor, 2018; Nyarugwe, Linnemann, Hofstede, Fogliano, & Luning, 2016). Food companies nowadays attempt to create and sustain a culture of food safety, evidenced by efforts

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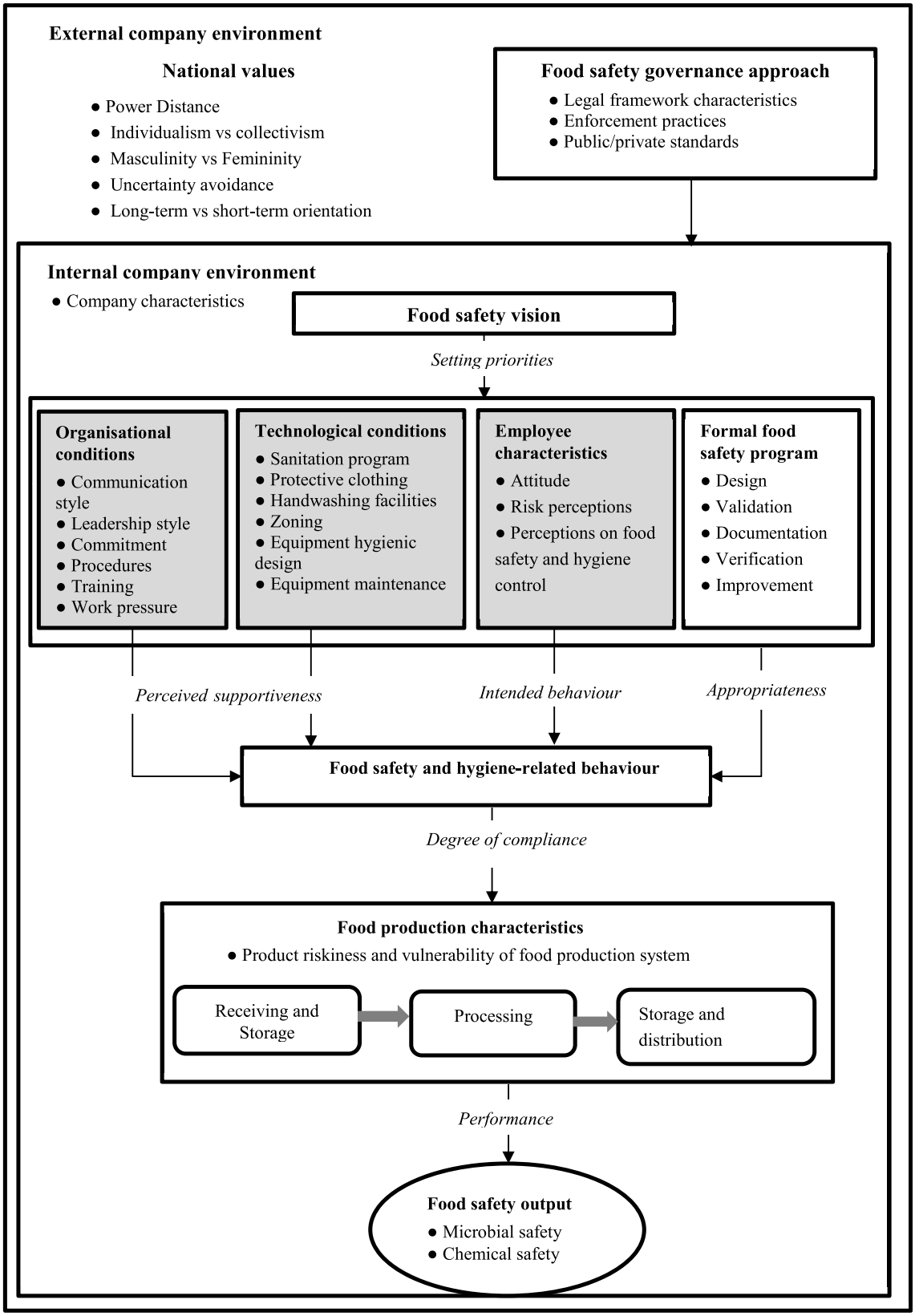

Fig. 1. Research framework to analyse prevailing FS-culture of a company within its environmental context.
In grey are the elements used to give an indication of an organisation's prevailing FS-culture from a food handler's perspective.

of e.g. Campden BRI (Emond & Taylor, 2018) and the Global Food Safety Initiative's position paper on FS-culture (GFSI, 2018). This is because in the midst of persistent food safety challenges and globalisation, food safety should go beyond fulfilling regulatory requirements to "live within the company's culture" (GFSI, 2018).

However, ensuring food safety is more complex and may go beyond

a company FS-culture as advocated previously (Nyarugwe et al., 2018). It should incorporate the external environment in which the company operates, such as national values and food safety governance (GFSI, 2018; Taylor, 2011). De Boeck, Jacxsens, Bollaerts, Uyttendaele, and Vlerick (2016) suggested that not only the technological and managerial factors reflect an organisation's FS-culture but also the human factors and the environment, in which a company operates. Moreover, Donaldson (2001), and Sousa and Voss (2008) indicated that an organisation's performance varies with differences in the organisation's situation like company size, environment and strategy, based on the contingency theory principles. De Boeck, Mortier, Jacxsens, Dequidt, and Vlerick (2017), Fatimah et al. (2014a), and Taylor (2011) also confirmed the importance of the environment or context to the FS-culture of a company.

Other studies have discussed the importance of context in relation to FSMS performance (Herath, Hassan, & Henson, 2007; Kirezieva et al., 2013; Luning et al., 2011). Context refers to a broader concept, which encompasses characteristics of the external company environment and characteristics of the products, process and chain environment as described by Kirezieva et al. (2015a) and Luning et al. (2011). Kirezieva et al. (2013) proposed that the context puts demands on the design and operation of FSMS. Luning et al. (2011) identified product riskiness as one of the context factors and indicated that companies with a high-risk context are typified by a high vulnerability to food safety problems and need to have advanced control and assurance activities when compared with those with a low-risk context. Moreover, empirical studies demonstrated that companies operating with more vulnerable food products and food processes have a higher chance of food safety issues if their food safety system is not well developed (e.g. Luning et al., 2015; Sampers, Toyofuku, Luning, Uyttendaele, & Jacxsens, 2012). Studies also showed that companies place stricter requirements and greater priority on food safety in production of high-risk products (e.g. meat and dairy) than for other products as high-risk products are potentially hazardous if processed under non-conforming circumstances (e.g. De Boeck et al., 2018a; Herath et al., 2007; Jacxsens et al., 2015; Karaman, Cobanoglu, Tunalioglu, & Ova, 2012). Moreover, authors argued that companies with a more vulnerable context (i.e. product, process and supply chain characteristics, which indicate riskiness of the situation and that could affect food safety) need to provide better organisational support to enable consistency in decision-making (Kussaga et al., 2013; Luning et al., 2011).

Furthermore, Nyarugwe et al. (2016) discussed the need to adapt FS-culture to a company's food risks and context, as has been done in FSMS performance and in safety culture studies (e.g. Flin, 2007). To the best of our knowledge, no empirical studies have investigated if companies' food safety risks are reflected in the prevailing FS-culture and whether companies operating with more risky products and processes possess a more pro-active FS-culture. We postulate that companies working with high-risk food products possess a pro-active FS-culture.

Besides product riskiness, the broad national context (i.e. external company environment), particularly food safety governance (i.e. characteristics of the regulatory environment and enforcement practices), plays a role in food safety performance (Kirezieva et al., 2015a; Kussaga et al., 2013; Nanyunja et al., 2015). Several authors also hypothesised that food safety governance could shape the FS-culture of an organisation (De Boeck et al., 2017; Taylor, 2011). In many transition economies, food safety legislation and its enforcement are weak and underdeveloped (Kirezieva et al., 2015b; Kussaga et al., 2013, 2014; Nanyunja et al., 2015), which could constrain the development of FSMS and negatively impact FS-culture. This study therefore aims to investigate whether food companies operating under the same national context but varying in product riskiness differ in their prevailing FS-culture. As a case study we used Zimbabwe, where the food safety governance system is fragmented (i.e. consists of multiple actors in food safety governance leading to overlaps or oversights in food safety control), lacks a clear enforcement strategy, and authorities act independently and uncoordinated, except when faced with food safety challenges (e.g. Macheka et al., 2013; Pswarayi, Mutukumira, Chipurura, Gabi, & Jukes, 2014).

