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3 Terminology and the understanding of Culture, Climate, and Behavioural Change –

4 Impact of Organisational and Human Factors on Food Safety Management

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15

16 Abstract

17 Background: The topic of food safety culture and climate is growing attention from industry,  
18 researchers, standards owners and certification bodies. Authors use the terms food safety  
19 culture and climate, however, there are no unified definitions to provide clarity on the  
20 meaning of these terms.

21 Scope and Approach: The objective of this study is to analyse the similarities and differences  
22 in current definitions and statements of Food Safety Culture and Food Safety Climate, and  
23 provide suggested clarifying definitions for both concepts, to bring a consistent approach to  
24 the field. The study evaluates the types of organisational cultures, climates and employees'  
25 behaviours which provide important differences and further insights into each of these.

26 Key Findings and Conclusions: Looking back at the origins of safety culture following the  
27 Chernobyl accident in the 1980's provides an understanding of how this laid the foundation  
28 for safety culture and climate in the UK. Reflecting on the increasing trend in Hazard  
29 Analysis and Critical Control Point (HACCP) breaches due to the increasing number of  
30 incidents reported to authorities, the study suggests an increased focus is needed on  
31 culture, climate, and behaviour in food businesses. A critical analysis of previous definitions,  
32 statements and common words currently used to describe culture and climate in published

33 definitions is provided. New definitions for food safety culture and climate based on factors  
34 shown to be important and are recommended for use by industry and researchers are  
35 proposed. The study assesses different types of culture, climate and employees, and  
36 suggests different employee behaviours impact the culture and climate of an organisation.

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38 Keywords:

39 Food Safety Culture, Food Safety Climate, Behaviour, Organisational Culture/Climate,  
40 Human Factors

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42 Highlights:

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44 1. Provides critical analysis of published culture and climate definitions and statements

45 2. Identifies common words and factors used in published definitions

46 3. Proposes new definitions for food safety culture and food safety climate

47 4. Explores how types of culture and behaviours may impact food safety

48 5. Highlights future research requirements for enhanced food safety performance

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52 **Introduction**

53 According to the World Health Organisation (WHO), one in ten of the global population  
54 experiences foodborne illness annually (WHO, 2017). Incidents (e.g., product withdrawal  
55 and recalls) have occurred across a number of countries (Table 1) and there is an increasing  
56 trend in the incidents notified to food authorities, with exception from the US Federal Food  
57 and Drug Administration (FDA), who have seen a declining trend.

58 *Table 1: Number of Incidents (e.g., product withdrawal and recalls) notified to authorities*  
59 *during 2 different time periods (www.food.gov.uk, www.foodstandards.gov.au,*  
60 *www.fda.gov, www.fsis.usda.gov)*

Location/Authority	2013/14	2016/17	% difference
Australia & New Zealand/ Food Standards Australia New Zealand (FSANZ)	42	72	+70
UK/Food Standards Agency (FSA)	1567	2265	+44
USA/United States Department of Agriculture (USDA)	75	122	+65
USA/US Federal Food and Drug Administration (FDA)	3844	2847	-26

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62 To limit the risk of foodborne illness, all food manufacturers and caterers must have a food  
63 safety management system (FSMS) in place. In addition, all businesses have a culture  
64 (organizational and food safety); however the question remains: what type of culture is  
65 prevailing and how it can be understood and used to prevent foodborne disease outbreaks.  
66 Whilst some argue that a Hazard Analysis and Critical Control Point (HACCP) plan with  
67 effective prerequisites in place is the most effective way to manage food safety (Griffith et  
68 al., 2010a; Wilcock et al., 2011), the data in Table 1 suggest that food safety breaches  
69 continue to occur, and it must be recognised that HACCP is just one tool within an FSMS,  
70 (Wallace, Sperber and Mortimore, 2018). Also, without there being a compliance culture  
71 where employees are more likely to engage in behaviours that collectively contribute to  
72 organisational compliance (Interligi, 2010), there is room to improve culture maturity. In the  
73 food safety context, this means that all reasonable precautions and all due diligence need to  
74 be completed truthfully and actioned appropriately by all personnel at all times. Where  
75 people fail to adhere to the procedures which control the hazards identified in the HACCP

76 plan, consumers and products are put at risk, which may lead to recalls or foodborne illness  
77 (Powell et al., 2011; Jespersen and Huffman, 2014).

