

Assessing food safety culture in food-manufacturing: A review of applicable determinants and tools

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Introduction

Maintaining food hygiene in high yield food manufacturing environments requires considerable management and skill. A single food handler is typically thought to implement up to 2000 food-related actions every day and so the potential for malpractices along the gate-to-plate chain are many¹. Despite progress in developing comprehensive food safety management frameworks (e.g. HACCP, quality management systems etc), the perpetual burden of foodborne-related illness persists^{2,3}.

Consequently, it is widely acknowledged that the maturity of an organisation's prevailing food safety culture may account for the failure in systems designed to manage food production safely⁴. Food handler beliefs, attitudes and perceptions can influence behaviour in as much as organisational characteristics (such as food safety values, commitment or leadership), influence the production realm in which food handlers operate⁵.

Numerous studies have explored and assessed food safety culture across the food industry, but few are exclusive to food manufacturing. Consensus on one assessment method, classification system, single definition or definitive determinants have yet to be agreed. While this offers a broad spectrum of valuable knowledge, inconsistency can also lead to confusion; not least for food manufacturing operators proactive in their efforts toward making positive food safety culture change. To date, a review of these components and their applicability to food manufacturing has yet to be conducted.

Purpose

The purpose of the study was to conduct a review of literature to identify definitions, determinants, methods and tools available for food safety culture assessment and to assess their applicability to a food manufacturing operation.

Methods

Data Collection: Online databases identified primary food safety culture (FSC) research studies published between 2008 and 2018 which met the pre-devised inclusion/exclusion criteria.

Data capture: Relevant articles were uploaded to NVivo qualitative data analysis software and coded to a predefined code book structure (including tools, sector, definitions, determinants, theories, sub-systems, methods and limitations).

Ethical Approval: Approval was obtained from the Health Care and Food, Ethics Panel at Cardiff Metropolitan University (Ref PGR648).

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Results

A total of 41 research studies detailing food safety culture determinants, definitions, assessment tools/methods and theoretical constructs were identified and reviewed. Thirty one offered empirical evidence and 10 comprehensively assessed literature and provided perspectives on food safety culture components. More than half (52%) of all papers were published between 2016 and 2018. Case studies (n=31) were conducted across a variety of food sectors (37% in hospitality, 25% in food manufacturing, food processing and meat plants, 17% in onsite food-service, 13% in catering establishments and 8% pre-farm-gate and wholesale produce). Countries where data collection was conducted included USA (n=10), Canada (n=4), Belgium (n=2), Ghana (n=2), UK (n=2), Lebanon, Spain, Japan, UAE and Brazil.

Research methods

Figure 1 illustrates the most frequently utilised FSC assessment method being surveys (quantitative closed responses) and questionnaires (incorporating qualitative responses) (34%), interviews (24%) and focus groups (22%); predominantly pre and post interview to inform or validate findings.