2. Food safety culture research framework

Fig. 1 shows the FS-culture research framework extended from Nyarugwe et al. (2018), used to analyse an organisation's prevailing FS-culture within its national context. Development of this FS-culture research framework was founded on the contingency theory, the food quality functions model and principles of the techno-managerial approach, i.e. concurrent analysis of technological and managerial factors that can have an influence on food safety (Luning & Marcelis, 2006, 2007; Sousa & Voss, 2008). The figure shows elements, which include: organisational and technological enabling conditions, employee characteristics, food production characteristics, food safety output, and the internal and external company environment. Enabling conditions and employee characteristics reflect an organisation's FS-culture. Enabling conditions include technological and organisational conditions that measure the supportiveness of the company's technological and managerial environment to food handlers when executing their work tasks (Luning et al., 2011; Nyarugwe et al., 2018). Regarding employee characteristics, food safety, hygiene and risk perceptions, and attitudes of food handlers were assessed. Perceptions measure how personnel evaluate and ascribe meaning to their work environment (De Boeck et al., 2015). Attitude has been proposed as one of the predictors of intention to comply with food safety and hygiene requirements and intention as an influencer of actual behaviour (Ajzen, 1991; Clayton & Griffith, 2008; Manning, 2018; Young, Thaivalappil, Greig, Meldrum, & Waddell, 2018). With actual behaviour, we measure actual compliance to food safety related activities as behaviour reflects an organisation's FS-culture (De Boeck et al., 2017; Nyarugwe et al., 2018). Food safety output gives an indication of actual food safety performance as an outcome of the FSMS (Jacxsens et al., 2010). Above elements and their associated indicators (i.e. crucial aspects) were identified from previously validated studies (e.g. De Boeck et al., 2016; Fatimah et al., 2014a; Jacxsens et al., 2010; Nyarugwe et al., 2018).

Fatimah et al. (2014a) denoted company characteristics as operational characteristics including management system, size and product type, which all could influence an organisation's FS-culture. In our study, food production characteristics (i.e. product riskiness and vulnerability) were incorporated in addition to company characteristics (including size, product type and organisational structure) to typify the internal company environment. Moreover, food safety performance was included as Luning et al. (2011) suggested food safety performance to not only depend on FSMS performance but also on the system's context with the assumption that product riskiness is a determinant of food safety performance. The food safety program was furthermore incorporated in the framework as a FSMS has been indicated as part of FS-culture assessments (De Boeck et al., 2016; Griffith et al., 2017; Nyarugwe et al., 2016).

Additionally, the framework shows national values and food safety governance as part of the broad national context used to typify the external company environment. In this study, national values characterise the national culture based on the Hofstede cultural dimensions i.e. power distance, individualism vs collectivism, masculinity vs femininity, uncertainty avoidance, long vs short-term orientation, and indulgence vs restraint (Hofstede, Hofstede, & Minkov, 2010). The food safety governance approach (i.e. characteristics of legal framework and enforcement practices) was assessed as it shapes an organisation's food safety system and the way it is implemented (Kirezieva et al., 2015a; Rouvière & Caswell, 2012), which possibly reflects the FS-culture.

3. Materials and methods

3.1. Study design

3.1.1. Selection of respondents

The study was carried out between July 2017 and September 2018 in nine Zimbabwean food companies coded L1-3, M1-2 and H1-4 for confidentiality reasons. The companies differed in level of product riskiness (low-L, medium-M, and high-risk-H), product type (dairy, meat, juices and cordials, baked goods, fresh vegetables), and company size (small to large). Small to medium companies employ more than 10 but less than 250 people with an annual turnover of EUR 50 million and balance sheet not exceeding EUR 43 million (European Union Commission, 2003). Dairy and meat companies were classified as high-risk, and vegetables and baked goods as low-risk (Dora, Kumar, Van Goubergen, Molnar, & Gellynck, 2013; Jacxsens et al., 2015; Karaman et al., 2012). Medium-risk companies produced cordials and pasteurised juices. Companies and respondents were selected based on their willingness to participate. In the study, different types of respondents were interviewed. Food handlers (i.e. machine operators, production attendants, packers and supervisors) were randomly selected by the researchers from the production floor (according to Nyarugwe et al., 2018) to obtain the maximum participants within the allowable time. In each company, the quality assurance (QA) manager was interviewed. Three food safety authorities, one from a private certification body (coded as FSA1), and two from governmental bodies (FSA2 and FSA3), were also interviewed. FSA1 operated at the managerial level whilst the others operated at the directorship level. All received information about the research background and a guarantee of confidentiality. Table 1 summarizes respondent characteristics.

3.1.2. Design of empirical study

The empirical study design consisted of one part to typify internal and external company characteristics that could shape the FS-culture of an organisation and another part to assess the FS-culture elements that give an insight into the prevailing FS-culture. Questionnaires were used to collect data on external company characteristics (national values, food safety governance) and internal company characteristics. Interviews were also used to assess food safety governance. To assess the prevailing FS-culture, a mixed-methods approach, which involved triangulation of research methods, was used as recommended in other studies De Boeck et al. (2018b) and Jespersen and Wallace (2017). The approach included interviews, card-aided interviews, questionnaires, participatory observations, and document analysis as previously developed (Nyarugwe et al., 2018).

Some methods, such as storytelling to assess the prevailing FS-culture, were slightly modified (sections 2.2.3.1 to 2.2.3.4) based on recommendations from a previous study (Nyarugwe et al., 2018). Two research assistants from the University of Zimbabwe, who were trained in conducting the FS-culture assessments, assisted in data collection. In each company, data was collected for a period of 1 week as that was the maximum time the companies allowed.

3.2. Data collection

3.2.1. Assessment of external company environment

Food handlers received the values survey module (VSM), a questionnaire developed by Hofstede, Hofstede, Minkov, and Vinken (2013) to characterise national values, as the assessment had not yet been fully done for Zimbabwe. Questions to typify the food safety governance approach were developed by the researchers based on previous research (Kirezieva et al., 2015a), adapted to fit the context of emerging economies based on previous findings (Kussaga et al., 2014) and directed to food safety authorities and QA managers. The questionnaires consisted of both open and closed questions on characteristics of the legal framework, enforcement practices, and private enforcement. All questionnaires, except for the VSM, had three answer categories reflecting unsupportive, restricted support, and supportive, which correspond with scores 1, 2, and 3, respectively.

Table 1
Characteristics of company respondents.

	Companies								
	Low-risk			Medium- risk		High-risk			
	[a]L1	L2	L3	M1	M2	H1	H2	H3	H4
Respondents profile									
Gender									
Male	25	26	1	27	24	25	25	21	10
Female	1	2	9	5	1	0	0	1	2
Age									
Below 26	3	2	3	2	1	6	7	6	5
26–30	8	1	4	10	2	10	5	7	1
31–35	7	1	1	8	5	6	5	4	4
36–40	3	5	0	2	4	3	4	2	1
41–45	1	6	1	3	3	1	2	1	0
46–50	0	6	0	4	4	0	2	2	0
50 and above	2[b]	7	1	1[b]	5[b]	0	0	0	1
Position									
Managers	1	1	1	1	1	1	1	1	1
Food handlers	25	27	9	31	24	24	24	21	11
Years in employment									
< 1	2	2	0	4	2	4	12	10	2
1–5	11	5	9	12	5	16	8	12	8
6–10	9	0	1	6	6	5	5	0	2
11–15	2	0	0	2	2	0	0	0	0
16–20	1[b]	9	0	4	2	0	0	0	0
21 and above	0	12	0	2	7[b]	0	0	0	0
Type of employment									
Contract	23	4	9	9	10	15	17	16	2
Permanent	3	24	1	23	15	10	8	6	10
Educational level									
Primary	0	2	3	0	5	0	0	2	4
Secondary	24	23	6	12	16	23	21	17	4
Tertiary	2	3	1	17[b]	3[b]	2	4	3	4
Nationality									
Zimbabwean	26	28	10	32	25	26	25	22	12
Non-Zimbabwean	0	0	0	0	1	0	0	0	0

[a] CA, L1 … refers to company A, company B etc.
[b] Some respondents chose not to respond.

3.2.2. Assessment of internal company environment

Questionnaires were developed to assess, from the QA manager's perspective, the internal company environment, which included vulnerability of the product and production characteristics, and the organisation's food safety vision, company characteristics and formal food safety program (full questionnaires in Appendix A). One questionnaire comprised closed questions to characterise vulnerability (modified from Luning et al., 2011). Vulnerability reflects the perceived riskiness in the context (Sawe, Onyango, & Njage, 2014), encompassing, in the current study, the inherent product and production characteristics. The other questionnaire comprised both closed and open questions to assess company characteristics and the formal food safety program. All questions had answer categories characterising a reactive, active, and proactive FS-culture, which correspond with scores 1, 2, and 3, respectively. Vulnerability and assigned food safety performance scores were based on Sampers et al. (2012) and Jacxsens et al. (2010). Scores were also assigned for the formal food safety program using the same approach.

3.2.3. Assessment of organisational and technological enabling conditions

Card-aided interviews were used to assess food handlers' perceptions of the organisation's technological and organisational enabling conditions (Fig. 1) as described in Nyarugwe et al. (2018). For each enabling condition, three cards providing descriptions reflecting

Table 2
Overall characteristics of the FS-culture elements and the internal and external environment used to typify the prevailing FS-culture and the company environment extended from Nyarugwe et al. (2018).