78 Whilst some preceding studies exist linking climate to (workforce) safety (e.g. Keenan, 1951;  
79 Zohar, 1980), a key reference to the term safety culture followed the 1986 Chernobyl  
80 accident, and subsequently this has been at the forefront of thinking with regards to health  
81 and safety (people safety) in the UK ([www.hsl.gov.uk](http://www.hsl.gov.uk), Griffith et al., 2010a; Zohar, 2000).  
82 Decades have passed since the Chernobyl accident occurred, numerous papers have been  
83 published on the topics of organisational safety culture and climate and human factors  
84 pertaining to safety (Schein, 1985, 2017; Denison and Mishra, 1995; Denison, 1996; Hartnell  
85 et al., 2016; Reason, 2008, 2016). Where businesses operate in a high-risk environment the  
86 UK Health and Safety Executive provides guidance on how to manage health and safety.  
87 However, the application of organisational culture and climate in the food industry  
88 regarding consumer safety rather than personnel health and safety has been more recent.  
89 Regarding health and safety, Nayak and Waterson, (2017) report that there are many highly  
90 regulated industries around the world, including healthcare, nuclear and automotive. In  
91 China where coal mining is thought to be the riskiest industry, leadership has been found to  
92 support safety behaviour (Zhang et al., 2017). Likewise, in the food industry, when senior  
93 management drives a positive food safety culture, they are choosing to behave in a way that  
94 has the potential to reduce food safety incidents (Yiannas, 2009). Whilst learnings can be  
95 taken from other industries this study will focus on culture, climate, and behaviour with  
96 respect to food safety.

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98 Culture and climate (including food safety culture and climate) have been gaining much  
99 attention by researchers and practitioners with Denison (1995), Schein (1997), Griffith  
100 (2010a, 2010b), Guldenmund (2000) evaluating both aspects. However, there are still no  
101 consistent definitions of food safety culture and climate for use by industry practitioners  
102 and researchers. Zohar was one of the first authors to discuss organisational climate in the  
103 safety domain in the 1980s (Zohar, 1980); however, since this early work, published  
104 research has conflicting views between the definitions of culture and climate, whether from  
105 an organisational, people safety or a food safety perspective. This could potentially cause  
106 confusion in organisations seeking to understand their culture and climate and further  
107 research is needed to see if this has an impact on the organisation when they are in the

108 process of changing their approach to food safety. Denison (1996) debated the differences  
109 between organisational culture and climate, highlighting that when people come from  
110 different research backgrounds the words culture and climate mean different things.  
111 Denison considered climate as a transient situation, considering the thoughts, feelings, and  
112 behaviours of employees. These perceptions are subjective, a moment in time, and thus  
113 management can use their power and influence to change them. In comparison, culture is  
114 considered as an evolved concept which is rooted in history, is complex and adhered to by  
115 all (Denison, 1996). Due to the depth that culture is ingrained within the organisation, it is  
116 difficult to manipulate and change the culture. Schein (1985, p19) defines culture as “A  
117 pattern of shared basic assumptions learned by a group as it solved its problems of external  
118 adaptation and internal integration, that has worked well enough to be considered valid  
119 and, therefore, to be taught to new members as the correct way to perceive, think, and feel  
120 in relation to those problems”. Jespersen et al. (2016) adopted this definition when  
121 developing the theoretical framework for a food safety specific maturity model and Griffith  
122 et al. (2010a) stated that Schein was probably the most influential writer in organisational  
123 culture. Yiannas (2009) believes organisations can choose to create a strong food safety  
124 culture, with leaders who are accountable for instigating it as they have the power and  
125 influence to create a positive food safety culture. Further, where there is a good Food Safety  
126 Management System (FSMS) with a positive compliance culture, it is possible to reduce the  
127 risks to the consumer (Griffith et al., 2010a). This may be due to a combination of  
128 leadership, communication and FSMS compliance, as illustrated in the study by De Boeck et  
129 al. (2018), who found that one company with multiple food processing sites had a better  
130 food safety climate than a one-site operating company. The multiple site company was  
131 stronger in leadership, communication and commitment and this suggests that it could be  
132 due to a larger workforce requiring a structured approach (De Boeck et al., 2018). In  
133 addition, Ball et al. (2009) and Hinsz and Nickell (2015) showed predictive validity between  
134 culture and behaviours, and Denison (1996) showed the same through his organisational  
135 culture work. Nevertheless, the role of a leader, worker behaviour and the routes to  
136 changing and strengthening food safety culture and climate towards a more effective  
137 management of food safety within food businesses remain unclear.  
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139 The first objective of this study is to compare and contrast current definitions and  
140 statements of culture and climate (i.e. organisational, safety, and food safety) and provide  
141 suggested definitions for both concepts. This will allow these two distinctly different but  
142 related domains to be clarified for future research and industry applications. The second  
143 objective is to review and discuss knowledge of different types of climates and cultures to  
144 provide information on typologies of culture and climate, and to outline important  
145 differences and further insights into the impact of employee behaviour on culture and  
146 climate.

## 147 **Method**

148 A literature review was conducted using databases Science Direct and Emerald Insight, and  
149 grey literature such as industry reports. The search used keywords to find relevant material,  
150 for example; Senior management effects on food safety culture, assessment of food safety  
151 culture, food safety climate, measuring food safety culture, change management,  
152 behavioural change. Inclusion criteria were: (i) articles published in English, with a  
153 preference for peer-reviewed articles, (ii) scope of the article includes information pertinent  
154 to objectives of this study, (iii) article includes safety culture and climate definitions in food  
155 and other industries, management of culture, behavioural changes.

