The attitudes, barriers and facilitators to establishing a strong food safety culture in small food businesses.

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Foreword

This research provides insight into the knowledge, beliefs, attitudes and presence of a food safety culture (FSC) in small food businesses (SFBs) on the island of Ireland (IOI). It also offers advice on resources that could support SFBs in implementing an FSC. The study employed a mixed-methods approach. Firstly, it combined qualitative one-to-one and focus-group discussions, which produced data on the level of knowledge and understanding of FSC and the attitudes and beliefs that surround it. Secondly, a large quantitative survey sampled owners, managers and employees of SFBs across IOI on their FSC knowledge and practices. This allowed us to compare different demographic regions, business types and ranking among the SFBs. This research sought insights that could help SFBs maintain or improve FSC provision in relation to training, development and future policy.

Glossary of acronyms

BRC – British Retail Consortium

BRCGS – British Retail Consortium Global Standards

EHO – environmental health officer

EC – European Commission

EE – external experts

FS – food safety

FSC – food safety culture

FSMS – food safety management systems

GFSI – Global Food Safety Initiative

HACCP – hazard assessment and critical control points

IOI – the island of Ireland

MRS – market research survey

NI – Northern Ireland

PIS – participant information sheet

RA – research associate

REA – rapid evidence assessment

SALSA – Safe and Local Supplier Approval

SFB – small food business (a food business with not more than 50 employees)

Acknowledgements

Executive summary

In March 2021, the European Commission updated its regulation on hygiene and safety of foodstuffs (Regulation (EU) 2021/382) (EU, 2021) to include new regulations on food safety culture (FSC). The new EU regulations say that all food businesses must put an appropriate food safety culture in place and have evidence of it. Committing to a culture of food safety excellence can help a Small Food Business (SFB) to not only remain compliant and reduce any non-conformities but also to enhance their business performance. This project aimed to investigate current attitudes to and awareness of FSC among SFBs on the IOI, and to identify the barriers to, and facilitators for, adopting a culture of food safety within the businesses. To achieve the project objectives, the work was divided into four stages: a rapid review, group discussions, a consumer survey and follow-up group discussions.

Rapid evidence assessment

The rapid review of available academic studies and grey literature (e.g. government reports) yielded 17 studies of food safety interventions. No intervention focused on FSC as a whole or addressed more than one component of FSC. Most studies aimed to improve knowledge among food handlers (such as proper handwashing techniques, cleaning practices and temperature control of food) which was found to be lacking across the food businesses. No sustained behavioural change was reported following any intervention, which suggests that interventions to improve FS should be dynamic and ongoing if they are to ensure lasting change.

Stakeholder discussions

Thirty-three participants (10 external experts and 23 SFBs) from across the IOI were recruited to the study. Results indicated a general lack of awareness of FSC and current EU legislation relating to FSC. The following themes emerged:

1. Understanding FSC as a strategic imperative
2. Investing in FSC-focused capacity building
3. Prioritising FSC alongside business survival
4. Encouraging continuous communication on food safety
5. Embedding a mindset of FSC culture
6. Striking the balance between regulation, reassurance and safety.

A total of 13 barriers and 14 facilitators were identified (see tables 4 and 5).

Survey of owners, managers and operatives

A total of 459 respondents (34% from Northern Ireland and 66% from Ireland) from SFBs participated in the phone survey. They were asked to assess the FSC within their SFB using an FSC maturity index score with 9 FSC components. Participants had to be aged 18 years or over, work in an SFB (50 or fewer employees) on the IOI and be either the owner/ manager or a staff member handling food. Results revealed that 79% of owners/managers and operatives were aware of the term FSC. However, fewer (61%) were aware of the EU legislation on FSC. Overall, managers/owners and operatives all considered their food business had implemented a high standard of FSC (total mean FSC score 5.18/6).

According to FSC component scores, operatives believed everyone in their food business took on their responsibility to encourage safe food practices (highest component score 5.46/6). Owners/managers considered there was strong FSC leadership within their business (highest component score 5.24/6). We identified the following areas needing improvement.

- For operatives: communication and information sharing about food safety practices throughout the business to ensure all staff meet expectations and address safety concerns (5.17/6)
- For owners/managers: inclusion of food safety in businesses management systems such as processes, policies and procedures (4.96/6)

Level 3 food safety and hygiene training was the highest level of training undertaken by most owners/managers. This suggests there is an opportunity for further development and training. Both operatives and owners/managers preferred training formats that could be tailored to the needs of the business and delivered face to face.