[b]Element	Score 1 (typifying reactive FS-culture)	Score 2 (typifying active FS-culture)	Score 3 (typifying proactive FS-culture)
External company environment			
[a] Food safety governance	Unsupportive i.e. Out-of-date, unusable, generic food safety standards which leave much room for interpretation or punitive enforcement practices or ad hoc inspections and audits are done only when problems occur	Restricted support i.e. relevant food safety standards, useable to some extent and are prescriptive. Partially facilitative enforcement practices. Structured inspections and audits done on a regular basis	Supportive i.e. up-to-date food safety standards. Facilitative enforcement practices. Inspections and audits done on a defined frequency and are risk-based
Internal company environment			
[a]Company characteristics	Unsupportive e.g. Low workforce quality (related to food safety competence) with high employee turnover. Lack of or unclear organizational structure	Constrained e.g. Constrained workforce quality with variable workforce composition. Restricted organizational structure	Supportive e.g. High workforce quality with low turnover and a clear organizational structure
[a] Formal food safety program	Non-existent or if it exists is not formally written, is unstructured, and not verified or validated	Improperly implemented. Based on experience and in-house or general knowledge, partially digital, updates are ad hoc, restricted access, verified/validated based on in-house knowledge	Properly implemented Science-based, digital, decentralised, always updated, verified based on scientific sources and validated based on rigorous analysis by independent experts
Vulnerability			
Product characteristics	High chance on chemical and microbial contamination, and growth or survival of pathogens	Potential contamination and likely chance for growth or survival of pathogens	Low chance of contamination and growth or survival of pathogens
Process characteristics	Highly susceptible to cross contamination	Potentially susceptible to cross contamination	Unlikely to be susceptible to cross contamination
Enabling conditions			
Technological and organisational conditions	Reactive (lack of support/conditions are not enabling) - acting only when there is a situation that needs to be controlled. Routine response to inspection findings, problems/incidents. Control is mainly problem driven.	Active (restricted support/conditions are enabling only to a certain extent) - systems are in place to manage the likelihood of (cross) contamination and to support food handlers' food safety/hygiene control decisions	Proactive (full support/conditions are enabling) - thinking and acting in advance of anticipated problems. Focus is on prevention of (cross) contamination
Employee characteristics			
Attitude	Weak and negative attitude-negative predisposition toward compliance with food safety/hygiene requirements. Employees have no regard for food safety/hygiene issues unless compelled to	Ambivalent attitude- uncertain predisposition to comply with food safety/hygiene requirements. Employees perform adequately only when circumstances are appropriate	Strong and positive attitudes- positive predisposition to comply with food safety/ hygiene requirements under all circumstances. Employees always maintain adequate performance
[a] Risk perceptions	Inadequate - complete lack of awareness in the risk posed on a majority of food safety and hygiene issues.	Moderate - incomplete awareness on the risk posed on some food safety and hygiene.	Good - ample awareness on the risk posed on a majority of the food safety and hygiene issues.
Food safety and hygiene perceptions	Non-aligned- employee perceptions incorrect and not aligned with the company's food safety and hygiene control requirements	Partially aligned- employee perceptions partially/incompletely aligned with the company's food safety and hygiene requirements	Fully aligned- employees have appropriate perceptions aligned with the company's food safety and hygiene control requirements
[a] Intended behaviour	High-risk due to high inclination to engage in risky behaviour (i.e. not to comply with food safety and hygiene control practices ≥80% of the time).	Moderate-risk due to moderate inclination to engage in risky behaviour (i.e. to incompletely comply with food safety and hygiene control practices ≥80% of the time).	Low-risk due to high inclination to engage in non-risky behaviour (i.e. to comply with food safety and hygiene control practices ≥80% of the time).
Actual Behaviour			
Actual food safety and hygiene control behaviour	High-risk due to noncompliance with food safety and hygiene control requirements. Food safety and hygiene practices are not executed ≥80% of the time. Risk of cross-contamination is highly likely to occur.	Moderate-risk due to partial compliance with food safety and hygiene control requirements. Food safety and hygiene control practices are executed wrongly/incompletely ≥80% of the time. Risk of cross-contamination likely to occur.	Low-risk due to full compliance with food safety and hygiene control requirements. Food safety and hygiene control practices correctly and completely executed ≥80% of the time. Risk of cross-contamination highly unlikely.
Food safety output			
Food safety performance	Poor food safety performance (noncompliance/ conformance) -minimal criteria used for food safety performance evaluation, and having various food safety problems due to different problems in the FSMS	Moderate food safety performance restricted compliance/conformance) - several criteria used for food safety performance evaluation and food safety problems restricted to one type of problem in the FSMS.	Good food safety performance (full compliance/conformance) - systematic evaluation of food safety performance using specific criteria and having no food safety problems.

[a] Extended from Luning et al. (2011); Nyarugwe et al. (2018).
[b] For national values, typification is based on Hofstede et al. (2010).

characteristics of a reactive, active, and proactive FS-culture (scores 1, 2, 3, respectively) were given to respondents. This supported the respondents to choose the situation that best described the organisation's supportiveness to food safety and hygiene. The cards were given random letters and numbers and the combinations of letter and number chosen by the food handlers were recorded on a separate answer sheet together with the respondent's justification of the selected response. Each interview lasted for 20–45 min, depending on the respondent's ability to use English for communication, with the local language (Shona) used where translation was required.

3.2.4. Assessment of employee characteristics

Following the card-aided interviews, food handlers received a FS-culture self-assessment questionnaire. The questionnaire included demographic variables, operating characteristics, and employee characteristics. The employee characteristics section consisted of closed and open questions to: (1) evaluate attitudes towards food safety and hygiene control, (2) assess risk perceptions, (3) analyse perceived

appropriateness of personal hygiene practices, crucial control and sanitation practices, and (4) assess intended food safety and hygiene control behaviour. The questionnaire was modified from our previous study (Nyarugwe et al., 2018) by including risk perceptions and intended behaviour. Most food handlers completed their own questions with a few requiring assistance from the researchers in translating the questionnaires. The questionnaire comprised three answer categories reflecting reactive, active, and proactive FS-culture, which correspond with scores 1, 2, and 3, respectively. Exceptions were the food safety and hygiene perceptions where the chosen *responses* were classified as reactive, active or proactive.

3.2.5. Assessment of actual behaviour

An observation checklist was used to assess food handler behaviour based on guidelines previously described by Nyarugwe et al. (2018). The checklist contained three sections, namely on personal hygiene, actual sanitation practices, and actual control of crucial process parameters. For each section, the observer classified the observations into non-, partial, or full compliance corresponding with scores 1, 2, and 3, respectively. Two researchers randomly and independently observed the same person. The duration varied depending on, e.g., work area, tasks, and product or process requirements. Participatory observation, where the researchers integrate themselves within a group without informing group members that they are being observed, was done to observe actual execution of work tasks by the food handlers, as described by Kawulich (2005).

3.2.6. Assessment of food safety output

A checklist was developed to systematically analyse records for microbial trends, and type of microbial and hygiene-related complaints based on Nyarugwe et al. (2018). Analysed records covered a period of eight months to get insight into the companies' activities over a longer period. This period was the same for all companies. Companies were scored 1, 2 or 3, depending on whether records indicated multiple problems, restricted or no food safety problems. This was associated with respectively a reactive, active, or proactive FS-culture. Additionally, food safety key performance indicators were assessed through questions on food safety directed to the QA manager, as previously described by Jacxsens et al. (2010). Food safety performance indicators are useful to give a first indication of the microbial food safety performance as a measure of the food safety output without actual microbial analysis, as demonstrated by Jacxsens et al. (2010). These authors suggested that food companies that evaluate their performance in a structured way and according to very strict and specific criteria, will have a better insight in their actual microbial food safety performance because "food safety problems will be more systematically detected".

3.3. Data interpretation and analyses

3.3.1. Data interpretation

For each of the assessed elements and their associated indicators, situational descriptions and scores that reflect a reactive, active, and proactive FS-culture were defined to interpret data obtained from the multiple data collection methods with the exception of national values. Table 2 shows the overall characteristics to define these descriptions and assign scores. The assigned scores were used for both data and statistical analyses.

Scores for technological and organisational enabling conditions, employees' food safety, hygiene and risk perceptions, attitudes, and intentions were used to gain insight into the overall prevailing FS-culture (Nyarugwe et al., 2018). Score 1 indicated low support and little or no regard towards the importance of food safety. Score 2 reflected an incomplete regard and restricted support and score 3 a high regard and complete support towards food safety. These scores reflected a reactive, active and proactive FS-culture, respectively.

3.3.2. Data analysis and statistical analysis

Microsoft Office Excel was used to calculate the percentage non-conformance of food products to microbiological criteria and the percentage of microbiological and quality complaints (Nyarugwe et al., 2018) related to the food safety output (Fig. 1). For national values, index scores were calculated from the five-point Likert scale based on Hofstede and Minkov (2013) and used to determine the predominant cultural dimensions in the country, as well as to give an indication of the external company environment. For the food safety governance approach, which was also used to give an indication of the external company environment, assigned scores of each of the three food safety authorities and eight QA managers were entered into IBM SPSS software version 25.0 (2017) and frequencies calculated for the two groups to check for alignment in responses between the QA managers and food safety authorities.