156 Titles and abstracts were reviewed for relevance based on whether they met the objective  
157 and inclusion criteria. Fifty-six articles meeting the criteria from 1980 to the present day  
158 were obtained and reviewed. Relevant content from each paper was categorised under  
159 themes to enable comparison of the content. In addition, citations and reference lists of  
160 these papers were reviewed to identify earlier seminal papers in the fields, which were also  
161 obtained and reviewed.

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163 Further categorisation of all definitions or statements was performed to enable a textual  
164 analysis to compare and contrast the definitions or statements.

## 165 **Definitions from literature**

166 Throughout the literature reviewed the terms culture and climate are defined and applied  
167 differently. Some authors believe they are intertwined e.g., Pettita et al. (2017), whilst

168 others e.g., Griffith et al. (2010a) and Denison (1995) discuss how they are different. Table 2  
169 provides an overview of the historical development of culture and climate definitions or  
170 statements quoted by authors working in the domains of organisational, safety and food  
171 safety between 1968 and 2018.

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Construct	Definition or Statement	Field	Reference
Culture and Climate	“the relatively enduring quality of the total organisational environment that a) is experienced by the occupants b) influences their behaviour, and c) can be described in terms of the values of a particular set of characteristics (or attitudes) of the environment”	Organisation	Tagiuri & Litwin (1968, p25) cited by Denison (1996, p626)
Culture and Climate	“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 to perceive, think, and feel in relation to those problems”.	Organisation	Schein (1985, p19)
Culture and Climate	“Belief and value structure members employ as they act in an organisation”.	Organisation	Poole (1985, p101) cited by Denison (1996, p633)
Culture and Climate	“the product of multiple goal-directed interactions between people (psychological), jobs (behavioural) and the organisation (situational) situations. In particular, safety culture is the observable extent to which all organisational members put their effort in improving safety on a daily basis.”	Safety	Cooper and Phillips (1995, p6)

Culture and Climate	“the relatively enduring quality of the total organisational environment that a) is experienced by the occupants b) influences their behaviour, and c) can be described in terms of the values of a particular set of characteristics (or attitudes) of the environment”	Organisation	<del>Tagiuri &amp; Litwin (1968)</del> cited by Denison (1996, p626)
Culture and Climate	“the attitudes, beliefs and perceptions shared by natural groups as defining norms and values, which determine how they act and react in relation to risk and risk control systems”.	Safety	Hale (2000, p7)
Climate	“[...] a summary of molar perceptions that employees share about their work environments”.	Safety	Zohar (1980, p96)
Climate	“shared perceptions among members of an organisation with regards to organisational policies, procedures and practices.”	Organisation	Zohar (2000, p587)
Climate	“a Specific form of organisational climate, understood as individual perceptions of policies, procedures, and practices relating to safety in the workplace”.	Organisation	Neal et al. (2000, p100)
Climate	A summary concept describing the employee’s beliefs about all the safety issues.	Safety	Guldenmund (2000, p222)
Climate	“Employees’ (shared) perceptions of leadership, communication, commitment, resources and	Food Safety	De Boeck et al. (2015,

	risk awareness concerning food safety and hygiene within their current work organisation”.		p244)
Climate	“considered more temporal and more subject to the perception of individual employees of an organisation or company”.	Organisation	De Boeck et al. (2018, p17)
Culture	“[...] a set of attributes that can be perceived about particular work organisations (maintenance, construction, and central repair shops) and which may be induced by the policies and practices that those organisations impose upon their workers and supervisors”.	Safety	Niskanen (1994, p241)
Culture	Safety culture is a set of prevailing indicators, beliefs, and values that the organisation owns in safety.	Safety	Fang et al. (2006, p574)
Culture	“The aggregation of the prevailing, relatively constant, learned, shared attitudes, values and beliefs contributing to the hygiene behaviours used within a particular food handling environment.”	Food Safety	Griffith et al. (2010a, p435)
Culture	Interplay of the food safety climate as perceived by the employees and the managers of a company (so called ‘human route’) and the context in which a company is operating, the current implemented FSMS, consisting out of control and assurance activities (so called ‘techno managerial route’) resulting in a certain (microbiological) output.	Food Safety	De Boeck et al. (2015, p243)
Culture	“Culture in general can be analysed at several different levels, with the term “level” meaning the degree to which the cultural phenomenon is visible to you as participant or observer.	Organisation	Schein and Schein

	These levels range from the very tangible, overt manifestations that you can see and feel to the deeply embedded, unconscious, basic assumptions that we are defining as the essence of culture or its DNA. In between these layers are various espoused beliefs, values, norms and rules of behaviour that members of the culture use as a way of depicting the culture to themselves and others.”		(2017, p17)
Culture	“shared values, beliefs and norms that affect mindset and behaviour toward food safety in, across and throughout an organization”.	Food Safety	GFSI (2018, p34)

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200 **Common words used in definitions or statements**

201 The overview of definitions or statements found in the literature shows that many of the  
 202 definitions combine culture and climate and relate to either organisation safety or food  
 203 safety. Further analysis of the language used across the three fields: culture, climate or a  
 204 combination; shows the top six words used in definitions are: perception (9) mainly used  
 205 when defining climate, belief (7), values (5) and behaviours (5) are all seen in culture and in  
 206 a combination of both culture and climate. Employees (8) are most commonly used when  
 207 defining climate and finally shared (6) was evenly noted by construct. (Table 3).