Follow-up discussions

External experts (EE) and small food business (SFB) owners and managers who had participated in Stage 2 or 3 were re-contacted and invited to join a follow-up discussion. Twenty-one people including 9 EEs (Northern Ireland 7, Ireland 2) and 12 SFB owners/managers (Northern Ireland 6, Ireland 6) participated. Three themes emerged:

1. Harnessing a holistic approach to FSC
2. Cultivating a clear understanding of FSC
3. Supporting SFBs with appropriate resources

Recommendations

The project provided valuable insights at each stage on awareness, understanding, and practices in regard to food safety culture (FSC) within small food businesses (SFBs) on the island of Ireland (IOI). The key recommendations that emerged are as follows:

1. A whole-systems approach for interventions on FSC is required. Proposed interventions should consider:
   a) An ongoing dynamic approach rather than a once-off intervention
   b) Sustained behaviour-change as the intended outcome
   c) The influence of novel incentives on FSC
   d) A range of teaching techniques, particularly demonstrations in the workplace and group discussions
   e) Including management staff in the target group

2. A multi-functional tool for FSC measurement, auditing, and research should be developed to better assess the cultural aspects of food safety. This could be achieved by:
   - Planning in partnership between environmental health officers (EHOs) and SFBs
   - Identifying proxy measures of FSC
   - Linking business performance to overall FSC performance
3. Development of a business-to-business (B2B) awareness-raising campaign for SFBs. Key messages should emphasise the importance of integrating FSC into management systems and communication within a business. The messages should consider:
   a) Defining FSC and its importance
   b) Dedicated training support and resources on FSC
   c) Safefood as an information source and point of contact for SFBs
   d) Promotion of level 3 and above FS training to owners/ managers
4. Development of training courses on FSC, taking account of training preferences (such as on-site and interactive training), tailored to:
   a) EHOs – FSC concept; its importance; how to assess it; and tools to support SFBs
   b) SFB operatives – FSC concept; its importance; and how it is implemented within a business
   c) SFB owners/managers – FSC concept; FSC as a strategic imperative; how to communicate FSC within their business; and how to implement it within a business through business systems
5. Integration of the FSC concept within existing FS training programmes and communications
6. Development of a practical resource area for EHOs and SFBs on the Safefood website (such as templates, multi-lingual resources, leadership role model examples, and case studies). This could be combined as part of the awareness-raising campaign

7. Promotion of a co-design approach for implementing a FSC within an SFB
8. Development of a live app chatbot, ping notifications and mapping of accredited food safety trainers to support SFBs with their FSC training needs and communication
9. Creation of an FSC network for SFBs and stakeholders, covering all aspects of FSC and incorporating many of the above recommendations
10. Proposal to implement a food hygiene rating scheme for Ireland

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1 Introduction

Food safety and food contamination leading to foodborne illness continue to be a concern within the food industry on the island of Ireland, with estimated case numbers of illness being 27,000 people in Northern Ireland and 7,200 cases were reported in Ireland (Holland and Mahmoudzadeh, 2020; HPSC, 2021). This has a direct impact on public health and consumer confidence and is therefore important for the entire food industry. Both Northern Ireland and Ireland have a rich culinary heritage and a thriving food sector, but ensuring the highest standards of food safety remains a constant challenge. This report examines the current level of food safety culture in small food businesses (SFBs) on the IOI, highlighting both the progress made and the persistent challenges that need attention.

The IOI has a robust regulatory framework for food safety, which continues to fall under EU laws. At present the overarching regulation on food safety is the Commission Regulation (EU) 2021/382, which came into effect on 3 March 2021, amending the Annexes to Regulation (EC) No 852/2004 of the European Parliament and of the Council on the hygiene of foodstuffs as regards food allergen management, redistribution of food and food safety culture (EU, 2021). Furthermore, the Global Food Safety Initiative (GFSI) (GSFI, 2018) and Brand Reputation Compliance Global Standards (BRCGS) are internationally recognised standards that are in place to both support and ensure compliance with the regulations (Griffith, 2017; BRCGS, 2022). Within the IOI, the Food Safety Authority in Northern Ireland (FSA NI) and the Food Safety Authority of Ireland (FSAI) in Ireland enforce these laws.

Regular inspections from environmental health officers (EHOs) and audits help ensure that food businesses adhere to the regulations. In addition, guidance and resources are available to help businesses to maintain high food safety standards.