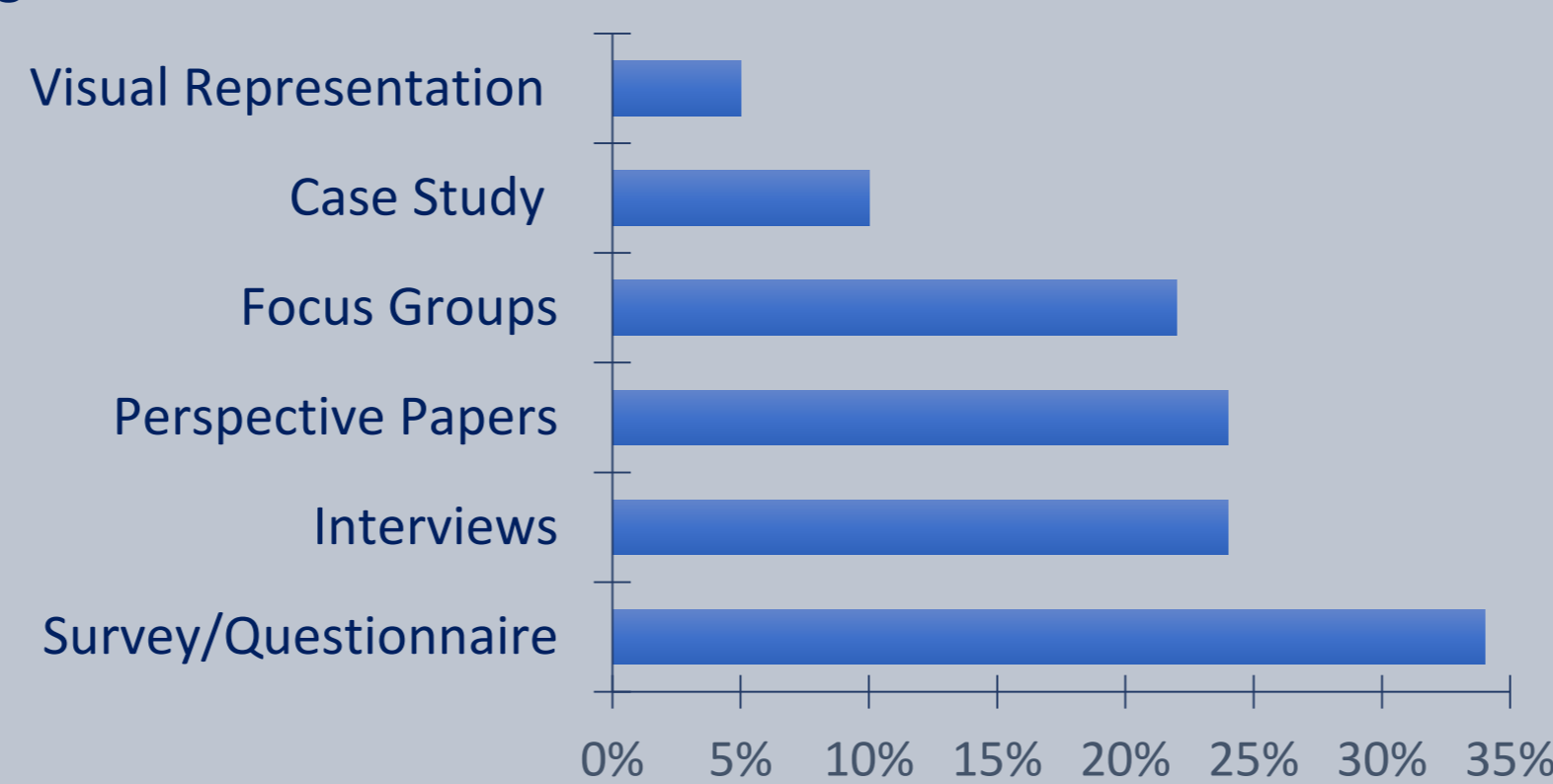


Figure 1: Research method by type (n=41)

Surveys offer a broad representation of large cohorts, but many factors can influence responses (such as language barriers and attitudes). The addition of visual aids to roadmap complex interrelated functions across a large multi-site food manufacturing business would be valuable as a simple organisational learning aid (explored in only 5% of studies).

Triangulation and theoretical constructs

Although 15% of studies utilised mixed-methods (e.g. surveys, interviews and focus groups in combination) only 7% incorporated method triangulation, all of which were conducted in food manufacturing environments. Performance document analysis, microbiological assessments, observational techniques, hypothetical card-aided interviews and 'storytelling' to assess 'attitudes' ensured that weaknesses in any one method were mitigated and offered a multi-faceted perspective on the food safety culture.