208

209 *Table 3: Common words used in definitions or statements and number of occurrences.*

Common words	Culture and climate	Climate	Culture	Total
Influences	1		0	1
<b>Behaviour</b>	<b>2</b>		<b>3</b>	<b>5</b>
<b>Values</b>	<b>3</b>		<b>2</b>	<b>5</b>
<b>Employees, workers, members, people</b>	<b>1</b>	<b>5</b>	<b>2</b>	<b>8</b>
Characteristics/Attributes	1		1	2
Attitudes	2		1	3
Pattern	1			1
<b>Shared</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>6</b>
Assumptions	1		1	2
<b>Perceive, Perceived, Perceptions</b>	<b>2</b>	<b>5</b>	<b>2</b>	<b>9</b>
<b>Belief</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>7</b>
Norms	1		2	3
Policy		2	1	3
Procedures		2		2
Practices		2	1	3
Leadership		1		1
Communication		1		1

Commitment		1		1
Hygiene		1	1	2
Learned	1		1	2

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211 Comparisons between culture and climate definitions or statements provided in Table 3  
 212 illustrate the complexity and potential for confusion. Phrases such as a ‘shared set of  
 213 assumptions, beliefs or attitudes’ are common themes in the culture and climate definitions  
 214 (Schein, 1985; Hale, 2000; Zohar, 2000; De Boeck et al., 2015; Niskanen, 1994; Fang et al.,  
 215 2006; Griffith et al., 2010a; GFSI, 2018).

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217 Niskanen (1994, p241) states that culture is “a set of attributes can be perceived about  
 218 particular work organisations”, the much earlier work by Tagiuri & Litwin (1968, p25)  
 219 contributes “the values of a particular set of characteristics”, and the Schein (1985, p19)  
 220 definition mentions, “a pattern of shared basic assumptions”.

221 Hale (2000) and Cooper and Phillips (1995) both intertwine culture and climate in their  
 222 definitions. Hale (2000, p7) refers to safety culture as “attitudes, beliefs and perception  
 223 shared by natural groups as defining norms and values”, whereas Cooper and Phillips (1995,  
 224 p6) define culture as “the product of multiple goal-directed interactions between people,  
 225 jobs, and the organisational situations”. Fang et al. (2006, p574) singularly defines culture  
 226 and also refers to “a set of prevailing indicators, beliefs and values that the organisation  
 227 owns in safety.”

228 Some of the safety climate definitions also reference shared perceptions in relation to the  
 229 working environment, rather than the deep-rooted values and beliefs seen in the culture  
 230 definitions (Zohar 1980, 2000). Nayak and Waterson (2017) suggest culture can be  
 231 considered as how people behave and climate is more about how they feel.

232

233 **Working towards a definition of food safety climate**

234 The summary of the definitions or statements detailed in Table 2 provides some insight into  
 235 the evolution of safety climate. The terms used to define safety climate have themes around  
 236 behaviours in the working environment, people, procedures and policies. Authors such as  
 237 Zohar (1980, 2000) and Neal et al. (2000) contribute definitions specifically for safety  
 238 climate: Zohar (2000) and Neal (2000) have similar definitions that focus on the organisation

239 and how the employees perceive the policies, procedures, and practices. Neal et al. (2000)  
240 specifically link the definition to safety in the workplace but Zohar (2000) suggests it's for  
241 every member of the organisation. Tagiuri and Litwin (1968) refer to the whole organisation  
242 considering how the climate is experienced by others and influences behaviours. Poole's  
243 (1985) definition refers to how members act in an organisation, whereas Schein's (1985)  
244 definition waits until a system has worked multiple times so it can be considered as valid,  
245 which is then seen as the correct way to perceive, think and feel in those situations. Hale  
246 (2000) has a similar definition: once attitudes, beliefs, and perceptions are shared it will  
247 "determine how they act and react to risk and risk control systems." A common thread in  
248 these climate definitions is perception and its role in how individuals act and interact.  
249 Denison (1996) argues that unlike organisational culture, organisational climate is less  
250 concerned about the evolution of social systems over time and more concerned with the  
251 impact that organisational systems have on groups or individuals. Organisational climate can  
252 also be considered in relation to the organisation's basic values and behaviour, which can be  
253 objectively measured through observable practices in the organisation (Schein, 1985).  
254 Denison cited Litwin & Stringer (1968) who consider the way in which social environment is  
255 experienced by others and how climate encompasses both organisational conditions and  
256 individual reactions, whereas Schein (1985) considers there to be more emphasis on how  
257 the social environment is created by others. Denison (1996, p624) builds on this stating  
258 climate "portrays organizational environments as being rooted in the organisation's value  
259 system" and considers climate to be temporary due to the members of an organisation and  
260 how they perceive the social environment. Denison (1996) argues there are three distinct  
261 approaches to study climate which consider 1) the perceptual measurement of individual  
262 attributes, 2) perceptual measurement of organisational attributes and 3) the multiple  
263 measurements of organisational attributes combining perceptual and objective measures.  
264 Thus, perception is a key factor of organisational climate as people's perceptions may  
265 change based on information and other conditions around them. The first approach  
266 considers the psychological climates, through studying the individual's perception of their  
267 working environments, whereas approaches two and three are more targeted to the climate  
268 within the organisation.  
269