The assigned scores of each respondent for the nine companies were also entered into IBM SPSS software version 25.0. Frequencies and mode scores were calculated per company for the organisational and technological enabling conditions, and employee characteristics reflecting an organisation's prevailing FS-culture and for actual food handler behaviour, i.e. food safety and hygiene-related behaviour (Fig. 1). The mode scores were used to designate the prevailing FS-culture and find possible associations between actual behaviour and the FS-culture variables using multiple linear regression, where findings were considered statistically significant if the p-value < 0.05. The forward selection method was used (Alexopoulos, 2010).

4. Results

4.1. Characteristics of the company environment

4.1.1. External company environment

4.1.1.1. National values. Hundred and ninety food handlers completed the Hofstede questionnaire (VSM). Data (Table 3) indicated that Zimbabweans have a high (68.6) power distance (PD) depicting a culture where inequality exists. The low score on long-term orientation (18.3) shows a culture that focuses on prevailing issues in the short-term, and an intermediate score for uncertainty avoidance (57.2) was given as no clear preference was depicted. Additionally, low scores on individualism (38.7) and masculinity (8.3) dimensions shows that the Zimbabwean culture is typified by collectivism and femininity.

4.1.1.2. Food safety governance approach. Table 4 shows results for the food safety governance approach from the FSAs and QA managers' perspectives. Only on the specificity of food safety regulations and type of assessments did both FSAs and QA managers have aligned perspectives. Both perceived food safety regulations to be

Table 3
Scores for national values based on the value surveys module.

Cultural Dimension	Score
Power distance	68.6 (high power distance)
Individualism	38.7 (collectivism)
Masculinity	8.3 (femininity)
Uncertainty Avoidance	57.2 (intermediate)
Long-Term Orientation	18.3 (short-term orientation
Indulgence vs restaint	61.8 (indulgence)

Based on 190 respondents.
Interpretations based on Hofstede et al. (2010) where a high score on power distance refers to high power distant cultures and low score refers to low power distant cultures. Low scores on individualism, masculinity, uncertainty avoidance, long-term orientation and indulgence refer to collectivist, feminine, low uncertainty avoidance, short-term oriented and restrained cultures whereas high scores refer to individualistic, masculine, high uncertainty avoidance, long-term orientation and indulgent cultures. Intermediate scores indicate no preference.

Table 4
Frequency of scores for the food safety governance approach from the food safety authorities and QA managers perspective.

Characteristics	Food safety authorities (N = 3)			QA managers (N = 8)			Qualitative Data
Score	1	2	3	1	2	3	
Status of food safety regulations	**3**			2	**6**		Food safety authorities unanimously agreed on food safety regulations being out-of-date and unusable. Majority of companies indicated regulations as relevant and useful to a certain extent. Only M1, an international company was aligned with the food safety authorities
Specificity of food safety regulations	**2**	1		**5**	2	1	2/3 Food safety authorities emphasised that food safety regulations are written in general terms and leave much room for interpretation, and a majority of the QA managers perceived so too.
Enforcement practices	**3**			4	4		Food safety authorities unanimously stressed that they penalized those who did not comply. Whilst some QA managers agreed with the food safety authorities, others felt that the food safety authorities provided assistance e.g. reference standards, training.
Type of assessments	**2**		1	4		4	Inspections were done by two food safety authorities. However, the other also provides 3rd party audits. Some QA managers scored 1 or 3, in alignment with food safety authorities.

Scores 1, 2, 3 represent unsupportive, restricted support and supportive respectively. The food safety authorities were from 3 different institutions and the QA managers were from 8 different companies as 1 QA manager mentioned they did not know the answers.

unsupportive (score 1) and type of assessments as either unsupportive or supportive (score 3). Both authorities and QA managers agreed that the legislation was written in general terms, leaving room for different interpretations. Interestingly, authorities indicated the status of food safety regulations as reactive, whilst companies perceived it to provide restricted support (score 2) except for M1, which was aligned with the authorities.

Overall, both described the food safety governance approach as fragmented, without clear structures of authority, and somewhat punitive with outdated and generic legislation. Moreover, legislation was only available upon request as mentioned by authorities:

> *"If you don't know that legislation or updates have been gazetted then you will be in the dark as legislation is upon request and at times you have to go and buy it"***.**

4.1.2. Internal company environment

4.1.2.1. Company characteristics. Table 5 shows the data to typify the internal company environment. At least five companies produced for export, whilst the rest produced for local markets. Those producing for the export market mostly had implemented HACCP and/or private standards, but companies producing for the local market did not have a certified FSMS. Overall, there were no distinct differences between the low, medium, and high-risk companies regarding the other characteristics. The only difference was that most low and medium-risk companies (4/5) exported some of their products, whereas most high-risk companies (3/4) mainly produced for the local market.

4.1.2.2. Formal food safety program. Table 5 also shows results of the assessment of the formal food safety program. Only M1, an international company, scored 3 as they had a well-designed food safety program and were FSSC certified. Even though H3 and H4 produce high-risk products, they overall scored 1 as they did not have any formal food safety program. Only H1 scored 2 overall, with a score 2 for design, documentation and verification and score 1 for validation as it was not done. Also, L2 scored overall 2; they designed their FSMS based on ISO22000 but were not certified. The other companies overall scored 1_2, because of poor design, and/or lack of validation, limited verification and poor documentation.

4.1.2.3. Vulnerability of food production system. Assigned scores (Table 5) to determine the vulnerability of the food production system overall confirmed that L1, L2 and L3, were low-risk, M1, M2 were medium-risk, and H1, H2, H3 and H4 were high-risk companies. However, even though companies produced similar products with similar riskiness, companies sometimes differed in the specific product and production characteristics, which means they actually differed in vulnerability. For example, L1, L2 and L3 differed in raw material storage requirements and degree of automation.

4.2. Food safety output

Table 6 shows that better performing companies (H2, M1, M2 and L1) had a moderate (score 2) to good (score 3) food safety performance. Companies H3, H4, and L1, L2, L3 did not perform any food safety (microbial or chemical) analysis, even though H3 and H4 produced high-risk products. All these companies, except for L2, did not have a complaints system in place, questioning how they control the food safety performance of their products. Companies H1 and H2, producing similar high-risk products, performed similarly, with the exception of the complaints system, which was absent in H2. Results from the analysis of the microbial data and customer complaints were mostly consistent with the food safety performance level as indicated by the QA manager using the FS-output questionnaire (Table 4). However, the QA managers in H4, H3, and L1 assigned higher scores for the performance of their system, which was not corroborated by the actual data on food

Table 5
Company characteristics, food safety program and vulnerability of food production system as assessed for the low, medium and high-risk food companies.

Internal company environment	Company								
	Low-risk			Medium-Risk		High-risk			
	L1	L2	L3	M1	M2	H1	H2	H3	H4
Company Characteristics									
Product type	Baked	Baked	Vegetables	Juice, cordials	Juice	Dairy	Dairy	Meat, Pastries	Dairy
Company size [a]	M	L	S	L	M	M	M	S	S
Local or export products	Local	Export	Export	Export	Export	Export	Local	Local	Local
FSMS implemented	None	ISO 22000, ISO/TS 22002	Global Gap	FSSC 22000, ISO 22002–4: 2013	HACCP	ISO 22000:2005, ISO/TS 22001:2009	HACCP	None	None
FSMS certified	None	None	Global Gap	FSSC 22000:2005	None	ISO 22000:2005	None	None	None
Type of ownership	Private	Private	Private	Private	Private	Private	Private	Private	Private
Organisational structure [b]	Central	Decentral	Central	Decentral	Central	Central	Central	Central	Central
Food Safety Program									
Design *(sources)*	2	3		3	2	2	1	1	1
Validation	1	2		3	2	1	2	1	1
Formal documentation *(characteristics, updating, accessibility)*	1	1		3	1	2	1	1	1
Verification	2	1		3	1	2	2	1	1
Overall assigned score [c]	**1_2**	**2**	[d]	**3**	**1_2**	**2**	**1_2**	**1**	**1**
Vulnerability of food production system									
Product characteristics									
Type of raw materials	1	1	1	2	1	3	3	3	3
Raw material storage	2	1	1	3	1	3	3	3	3
Product properties	1	1	3	1	1	3	3	3	3
Product heat treatment	2	1	1	2	2	3	2	2	3
Final product packaging	1	2	1	2	2	2	2	2	2
Overall score product characteristics	*1_2*	*1*	*1_2*	*2*	*1_2*	*3*	*2_3*	*2_3*	*3*
Production Characteristics									
Intervention steps	1	2	1	2	2	1	1	2	2
Process characteristics	1	3	3	1	3	1	1	3	2
Process design	1	3	1	2	1	3	2	2	2
Overall score production characteristics	*1*	*2_3*	*1_2*	*1_2*	*2*	*1_2*	*1_2*	*2_3*	*2*
Overall assigned score	**1**	**1_2**	**1_2**	**2**	**1_2**	**2_3**	**2_3**	**2_3**	**2_3**

[a] S, M, L refers to Small, Medium or Large companies.
[b] Central refers to centralised and Decentral to decentralised.
[c] Assigned Scores based on Luning et al. (2011) and Sampers et al. (2012), If the mean score was between 1 and 1.2 then assigned score 1, between 1.3 and 1.7 (assigned score 1_2), between 1.8 and 2.2 (2), between 2.3 and 2.7 (2_3), and between 2.8 and 3.0 (3). Scores 1, 2, 3 for the food safety program respectively represent unsupportive, restricted support, supportive. For vulnerability of the food production system, scores 1, 2 and 3 respectively refer to high, potential and unlikely susceptibility to contamination.
[d] Not evaluated as person responsible was not available.

safety and hygiene performance in their documents.