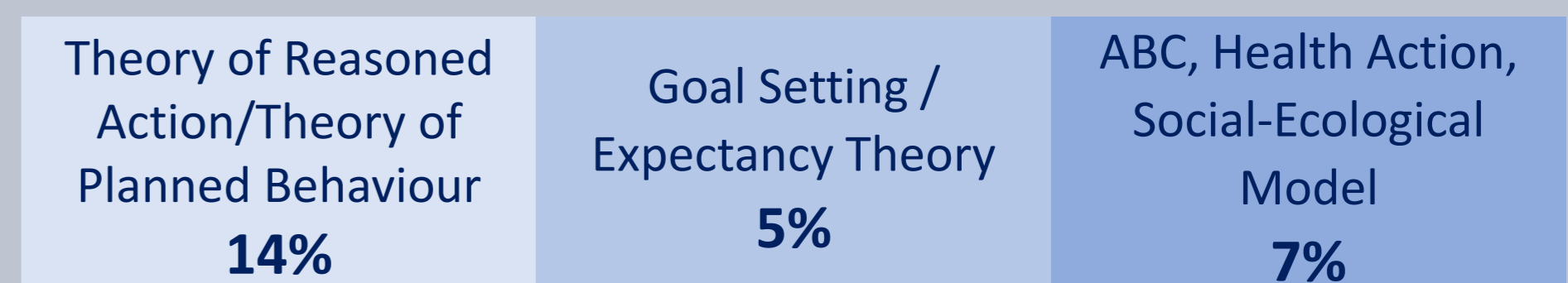


Figure 2: Theories and models underpinning study design (n=41)

Figure 2 illustrates the theories (19%) and models (7%) which underpinned the study design. Behaviour based (exploring behaviour-intention relationships) were most frequently applied while motivational theories (which recognise intrinsic and extrinsic drivers) were chosen as a route to successful task performance. Those studies incorporating models acknowledged environmental factors as a precursor or cue to prompt positive behaviour.

For food manufacturing, where safe food practices are prescriptive, combining theories or models appropriate to the desired outcome and context may prove beneficial.

Food safety culture definitions

'Culture' definitions were referenced in 36% of studies (either in combination from multiple disciplines or as a stand-alone concept).

From organisational and safety domains, the most frequently cited (22%) are attributed to Schein⁶ and Hofstede⁷. Food specific definitions included the work of academicians Yiannas⁸ and De Boeck *et al* (19%)⁹.

However, the most frequently cited definition across the data-set is attributed to the work of Griffith *et al*¹⁰, referenced in 73% of papers. This is given as:

"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"

An intentional definition (as above) offers a simple statement for organisations to communicate the premise of food safety culture which is comprehensible at any level in any food operation.

Food safety culture attributes

The interpretation of food safety culture attributes are many. Determinants were categorised by the element most frequently associated with its dimensional context.