## 270 **Working towards a definition of food safety culture**

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272 The summary of the definitions or statements detailed in Table 2 provides some insight into  
273 the evolution of culture. Schein defined culture as three layers considering the surface,  
274 intermediate layer and deep-rooted, where the surface is represented by artefacts and  
275 symbols that can be seen, the intermediate layer consists of values and beliefs, and the  
276 deepest culture is considered as the core assumptions (Schein 1997). Culture can be  
277 considered as what distinguishes one group or organisation from another (Nyarugwe et al.,  
278 2016; Hofstede, 2001).

279 Organisational culture is the beliefs of an organisation, its values, attitudes and how they  
280 drive safety standards throughout the business (Pettita et al., 2017). Griffith et al. (2010a)  
281 use similar language, defining culture as “the aggregation of the prevailing, relatively  
282 constant, learned, shared attributes, values and beliefs”.

283 Schein (1997) discusses how culture is built on an evolution of social systems over time.

284 Thus, to understand the deeply rooted people’s viewpoint from within an organisation, i.e.  
285 the culture, researchers need to ascertain a deep understanding of the underlying  
286 assumptions and not just perception at a given point in time.

287 As discussed earlier, if we consider culture as values, beliefs and core assumptions and  
288 climate as regarding the impact that the organisation’s systems have on people, it can be  
289 seen that the definitions detailed in table 2 for culture and climate often are intertwined,  
290 focusing on the organisation’s systems and how employees should adhere to them.

291 Whereas, De Boeck (2015) defines culture by linking it with climate, and Griffith et al.

292 (2010a) defines culture but by linking this with hygiene behaviours, the latter could be part  
293 of the organisation’s systems, thus introducing an element of climate.

294 Through the review and analysis of culture and climate definitions found in literature it can  
295 be said that culture and climate differ in three areas; time, sociology, and psychology (Table  
296 4). As there are many cross-overs in definitions between food safety culture and climate,  
297 the analysis of the common words used in definitions, the three factors of culture and  
298 climate definitions was considered to be an appropriate route to creating proposed new  
299 definitions that would differentiate between food safety culture and climate in order to  
300 encourage clarity for research and industry application.

301

302 *Table 4: Three factors of culture and climate definitions*

	Time	Sociology	Psychology
Climate	Temporary	Individual	Attitude, perception
Culture	Long term	Group, organisation	Belief, behaviour, assumption

303

304 **Proposed Definitions for food safety culture and food safety climate**

305 Based on the literature review and analysis, the following definitions are proposed:

306 Food safety culture is defined as a long-term construct existing at the organisational  
 307 level relating to the deeply rooted beliefs, behaviours and assumptions that are  
 308 learned and shared by all employees, which impact the food safety performance of  
 309 the organisation.

310 Food safety climate is defined as a temporary construct existing at the individual  
 311 level, relating to the perception and attitudes of individuals and how they influence  
 312 others in an organisation to adhere to the food safety management systems and  
 313 practically apply these in their working environment.

314

315

316 **Establishing typologies for culture and climate and the impact of employee behaviour on**  
 317 **food safety.**

318 The behaviour of others is driven by how the management commit to demonstrating the  
 319 values and following the rules (Wilcock et al., 2011). There are some thoughts that the  
 320 management’s approach to food safety behaviour could influence the food safety climate at  
 321 work or the employees’ food safety behaviour (De Boeck et al., 2017; Griffith et al., 2010a;  
 322 Jespersen et al., 2016). Pettita et al. (2017) proposed five different types of organisational  
 323 cultures, each typified by a particular behaviour (Table 5).