4.3. Prevailing FS-culture

4.3.1. Enabling conditions

Fig. 2 shows scores for the organisational and technological conditions used in assessing the prevailing FS-culture based on card-aided interviews with the food handlers. H1, M1, and L1predominantly scored 3 for most of the technological and organisational conditions, signifying that these companies, which differ in product riskiness, were all supportive to food safety and hygiene. H2, H3, M2, and L2, also differing in product riskiness, predominantly scored 2, indicating restricted support, whereas H4 and L3 mostly scored 1, demonstrating lack of support. Of interest was that most companies, regardless of their level of product riskiness, scored 3 for the communication system and adequacy of time (both organisational conditions), as they had good communication systems and had sufficient time for food safety and hygiene activities. However, some food handlers raised concerns, e.g. in H3, a food handler said:

> "Sometimes there isn't enough time as the demand will be so high. It will be "hurry, hurry" as orders will be supposed to be dispatched …, … We then have insufficient time for hygiene tasks but sometimes it is sufficient when we have less orders".

Regarding the training program, food handlers in most high-risk companies perceived training to be generic (score 1), whereas in most low and moderate-risk companies these scored 2 and 3.

For the technological conditions, handwashing facilities mostly scored 3, as food handlers perceived them to be enabling in all the companies. In contrast, food handlers in most high-risk companies (H2, H3, H4) regarded the protective clothing to be inadequate (score 1), whereas food handlers in most low and moderate-risk companies regarded protective clothing to be adequate (score 3) except for L1, which scored 1. The low score (1) was attributed to the lack of additional protective clothing such as face masks, gloves, and cold-room suits required in the high-risk companies. Food handlers stated:

> "Protective clothing is not adequate, we have one set only …, There is no protective clothing, we use our own …, What we have is torn"

Food handlers in most low-risk companies (L2, L3) perceived equipment to be not hygienically designed (score 1) and equipment maintenance to be generally breakdown related (score 1). Food handlers in H2, H4 also mentioned breakdown maintenance to be prominent as illustrated in the text below:

> "They fix machines when told …, If a machine does not have a problem, it is not fixed/serviced"

4.3.2. Employee characteristics

4.3.2.1. Attitude. Fig. 2 also presents results of the assessment of

Table 6
Assigned scores for food safety output.

Characteristics	Company								
	Low-risk			Medium-Risk		High-risk			
	L1	L2	L3	M1	M2	H1	H2	H3	H4
Food Safety Performance Indicators									
External food safety performance indicators									
FSMS evaluation	2			3	1	2	2	1	2
Seriousness of remarks of FSMS evaluation	3			2	1	1	1		1
Customer complaints-microbial	3	3		2	3	2	2	2	3
Customer complaints- hygiene	2	1		3	3	1	3	3	3
Internal food safety performance indicators									
Product sampling	2	1		3	3	3	3	3	2
Judgement criteria	3	1		3	3	3	3	1	2
Hygiene and pathogen non-conformities	3	1		1	2	1	2	1	1
Overall assigned score [a] [b]	**2_3**	**1**	[f]	**2_3**	**2_3**	**2**	**2_3**	**1_2**	**2**
Actual food safety and hygiene performance									
Microbial Analysis -Yeasts and Moulds[c] [d]	X	X	X	100	86–100	59–61	61–63	X	X
Microbial Analysis - Coliforms[c] [d]	X	X	X	100	10–86	87–97	88–95	X	X
Quality complaints[c] [e]	X	100	X	71	100	34	X	X	X
Microbial safety complaints[c] [e]	X	0	X	29	0	66	X	X	X

[a] Assigned Scores.
[b] If the mean score was between 1 and 1.2 then assigned score 1, between 1.3 and 1.7 (assigned score 1_2), between 1.8 and 2.2 (2), between 2.3 and 2.7 (2_3), and between 2.8 and 3.0 (3) (https://www.sciencedirect.com/science/article/pii/S095671351100291X Jacxsens et al., 2010).
[c] Document analysis.
[d] % product conformance to microbial requirements.
[e] % complaints related to quality or microbial safety.
[f] Not evaluated as person responsible was not available. X –not done at the company. Score 1 = poor, 2 moderate, 3 good.

employee attitudes. Food handlers in L2, M1, and M2 predominantly scored 3, signifying strong and positive attitudes towards the food safety and hygiene tasks. Most food handlers in H1 and L1 also had positive attitudes, although some showed ambivalence (score 2), indicating an uncertain predisposition to comply with food safety and hygiene requirements. For H2 and H3, food handlers had ambivalent attitudes, and in L3 they even had a negative attitude (score 1), reflected in the lack of regard for food safety/hygiene issues unless compelled to.

With respect to handwashing requirements, food handlers in most companies (7/9) had negative attitudes (score 1), except in H1 and H3 were food handlers demonstrated ambivalent attitudes. Of concern was the attitude towards cleaning and sanitation of food handlers in all high-risk companies, L1 and L3 as these were mostly ambivalent.

4.3.2.2. Risk perceptions. Fig. 2 shows the results of the risk perception assessment. Food handlers in 2 out of 4 high-risk companies (H2, H3) revealed appropriate risk-perceptions (score 3), signifying that they were sufficiently aware of the risks posed on consumers by food safety and hygiene issues. Results also show that food handlers in both medium-risk companies predominantly scored 3. On the contrary, H1, H4 and all low risk companies predominantly scored 1 and 2, which reflects that their food handlers lack or have an inadequate perception of the food safety and hygiene risks.

With respect to the perceptions towards their safety and hygiene tasks, food handlers in all companies consistently scored 2 for risk perceptions regarding working while wearing jewellery. Moreover, in most companies (7/9), (except L3 and H4), food handlers revealed ample awareness (score 3) of the risks of microbial contamination when appropriate corrective actions were not followed. Likewise, food handlers in high and medium-risk companies demonstrated ample awareness (score 3) of the risks associated with inadequately sanitizing equipment when compared to L1, L3 and H4 (score 2), which demonstrated inadequate awareness.

4.3.2.3. Food safety and hygiene perceptions. Results in Fig. 2 show a mode score of 1 on food safety and hygiene perceptions for all companies. This indicates that food handlers in all companies had incorrect food safety and hygiene perceptions, which were not aligned with company requirements.

4.3.2.4. Intended behaviour. Food handlers in all companies predominantly scored 3 on intended behaviour (Fig. 2). This implies that food handlers were strongly inclined not to engage in risky behaviour. An exception was L3, where food handlers were moderately inclined to engage in risky behaviour regarding the control of crucial parameters (score 2).

4.4. Actual behaviour

Table 7 shows mode scores for actual food handler behaviour. Food handlers in H1, M1, and L1 correctly executed all personal hygiene, sanitation, and crucial process control requirements (score 3). However, results indicate that food handlers in all other high-risk companies (H2, H3, H4) did not follow multiple personal hygiene requirements (score 1). Likewise, food handlers in L2 and M2 did not execute multiple personal hygiene requirements (score 1), and food handlers in L2 performed all sanitation activities inadequately (score 2); two companies, H4 and M2, had a cleaning department and dedicated cleaning staff and these practices were not observed as the study was restricted to food handlers in direct contact with food.