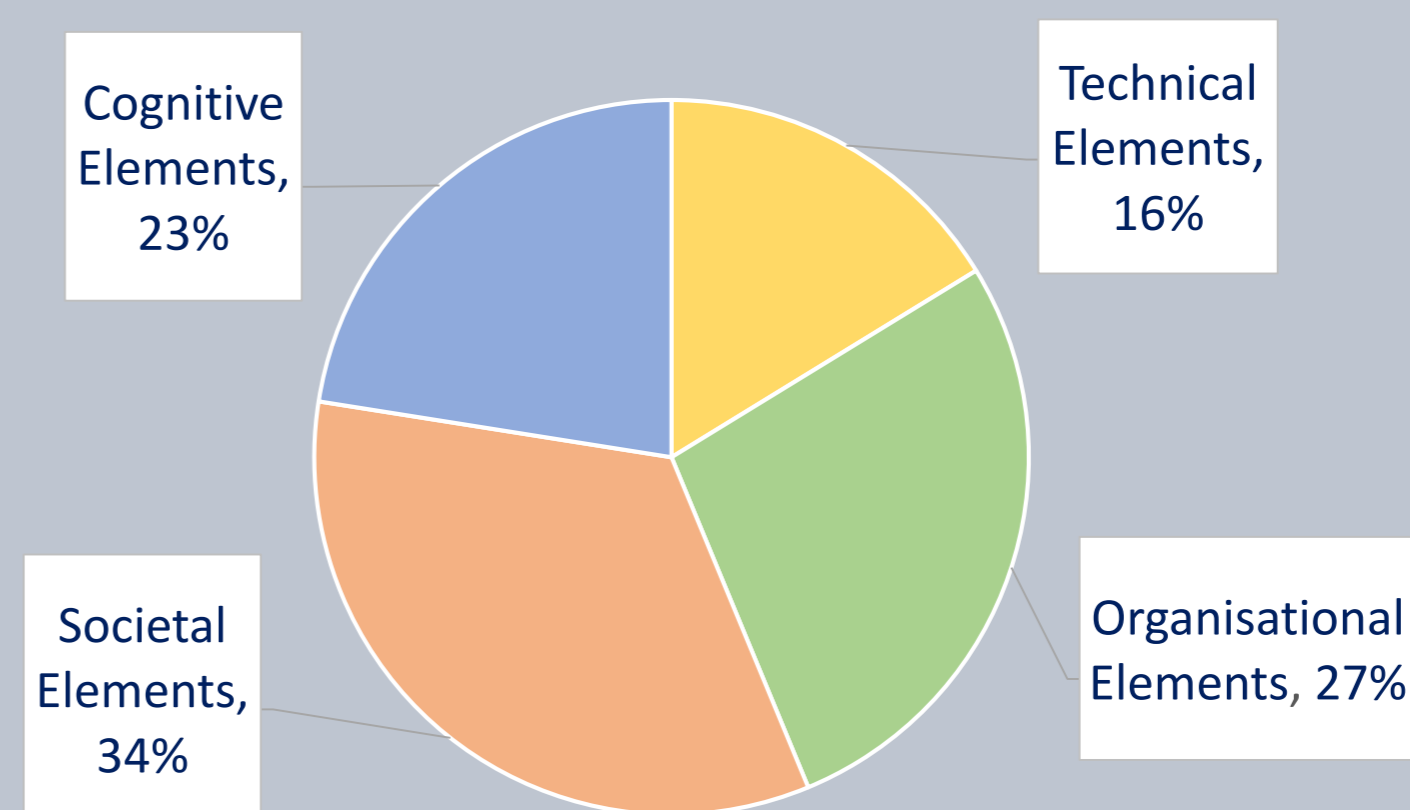


Figure 3: Food safety culture attributes by % distribution (n=41)

In figure 3, determinants associated with 'people' (cognitive and societal) were assessed more often (57%) than those associated with technical or organisational 'systems' (43%). While the distribution is relatively even overall, system elements are essential to support determinants associated with people, and quality and content should be analysed to ensure food safety culture expectations can be met.

National and sub-culture as a key evaluative attribute of food safety culture was considered in 10% of studies. Even less (5%) addressed national culture in design. It is well established that food manufacturing, as one element in a global supply chain, employs a diverse demographic.

Food safety culture determinants

Twenty-nine percent of studies developed methods to assess food safety culture elements in whole or part. Studies assessing five or more determinants (12%) offered a detailed approach to evaluating the maturity of food safety culture, thought to be a true representation of the organisation under study.

As illustrated in figure 4, determinants across the data-set varied significantly in terminology and associated classification. Those highlighted in bold (below) most frequently.

Cognitive Elements	Organisational Elements	Technical Elements	Societal Elements
assertions (positive) assumptions attitude behaviour behaviour gaps beliefs competence confidence denial of negatives deviant perceptions education	adaptability, agility auditing climate communication consistency context decision making establishing maturity external factors feedback flexibility governance	goals / long and short term orientation FSC/FSMS integration leadership intentions management control mission/vision operation size observation FSC scope stability/strategy supervision	accountability ambiguity collectivism commitment common purpose confidence co-worker support engagement execution experience, hierarchy individualism influences incongruence
knowledge motivation perceived values personal values perceptions risk awareness self-commitment self-deception skills and capabilities		data gathering education programmes enhanced micro assessment programmes environmental factors (facilities, equipment) food safety management systems quality plan-do-check-act	involvement indulgence leadership masculinity and femininity national culture ownership power distance responsibility sub-systems and sub-cultures trust/uncertainty teamwork work pressure

Figure 4: Specific determinants by categorised elements

Significance of study

- This review highlights that while many studies have evaluated food safety culture in whole or part, few are exclusive to food manufacturing. Further work to validate and corroborate current methods in this field would enable deeper understanding of factors that influence organisational characteristics.
- Triangulation provides a comprehensive assessment of food safety culture, however, the methods are time-consuming and elaborate. Demonstrating positive improvement through performance measurement (for example in food safety behaviours) following assessment would add further credibility and momentum to this developing research field.
- Determinants assessed as an indication of food safety culture maturity vary greatly across this research field. Aligning terminology and classifications with guidance available to industry (such as the Global Food Safety Initiative's 'Food Safety Culture' Position Paper)¹¹ may propel efforts; ultimately towards a common goal.