324 *Table 5: Types of organisational cultures and behaviours typically demonstrated by leaders*  
 325 *and/or employees (adapted from Pettita et al., 2017)*

Type of organisational culture	Description of behaviour
Autocratic	Direct superior/leader, is the source of safety instructions and directions for employees

Bureaucratic	Each employee follows the safety standards set by the top-level bureaucratic leaders
Co-operative	Where all employees work together to ensure they all achieve the safety outcomes
Technocratic	Where employees are focused on results because they are measured by the results
Clan-patronage	This operates with two groups, one who the dominant 'in-group' and the other who tries to be in the in-group are the 'out-group'

326 *Autocratic leaders* would give direction about the delivery of safety directives and provide  
327 feedback on non-conformances highlighting errors to avoid. This would be a good quality to  
328 have, as it ensures they are meeting standards and identifying errors in their system. A  
329 hierarchical business is more likely to have *Bureaucratic leaders* who set the safety  
330 standards that each employee will follow, therefore there is less reliance on supervisors to  
331 enforce the rules as employees are compliant. Conversely, *Co-operative leaders* rely on  
332 supervisor enforcement to ensure all employees work together to achieve safety standards.  
333 When a *Technocratic organisational* climate is predominant, i.e. a results-driven climate, it  
334 could drive behaviour which creates short-cuts, hides errors or skips safety steps. *Clan-*  
335 *patronage leaders* could have ways of working on a day to day basis which may differ from  
336 the behaviour during a specific day, e.g. a visit/audit. Clan-patronage are neither positive  
337 nor negative safety climates and are not associated with being compliant. This type of  
338 behaviour can be dangerous as they display the Hawthorne effect when they are being  
339 observed: they appear on the outside to be compliant yet when the external person leaves,  
340 the business returns to poor practices which may affect the safety of the products (Pettita  
341 et al., 2017). The authors argue that certain cultural types (autocratic and bureaucratic) can  
342 suppress the effect of safety climate, as it weakens the relationship between direct  
343 supervisor enforcement and employee compliance. Because of this strong management  
344 approach, a positive safety culture and high levels of compliance are seen regardless of  
345 supervisor enforcement. Pettita et al. (2017) also state that cooperative organisational  
346 climates create a positive safety culture, however, in contrast, technocratic organisational  
347 climates are associated with negative safety climates and are found to have less compliance.  
348 Kapp (2012) showed that with a positive safety climate, employee safety compliance

349 behaviours improve. Within other industries, such as nuclear, where safety is critical  
 350 Martinez-Corcoles et al. (2011) reviewed how safety culture was affected in a nuclear plant.  
 351 The research found that plant safety behaviours had a direct impact on the general safety  
 352 behaviours, which is no surprise in this industry because not following the correct safety  
 353 behaviour could result in a catastrophe. Similarly, Pettita et al. (2017) claim that supervisor  
 354 enforcement is significantly related to employee safety compliance and the overall safety  
 355 climate has a direct effect on employee compliance. If rules were not consistent for all  
 356 workers' then workers would revert to old habits. (Wilcock et al., 2011).

357

358 **Types of culture and behaviours**

359 Some authors report that new employees will normally adopt the dominant behaviour of  
 360 others which can have a positive or negative effect depending on what type of culture is  
 361 dominant (Griffith et al., 2010a; Yiannas, 2009). This suggests that it is important for a  
 362 business to recognise which behaviours each employee exhibits, so that when new  
 363 employees join the organisation, they are learning from those who show an appropriate  
 364 understanding and attitude; however, further research is needed in this field.

365 In addition to the types of climates identified by Pettita et al. (2017), Denison and Mishra  
 366 (1995) and Hartnell et al. (2016) provide behavioural traits for different types of  
 367 organisational cultures (Table 6).

368 *Table 6: Types of organisational cultures and behaviours typically demonstrated by leaders*  
 369 *(adapted from Denison and Mishra (1995) and Hartnell et al. (2016)).*

Type of organisational culture	Description of behaviour
Mission culture	Provides a purpose and meaning, and a host of noneconomic reasons why the organisations work is important. Defines the appropriate course of action for the organisation and its members. Focuses on the dynamics of external adaptation. Indicators of integration, direction and vision, and predictors of profitability.
Involvement cultures	Focus on the dynamics of internal integration.

	Flexible, open, responsive and strong predictors of growth.
Task-oriented cultures	Facilitating task accomplishment by defining role relationships among group members, by clarifying expectations and performance standards, and by encouraging the use of standardised rules and regulations to enhance consistency and predictability.
Relationship-oriented cultures	Emphasize interpersonal support and positive relationships by encouraging group members' involvement in decision making, implementing group members' suggestions, demonstrating respect for group members, and treating group members as equals.

370

371 Denison and Mishra (1995) identified that when an organisation demonstrates both a  
372 *mission culture* and *an involvement culture* this will have a positive impact as it creates and  
373 develops the skills of a team. Hartnell et al. (2016) reviewed the different organisational  
374 culture profiles and concluded that all typologies of organisational cultures promote *task-*  
375 *oriented* or *relationship-oriented* values. In relationship cultures, individuals influence their  
376 colleagues by working as a team to generate ideas, make decisions and communicate well  
377 with each other (Hartnell et al., 2016).

378 To embed a food safety culture a combination of these cultures and values would be the  
379 preferred team, thus, this could be useful in food safety performance, but more research is  
380 needed to understand the interrelationships of culture types.