4.5. Statistical analysis

Multiple linear regression (Table 8) shows which FS-culture variables significantly ($p < 0.05$) contributed to actual food handler behaviour and statistical associations. Training, time, protective clothing, sanitation, handwashing perceptions, attitude on control of crucial parameters, and intended corrective action behaviour explained 61% (adjusted $R^2 = 0.607$) of the variation of the actual personal hygiene behaviour. With actual sanitation behaviour as the dependent variable, time, sanitation, protective clothing, hygiene design, risk perceptions (on handwashing and corrective actions), perceptions on sanitation efficacy and intended personal hygiene behaviour explained 51.4% of

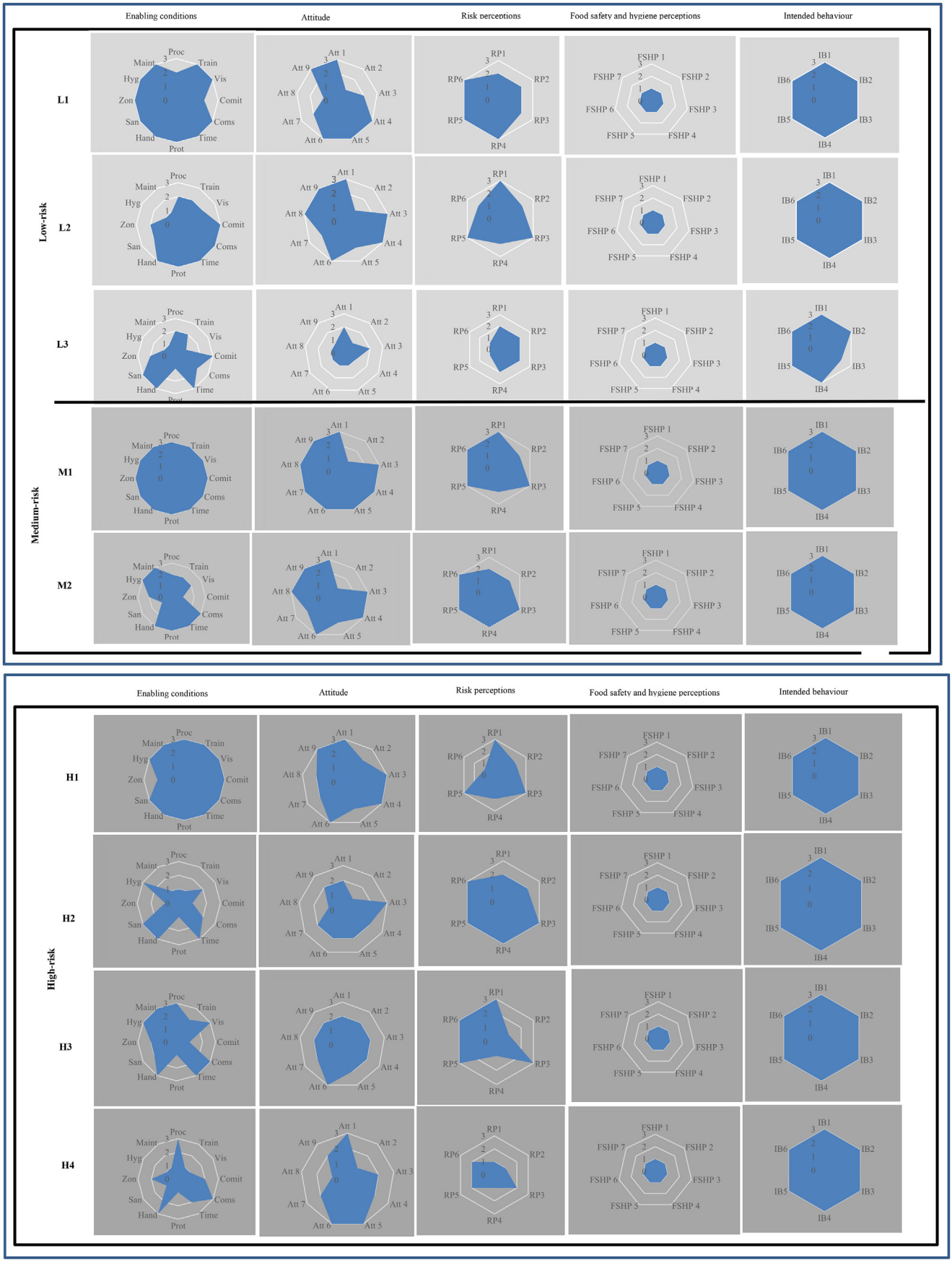

Fig. 2. Spider webs depicting the prevailing FS-culture for all 9 companies based on overall scores of the FS-culture indicators.
Scores 1,2, 3 reflect characteristics typical for reactive, active and proactive FS-culture. Detailed Interpretation of the scores is given in Table 2. Highly coloured web diagrams for both enabling conditions and employee characteristics corresponds with a proactive FS-culture i.e. the greater the surface area of the web diagrams the more proactive the FS-culture (Nyarugwe et al., 2018).

Table 7
Mode scores for actual execution of personal hygiene behaviour, sanitation activities and control of process parameters.

Observed behaviour	Company							
	Low-risk		Medium-Risk		High-risk			
	L1 [c]N = 10	L2 N = 27	M1 N = 23	M2 N = 9	H1 N = 10	H2 N = 16	H3 N = 10	H4 N = 10
Actual Behaviour								
Actual execution of personal hygiene behaviour								
Maintenance of high degree of personal cleanliness	3	3	3	3	3	3	3	3
Hand washing practices	3	2	3	1	3	1	2	1
Hand washing steps	3	**1**	3	**1**	3	**1**	**1**	**1**
Personal habits	3	**1**	3	**1**	3	**1**	**1**	**1**
Overall score personal hygiene practices	**3**	**1**	**3**	**1**	**3**	**1**	**1**	**1**
Actual execution of sanitation activities								
Following procedures for cleaning and disinfection	3	**2**	3	[b]	3	**3**	**2**	[b]
Correct cleaning compounds used	3	**2**	3		3	**3**	**2**	
Correct cleaning tools used	3	**2**	3		3	**3**	**2**	
Sanitation activities and/or efficacy monitored with microbiological sampling	3	2	3		3	3	2	
Overall score sanitation activities	**3**	**2**	**3**		**3**	**3**	**2**	
Actual control of process parameters								
Appropriateness of monitoring time-temperature parameters during processing	3	**3**	3	**3**	3	**3**	[a]	**3**
Corrective actions taken when time-temperature parameters deviate from required levels	3	**3**	3	**2**	3	**3**	**2**	**2**
Overall score control of process parameters	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**2**

[a] Monitoring done by QC and not food handlers.
[b] These were designated cleaners from the company's own cleaning department who were not part of food handlers, [c]N is for observed food handlers. Score 1 = non-compliance, 2 = partial compliance, and 3 = full compliance.

the variance. Commitment, sanitation practices, maintenance, protective clothing, perceptions on handwashing and execution of corrective actions, and intended behaviour towards corrective actions for sanitation explained 43% (adjusted $R^2 = 0.430$) of the variation for actual control of crucial process parameters.

5. Discussion

5.1. Prevailing food safety culture as related to product riskiness

This study investigated whether companies differing in product riskiness (low, medium and high) exhibit differences in their prevailing FS-culture, assuming that high-risk companies are more likely to have a proactive FS-culture. However, our results indicated that companies exhibited different FS-cultures, regardless of product riskiness. More specifically, our findings showed that for high-risk companies, only H1 reflected a proactive FS-culture. On the contrary, H2 and H3 showed an active, and H4 a reactive prevailing FS-culture (Fig. 2). Concerning medium-risk companies, M1 revealed a proactive FS-culture as food handlers highly regarded food safety and hygiene issues, whereas M2 exhibited an active FS-culture as enabling conditions were not always supportive. With respect to the low-risk companies, L1 showed a proactive FS-culture as the company and food handlers highly prioritised food safety and hygiene (predominantly score 3), whereas L2 and L3, respectively, depicted an active and a reactive FS-culture as scores implied restricted (score 2) or low (score 1) support for food safety. These findings are corroborated by De Boeck et al. (2018a), who did not find a significant correlation between food safety climate and food sector (i.e. foods of animal and non-animal origin), although they did not specify product riskiness.

Our data for companies operating in a transition economy indicate that the prevailing FS-culture cannot be attributed to product riskiness alone. This could be because in a transition economy, companies inevitably operate in a constantly changing external environment. Other variables explored in this study could have moderated the relationship between product riskiness and FS-culture, which will be further discussed.

5.2. Common characteristics in the prevailing FS-culture of participating companies

The nine companies showed several similarities in the assessed FS-culture elements. The most obvious similarities were related to the food safety and hygiene perceptions (Fig. 2), which were incorrect (score 1) and not aligned with company specifications. It could be because some companies (H3, H4 and L1) had no written procedures for personal hygiene. For example, H4 did not have food safety programs or specific personal hygiene and sanitation procedures. Moreover, H3, H4, L1, L2, and L3 did not perform hygiene checks (Table 6), which could also explain the incorrect perceptions. Regardless of incorrect perceptions, food handlers in all companies were strongly inclined not to engage in risky behaviour (Fig. 2) as all companies predominantly scored 3. Food handlers who highly perceive their organisation to be supportive to food safety, are more inclined to execute work tasks as required (Griffith, Livesey, & Clayton, 2010), which was not the case in this study. Even though food handlers were inclined to execute work tasks as required, only food handlers in companies H1, M1 and L1, which had a proactive FS-culture, actually executed work tasks as required as compliance behaviour predominantly scored 3 (Table 7).

Regarding the enabling conditions, we also found similarities among the companies. Food handlers in most companies (7/9) perceived the food safety communication system as supportive (score 3) (Fig. 2). Communication is crucial for organisational effectiveness as it enhances understanding of food safety information (De Boeck et al., 2015; Griffith et al., 2010, 2017). However, food handlers mentioned that there were no checks to verify whether the information was understood. Griffith et al. (2017) found checks and assessments necessary to ensure effectiveness of communication, which could explain the inadequacies in observed tasks. Food handlers also perceived time as sufficient as companies maintained a good balance between production, and food safety and hygiene activities (Fig. 2). Time is a crucial factor to consider in assuring FS-culture. Findings by Fatimah, Strohbehn, and Arendt (2014b) stressed that time affects compliance to food safety practices. Handwashing facilities were also considered to be adequate and food handlers were satisfied with them (Fig. 2). On the contrary, most food handlers had incorrect handwashing perceptions and incorrectly washed their hands in actual practice (Table 7), which could

Table 8
Possible determinants of actual personal hygiene, sanitation and control of crucial process parameters.