381

### 382 **Types of commitment employees exhibit and behaviours**

383 Having discussed types of culture and climate and how they impact employee behaviours, it  
384 is also necessary to consider how employees may impact culture, climate, and behaviour-  
385 change initiatives. A key factor linking employees to the organisation is commitment  
386 (Meyer and Allen, 1991) and a wide body of research exists in this area, although not  
387 directly linked to food safety culture and climate. Whilst it is outside the scope of this paper  
388 to review in detail, it is useful to consider commitment concepts that may play a role.

389 Meyer and Allen (1991) proposed a three-component model of commitment in  
390 organisations; affective, normative and continuance commitments, of which employees

391 might display one or a combination of commitment types. Affective commitment is  
392 displayed where employees want to remain within a business, their attendance is high, they  
393 complete tasks to their best ability and will do extra tasks to support the business. In  
394 normative commitment, employees attend work as they feel they are obliged to and that it  
395 is part of their duty. Employees exhibiting continuance commitment are aware of the costs  
396 of leaving the organisation and are thus continuing to work in the business because they  
397 need to do so, usually for financial gain. This means that they may do the bare minimum  
398 required to remain employed (Meyer and Allen, 1991; Meyer and Herscovitch, 2001;  
399 Herscovitch and Meyer, 2002). This research identified that affective and normative  
400 mindsets were more susceptible to behavioural changes. Herold et al. (2008) conducted  
401 research based on the model developed by Meyer and Allen (1991); although not applied  
402 specifically to the food industry it did look at organisations' general workforce and argued  
403 that affective commitment represents a positive attitude to change. However, whilst the  
404 different types of commitments may provide greater insight into the types of people  
405 working in food manufacturing factories, these factors are not working alone and would be  
406 further influenced by factors such as personal, job and organisational characteristics,  
407 demographic factors and leadership. This illustrates the complexity of the integration of  
408 culture, climate, and behaviours at the individual level. Whilst there is some research  
409 investigating the moderating role of burnout and job stress in food safety climate and  
410 behaviour (De Boeck et al., 2017) and indications of differences between workgroups and  
411 roles at different organisational levels (Jespersen et al., 2016), the impact of employees,  
412 roles and sub-cultures such as workgroups on food safety culture and climate is largely  
413 unstudied.

414 In practice, when there are significant changes to a Food Safety Management System  
415 (FSMS), for example a review of HACCP implementation or changes to procedures, this can  
416 be a challenge to implement especially when managers/supervisors need to break old  
417 habits and create new ones. Their behaviours when implementing change are important so  
418 that they set a good example for the workers (Wilcock et al., 2011; De Boeck et al., 2017).  
419 Any lack of motivation amongst the management will impact on the employees, potentially  
420 resulting in poor food safety culture. (De Boeck et al., 2017; Nayak and Waterson, 2017).  
421 Zohar and Tenne-Gazit (2008) also discuss how behaviours change when employees are

422 under pressure to meet production orders and supervisors change their behaviour and  
423 ignore safety procedures. Safety Compliance is driven by training and how management  
424 behaviour commits to demonstrating the values and following the rules (Wilcock et al.,  
425 2011). Griffith et al. (2010a) claim that workplace culture affecting employee behaviour is  
426 largely ignored in the food industry, but widely used in other industries such as aviation and  
427 nuclear. Thus, when any changes are required in the food industry these need to be  
428 frequently monitored through internal audits to ensure old habits are broken and the  
429 changes are implemented.

### 430 **Future Research Requirements**

431 Where there is a positive organisational climate it may enhance the relationship between  
432 safety leadership and employee safety behaviours (Kapp 2012; Probst, 2015; Pettita et al.,  
433 2017, Yiannas, 2009;). This may result in a positive attitude from the employees that could  
434 contribute to improved food safety compliance and the strengthening of food safety culture  
435 and climate. This may, in turn, impact the business' complaints and prevent any incidents  
436 that would create a product recall; however, there is no data to suggest this. Further  
437 research is needed to provide a greater understanding of how this positive culture and  
438 climate can be created.

439 Where different mindsets are identified, e.g. affective, normative and continuance  
440 employees described by Meyer and Allen (1991), Meyer and Herscovitch (2001) and  
441 Herscovitch and Meyer (2002), employees' approach to work and adapting to any changes  
442 may be a challenge, such that food safety behavioural changes and food safety  
443 management systems initiatives may be impacted. Further work could determine how each  
444 group benefits using different change management techniques, because what works for one  
445 group may not work for the others. This could then lead to tools and interventions that help  
446 the continuance group to be as motivated as the affective group and overcome potential  
447 resistance or poor engagement with change activities.