Characteristics	Personal hygiene		Sanitation activities		Control of Crucial Parameters	
	Standardised Coefficients Beta, β	Significance ($p < 0.05$)	Standardised Coefficients Beta, β	Significance ($p < 0.05$)	Standardised Coefficients Beta, β	Significance ($p < 0.05$)
Organisational and Technological enabling conditions						
Training	0.375	0.00	-	–	–	–
Commitment	–	–	–	–	0.224	0.03
Time	−0.354	0.00	−0.282	0.01	–	–
Protective clothing	0.410	0.00	0.455	0.00	0.232	0.03
Sanitation	0.301	0.00	0.263	0.04	0.353	0.00
Hygiene design	–	–	0.214	0.018	–	–
Maintenance					−4.94	0.00
Employee Characteristics						
Attitude on corrective actions on crucial parameters	0.206	0.02	–	–	–	–
Risk perception on handwashing	–	–	−0.359	0.00	–	–
Risk perceptions on corrective actions for crucial parameters	–	–	0.279	0.03	–	–
Perceptions on handwashing procedure	0.280	0.00	–	–	0.189	0.022
Perceptions on corrective actions for crucial parameters	–	–	–	–	0.197	0.013
Perceptions on sanitation efficacy checks	–	–	0.201	0.013	–	–
Intended personal hygiene behaviour	–	–	−0.437	0.00	–	–
Intended correction action behaviour	0.201	0.02	–	–	–	–
Intended corrective actions on sanitation requirements	–	–	–	–	−0.227	0.02

Only significant determinants are indicated in this table. Adjusted R^2 values were 0.607, 0.514, and 0.430 for possible determinants of personal hygiene behaviour, sanitation activities and control of crucial parameters respectively.

be caused by inadequate training and or ambivalent attitudes (Fig. 2). Statistical analysis proved ($p < 0.05$) handwashing perceptions to be a determinant of actual hygiene behaviour.

5.3. Prevailing FS-culture and food safety output

Some associations between the prevailing FS-culture and food safety and hygiene performance were observed. For M1, we found that the positive FS-culture was associated with a good food safety performance. Also, the reactive FS-culture in H3 and L3 was consistent with the poor food safety performance in these companies. Both De Boeck et al. (2016) and Nyarugwe et al. (2018) reported that companies with a positive FS-culture and a well-elaborated FSMS had a better microbiological safety performance. However, in other companies the prevailing FS-culture was not necessarily reflected in the food safety performance, e.g. H4 had a reactive FS-culture (Fig. 1) and a moderate food safety performance (Table 6), L2 with an active FS-culture showed a poor food safety performance, and H1with a proactive FS-culture had a moderate food safety performance. Findings are consistent with Nyarugwe et al. (2018), who also found that the prevailing FS-culture in some companies was not associated with food safety performance due to, e.g. extent of supportiveness of the company to food handlers when executing their tasks, i.e. whether the organisational and technological conditions enabled or hindered food handlers to appropriately execute their food safety tasks. In addition, the attitudes of the food handlers, alignment in perceptions of the food handlers, absence/presence of complaint systems and microbial analysis, and product sampling were also found to have influenced this association. M1 was the only international company and showed a proactive FS-culture. This finding is corroborated by our previous study (Nyarugwe et al., 2018), where a subsidiary of a multinational company also had a proactive FS-culture and performed better than companies operating within country boundaries. We therefore suggest to compare local versus multinational companies as a determining factor. Our reasoning is that although these multinationals adapt to the organisation's national culture, they tend to keep the national culture of the headquarters as a frame of reference (Ghemawat & Reiche, 2011; Hofstede et al., 2010).

5.4. Internal company characteristics

5.4.1. Prevailing FS-culture in view of companies' food safety program

Nowadays, companies are expected to have a food safety program in place to show their measures to manage food safety issues. In our study, most companies (6/9) did not have an established certified system. The majority implemented some form of food safety program, but most were evaluated as low to moderate because of inadequacies or constraints in design, validation, verification and or documentation (Table 5). Surprisingly, some exporting companies also did not have a sufficient program, and if they had one, they did not meet microbial specifications or check for food safety and hygiene performance, which is a prerequisite in FSMS (Table 6). This questions the utility of audits and inspections, as in the past, companies with certified FSMS have recorded inconsistences in microbial safety and reported food safety outbreaks (Powell et al., 2013). Moreover, De Boeck et al. (2015) found that having a FSMS is no guarantee of a good FS-culture and food safety performance.

Furthermore, we observed that large companies (M1, L2) implemented ISO22000/FSSC22000 and that the exporting companies (H1, M1, M2, L2, L3) had some form of implemented or certified food safety program (Table 6). This could have prompted companies to depend on their programs to mitigate food safety issues. Moreover, we found that low-risk companies did not check for food safety performance (Table 6). This leads us to postulate that the large, exporting and low-risk companies could have been complacent, which might explain why we did not find differences in the prevailing FS-culture between the companies. The Consumer Goods Forum (CGF) (2011) indicated that complacent companies are often not rigorous, as they believe in their systems. This could negatively impact the prevailing FS-culture.

5.4.2. Prevailing FS-culture in relation with food production system vulnerability

In our study, companies with products belonging to the same risk category (low, medium, high) differed in the degree of vulnerability of their food production system (Table 5). Thus, companies within the same risk category were not homogeneous, which could have contributed to the absence of distinct differences between the prevailing FS-culture and product riskiness. For example, even though M1 and M2 both produced medium-risk products, M1 applied stricter storage conditions for raw materials and the process was fully automated, whereas M2 had too much product handling. The companies also differed in their actual production characteristics as M1 produced cordials and fruit juices made from concentrates, and M2 produced fruit juices and concentrates made from fresh fruit. Sawe et al. (2014) found that the actual product and production characteristics of companies processing similar products, i.e. fresh produce, differed due to differences in product variety, initial raw materials, final product composition, process conditions and intervention strategies. These differences prompted companies to adopt dissimilar processing conditions to suit their production circumstances. Companies in the same product riskiness category could have therefore addressed food safety concerns differently to match their production circumstances, thus attributing to differences in the prevailing FS-culture amongst the companies.

Furthermore, we found in our study that companies with less vulnerable production systems do not necessarily have a reactive FS-culture as companies differing in the degree of vulnerability of the food production system differed in the prevailing FS-culture. For example, L1 had the least vulnerable production system but had a proactive FS-culture (Table 5, Fig. 2). L2, L3 and M2 also showed less vulnerable production systems and exhibited an active, reactive and active FS-culture, respectively. A reactive situation is unwanted for all levels of system vulnerability because it implies that action is only taken when there is a situation that needs to be controlled, i.e. corrective actions are only done when a problem has already occurred as also defined by Wright, Leach, and Palmer (2012).

5.4.3. Prevailing FS-culture in relation with other company characteristics

Regarding other company characteristics, we observed that most companies (6/9) employed contract workers (Table 1). This could cause a high employee turnover, which is characteristic for a high-risk organisation situation (Luning et al., 2011). The importance of a stable workforce composition for proper execution of food safety and hygiene has been stated before (Bas, Yuksel, & Cavusoglu, 2007; Walker, Pritchard, & Forsythe, 2003). Contract workers, except in M1, were considered to be temporarily affiliated with the companies. The companies sometimes did not invest in their training, incentives, and protective clothing, which could have also influenced food handler perceptions on the prioritization of food safety and hygiene in the companies. Findings were corroborated by regression analysis where training, commitment and protective clothing were found to be predictors ($p < 0.05$) of food handler behaviour. Subcultures could have been created as employees might have felt segregated because of the unequal treatment. Furthermore, during interviews it became clear that support functions of engineering and accounting were often highlighted as bottlenecks to food safety progression evidenced by the following statements:

> "When we request for example hand towels, or new sinks, finance always gives us a hard time …, Machine spares are not being bought …", "When machines are broken down, they can go 24 hours without running …, When we request something to be fixed, they are not active, unless there is complete breakdown".

Based on our findings, both employee segregation and

departmentalisation could have created subcultures. According to Cooper (2000), subcultures form around or emerge from functional roles/groups and hierarchical levels. Moreover, subcultures have been observed to oppose, support or interact with the prevailing FS-culture by either constraining or enabling it (Manning, 2017).

5.5. External company characteristics

5.5.1. Food safety governance

Manning (2017) mentioned that an organisation's FS-culture is not isolated as it is interlinked with the external company environment. In our study, we observed that the Zimbabwean legislation and enforcement practices were inadequate (Table 4), which was reflected in how some companies (H4, H3 and L1) operated without a food safety program and did not check for compliance to food safety and hygiene requirements (Table 5). Moreover, for all companies except for M1, the food safety programs were inadequately designed and implemented due to inadequate support from the FSAs, evidenced by the out-of-date, unusable legislation, which was also written in general terms, i.e. non-specificity, thus leaving room for different interpretations by the companies (Table 4). FSAs also indicated that they did not provide assistance to companies in cases of non-conformance as they lacked the resources to do so and QA managers stated that inspections were not regularly done. The non-specificity of the regulations and inconsistencies in assessments could explain why some companies did not check for food safety performance. Findings are consistent with Pswarayi et al. (2014) and Macheka et al. (2013) who found inconsistencies in inspection services, with some companies going two years without inspection, food monitoring, and information or training by food safety authorities. Pswarayi et al. (2014) also found that the country lacked the required resources to properly monitor food safety performance.

Non-alignment of authorities and companies in food safety governance shows the inadequacy to support companies to practice and prioritise food safety. This probably contributed to differences in how companies managed food safety issues and could probably explain the prevailing FS-culture in the companies. For example, lack of adequate enforcement could have resulted in inadequate food safety and hygiene training, inadequate protective clothing that was sometimes unfit-for-purpose (e.g. torn), and equipment, which was inadequately designed for hygienic purposes (e.g. L2, L3) and poorly maintained (e.g. H2, H4).

Nayak and Waterson (2016), and Powell, Jacob, and Chapman (2011) highlighted that complacency could also emanate from the attitude at regulatory level, i.e. food safety authorities, where we observed that the food safety governance approach was unsupportive or provided restricted support to the companies. Our study seems to fit with the context of many transition economies, where companies operate within the confines of deficient food safety governance approaches. A study by Kussaga et al. (2014) on the status of the FSMS in various African countries corroborates our findings. This questions whether a study in a transition economy is decisive and can be generalised. This is because legislation in established economies such as the EU, Canada and the USA is more developed, uniform, proactive and a legal requirement (e.g. CFIA., 2012; EC., 2004; FDA, 2011). However, even in countries with similar prescribed legislation, enforcement strategies can differ (Kirezieva et al., 2015a). Our findings on food safety performance, food safety programs and characteristics of the prevailing FS-culture seem therefore consistent with our findings on the food safety governance approach.

5.5.2. National values

National values could also have explained our findings as the cultural dimensions were also reflected in the prevailing FS-culture, actual food safety and hygiene behaviour, and the food safety governance approach. This could be because individuals bring different beliefs, values, and attitudes to the workplace as reflected in their national culture (Lok & Crawford, 2004). Moreover, organisational culture studies have shown that operating in ways that are congruent with the cultural context can improve an organisation's performance (Burke, Chan-Serafin, Salvador, Smith, & Sarpy, 2008; Lok & Crawford, 2004). The current study showed that Zimbabweans have a higher power distance (PD), where inequality exists, demonstrated by the centralisation of most companies (Table 5). Food handlers were therefore limited in decision-making, as they indicated that decisions were made by management and they were told what to do. Moreover, food handlers were not free to approach their bosses. The onus was on management to prioritise food safety and support food handlers in executing their food safety and hygiene tasks. Wallace (2009) mentioned that a consultative management style coupled with information sharing evidenced in low PD could be more suitable in a food safety environment. However, proactiveness by key management in high PD environments could also be effective. Countries with a high PD score are expected to have a low score on individualism (Hofstede et al., 2010), which was indeed the case in our study. Hence, Zimbabweans are perceived to have collectivist culture, which was reflected in, for example, the food safety and hygiene training, which was done collectively as a group. Results are consistent with Seymen and Bolat (2010), who suggested that in collectivist cultures, training is focused at group level as it is considered most effective.

As a nation with a slight preference for avoiding uncertainty, Zimbabweans are risk-averse, only expressive to a certain extent and are not keen on accepting new ideas and responsibilities. As uncertainty avoidance cultures dislike ambiguous situations and prefer structured organisations with clear rules and regulations (Burke et al., 2008), this might explain the food safety and hygiene perceptions (Fig. 2), which were mostly incorrect and not aligned with company specifications as some companies did not have food safety programs (e.g. H4) and clearly written procedures (e.g. H3 and L1). A low score on the masculinity dimension indicated that Zimbabweans are feminine, which means that they are less assertive when compared to masculine cultures that are assertive, success-oriented and focus on getting the job done (Hofstede et al., 2010; Seymen & Bolat, 2010), and which could explain the restricted technological and organisational support given by a majority of the companies to the food handlers (Fig. 2). Moreover, feminine cultures rely on consensus-based decision-making, which was not the case in our study as decision-making was centralised. This possibly explains the incorrect food safety and hygiene perceptions, and the attitudes in most companies, where food handlers demonstrated negative to ambivalent attitudes except for L2, M1, and M2. Wallace (2009) suggested that femininity could be beneficial to achieving food safety as the ability to work in teams, which is characteristic of feminine cultures is essential for good food safety performance.

Zimbabweans are also short-term oriented, which is consistent with Hofstede et al. (2010). In short-term oriented cultures, organisations are likely to provide temporary measures to address food safety concerns (Taylor, 2011). This is reflected in the fact that most companies (6/9) did not have certified food safety programs in place to mitigate unexpected risks. Moreover, the FSAs had outdated and generic food safety legislation, which provided restricted support to companies. Harvey, Carter, and Mudimu (2000) had similar findings on national values of Zimbabweans, although they studied managers. Even though the companies operated within the confines of one country, differences could occur because organisations also have their own unique cultural traits (Seymen & Bolat, 2010). Moreover, the political and economic situation during the period of study was unstable. This could also have influenced perceptions and attitudes of respondents, and the way companies prioritised food safety in addition to actual behaviour. In general, a politically, economically and sociotechnically balanced environment is of importance to the decisive operation and performance of any business entity (Asdullah, Zohaib-ur-Rehman, & Ahmad, 2015).

5.6. Methodological considerations, limitations and research recommendations

Perceptions of respondents were evaluated to assess the prevailing FS-culture because individuals use perceptual cues to infer and make decisions about their environmental circumstances. However, individuals may perceive the same thing differently (Robbins & Coulter, 2007), and food handlers could have given socially desirable answers, a bias we need to acknowledge (Jespersen et al., 2017; Krumpal, 2013).

Although statistical analysis showed associations between some FS-culture variables and actual behaviour, some determinants appeared to be endogenous. This could be because sub-indicators were considered as equally contributing to the indicators. Further studies should consider only the most relevant sub-indicators and add weight factors to enhance robustness of associations. We acknowledge that only a few companies representing each level of riskiness agreed to participate in the research. More companies should be assessed to draw strong conclusions on the correlations between product riskiness and FS-culture. Further studies should also assess matched companies in terms of product and process vulnerability in addition to product riskiness to avoid the influence of other factors. Our study was restricted to food handlers. Further studies should also include other groups like the cleaning and equipment maintenance departments, as these could also give an indication of an organisation's FS-culture. Our findings on national values and food safety governance were used to explain some characteristics of the prevailing FS-culture. Comparison of companies operating in different countries is needed to be able to determine a statistical correlation with the prevailing FS-culture.

In assessing national culture, a comparison with other countries with matched samples is advocated. Our findings were limited to one transition country and gave insights in the prevailing FS-culture and possible influence of the company external environment as a basis for improvement policies that could fit the possibilities in transition economies. For the findings to be generalised, more research is needed in other countries differing in food safety governance approach and national values. The political, economic, and sociotechnical environment must be considered in FS-culture assessments as it may influence the way food safety is prioritised and perceived.

6. Conclusions

Assessment of the prevailing FS-culture in nine companies operating in a transition economy revealed no direct relationship between product riskiness and the organisation's prevailing FS-culture. Each company had its own prevailing FS-culture governed by the extent of supportiveness of enabling conditions and the characteristics of employees. Our study indicated that the external company environment was reflected in the food safety performance, food safety programs and characteristics of the prevailing FS-culture, and could have possibly shaped the way companies prioritised food safety and how food handlers behaved. Findings showed that food safety governance, a characteristic of the external environment, was inadequate and consistent with the way companies prioritised food safety, which was also inadequate, i.e. food safety programs in multiple companies were unsatisfactory. Moreover, findings on national values revealed that the cultural dimensions used to typify the external company environment were in line with and could have possibly explained the food safety governance approach, food safety programs, and characteristics of the prevailing FS-culture such as the supportiveness of the organisational and technological conditions (e.g. food safety and hygiene training, and management commitment), employee characteristics (i.e. attitude, and food safety and hygiene perceptions). Based on our findings companies need to consider these factors in their external company environment as the ability to adapt to the external company environment could be beneficial for food safety. The outcome of our findings contributes to understanding an organisation's prevailing FS-culture from a systems perspective. Our study did not show to what extent this external company environment influences FS-culture, which requires further elaboration by evaluating companies operating in countries differing in national values and food safety governance approach.

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Appendix A. Supplementary data

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