448 Whenever any business wants to enable any changes, there needs to be 'buy-in' from the  
449 employers and employees. A company needs to make the decision to change and how this  
450 is managed will affect the workforce. Herscovitch and Meyer (2002) discuss that many  
451 employees and employers can find change stressful and recognise that the connection  
452 between commitment and coping could be more complex. De Boeck et al. (2017)

453 investigated the effects of job stress and burnout in the relation between food safety  
454 climate and food safety behaviour but did not examine how change can affect the  
455 workforce. They concluded that burnout and job stress did not affect food safety climate  
456 and food safety compliance (De Boeck et al., 2017) but, as this was only conducted for two  
457 vegetable processing plants with a small sample size (n=85), further research with a large  
458 sample size at various food manufactures may show different results. For example, perhaps  
459 the job stress at a ready meals factory may be higher than at a vegetable processing plant  
460 due to the multiple number of processes that are involved to create a complex product with  
461 different components that all need to be assembled at the correct time, whereas in a  
462 vegetable processing plant they may have one process and one raw material to pack.  
463 Therefore, the inherent risks with process complexity as well as the product food safety risk  
464 will likely be different, and it would be beneficial to explore whether the results on the  
465 impact of job stress and burnout on climate and behaviour may differ.

466 Where businesses have installed CCTV to monitor the employees' behaviours this has been  
467 found to have a rapid effect on changing behaviours (Powell et al., 2011; Powell et al.,  
468 2013), because when employees are observed it can improve safety compliance and can  
469 restore customer confidence if there has been an ongoing issue (Powell et al., 2011; Powell  
470 et al., 2013). This may also be due to 'The Hawthorne Effect' defined by Elton Mayo, where  
471 staff follow the procedures in areas when they know they are being observed (Hsueh, 2002)  
472 and positive effects can be seen due to close supervision. However, Evans and Redmond  
473 (2018) reported on video observation of handwashing and showed both positive and  
474 negative behaviours, suggesting that participants may have forgotten that they are being  
475 observed or that they do not understand the required behaviour or fail to comply for other  
476 reasons. Further research using this technique would be beneficial to gain data on  
477 employee behaviour as part of food safety culture and climate.

478 To ensure the climate remains stable and consistent during a period of change, all  
479 communications should be delivered to a team and be clear and frequent, otherwise this  
480 will create confusion and may impact the climate of the business negatively, instead of  
481 promoting a positive climate change. The research conducted by Zohar and Polachek (2014)  
482 found that when messages were frequently delivered by supervisors to a team it had a  
483 positive effect on employees' safety climate and team related behaviours. Similar results  
484 were identified by Wilcock et al. (2011) who found ways to communicate with the teams to

485 make effective changes in a process. Zohar and Polachek (2014) argue that it does not  
486 matter what type of climate is in a business but when managers' priorities are set, they  
487 should improve the climate by changing employee understanding of the kinds of behaviour  
488 that would be supported or rewarded at the workplace. Further research is required to  
489 establish the most effective methods of communication and whether employees will be  
490 more willing to change if there is a benefit or reward to the employee to comply.

491

492 Whilst this paper has considered the culture and climate of the business, future research  
493 should consider national culture and how this can impact on behaviours and ultimately the  
494 organisational culture. This may be particularly relevant in businesses with a multicultural  
495 workforce. Many studies from the safety culture and climate fields have been useful in  
496 developing an understanding of food safety culture and climate. However, the topic of  
497 safety culture is normally associated with health and safety of employees and is thus dealing  
498 with an immediate and visible risk within the business. In food safety, the risk of harm is to  
499 the consumer who may be detached from the food business employees due to the temporal  
500 and physical distances of the food supply chain. It is not known whether this distance has  
501 any impact on food safety culture and behaviour and, therefore, further work would be  
502 beneficial.

503

#### 504 **Conclusion**

505 Whilst HACCP breaches continue to occur, and the trends indicate that the reported  
506 incidents notified to the authorities are increasing, organisations need to understand what  
507 is causing this to happen. This requires an understanding of food safety culture and climate,  
508 which has been problematic because of the lack of accepted definitions.

509 Common words used in existing definitions and statements were found to be perception,  
510 values, employees, shared, belief and behaviours. Using the word analysis, the three factors  
511 involved in culture and climate definitions were identified as: time, sociology and  
512 psychology. New definitions have been proposed to provide consistent use of language for  
513 both industry and academia, as follows:

514           Food safety culture is defined as a long-term construct existing at the organisational  
515           level relating to the deeply rooted beliefs, behaviours and assumptions that are

516 learned and shared by all employees which impact the food safety performance of  
517 the organisation.

518 Food safety climate is defined as a temporary construct existing at the individual  
519 level, relating to the perception and attitudes of individuals and how they influence  
520 others in an organisation to adhere to the food safety management systems and  
521 practically apply these in their working environment.

522

523 Further, the study discussed different types of organisational cultures and behaviours  
524 typically demonstrated by leaders and employees, and how this influences the rest of the  
525 workforce. In reviewing different types of organisational cultures and climates, it was  
526 identified that an ideal team would include a combination of mission and involvement  
527 cultures together with task and relationship cultures. A team with all these behaviours and  
528 styles would influence, communicate well, develop the skills of the team and keep them on  
529 track so that their goals are achieved.

530

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