While the IOI has a strong record of food safety compliance, it is not immune to outbreaks of foodborne illness. These incidents can arise from various sources, including contaminated ingredients, improper food handling and cross-contamination (Nerin et al., 2016). Other factors such as supply chain complexity and food fraud also need to be carefully assessed (van Ruth et al., 2017). In addition, SFBs face further complications. SFBs are small to medium-sized enterprises (SMEs) with no more than 50 employees (UK Gov, 2022). SFBs play a significant national role in the production, processing and serving of food. The FSA NI estimates there to be 4,465 food service businesses in Northern Ireland and 15,370 food businesses overall in Ireland (NISRA, 2023; CSO, 2022). It is therefore important that SFBs implement food safety procedures at a high level to keep consumers safe. SFBs can include small producers, retailers, food service businesses, and artisanal businesses. They face unique challenges in meeting regulatory requirements as they often lack the resources and infrastructure of larger businesses (for example, compliance departments), making it harder to ensure consistent compliance (Sedyastuti et al., 2021). These SFBs may therefore need extra support to meet legal guidelines.

Food safety, however, is not solely about following regulations and implementing standard operating procedures. It is deeply rooted in the culture of a food business or even an entire industry. A strong food safety culture (FSC) is now suggested to be essential in preventing foodborne illness outbreaks (Lee et al., 2023). FSC is about the values, beliefs, attitudes and behaviours within a food business, organisation or community regarding food safety. It goes beyond compliance with regulations and standards and represents a commitment to ensuring that food is safe at every stage of production, from farm to fork (EU, 2021; Griffith et al., 2010; GSFI, 2018). However, research suggests that SFBs may find implementing a strong positive FSC challenging due to issues of size, including limitations on expertise, space and numbers of staff available to keep up to date with rules on regulatory compliance (Walker et al., 2003).

With SFBs playing such a significant role in the food production, retail and food service on the IOI, it is vital that they are helped to achieve a high level of food safety and FSC. This study aimed to investigate levels of knowledge and attitudes

towards food safety and FSC within the IOI in SFBs. The study recruited food safety experts, food business owners and managers and food business employees to give a three-tiered view of how food safety is implemented and their attitudes towards its importance in FSC. It also explored barriers and facilitators to a positive FSC. This provided a well-rounded insight into FSC across differing types of SFBs and their staff, which will help in framing new policies, training and resources for SFBs.

For the purposes of context, this report identifies several factors that determine overall FSC (Figure 1). Each factor is defined in Table 1.

Figure 1. Components of food safety culture
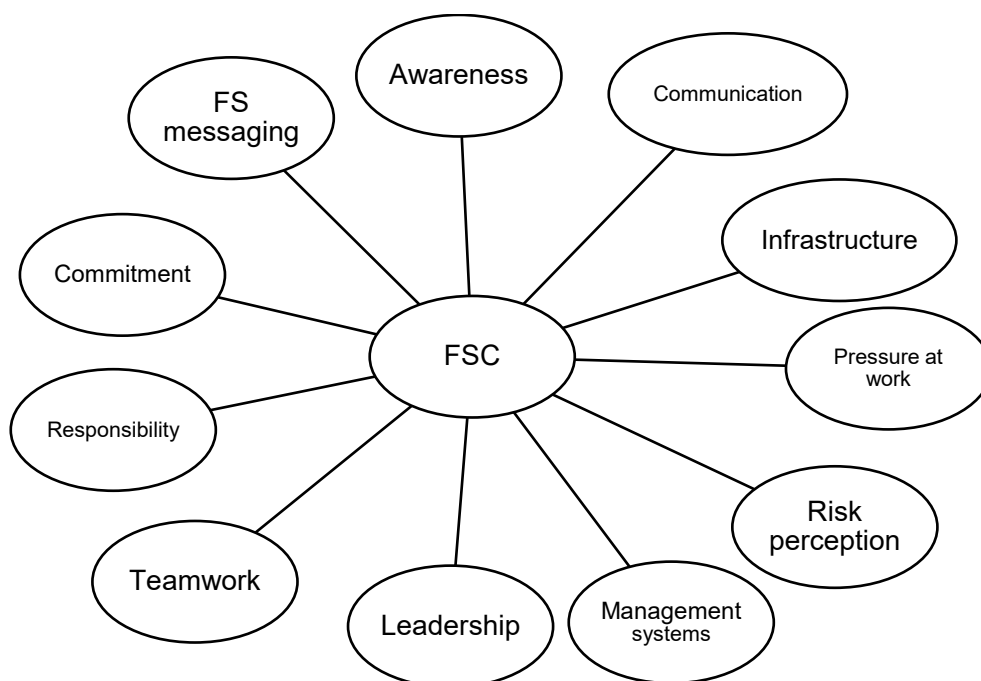
Figure one shows the components of food safety culture as a spider diagram listed as awareness, communication, infrastructure, pressure at work, risk perception, management systems, leadership, teamwork, responsibility, commitment, food safety messaging.

Table 1. The 11 components of food safety culture

FSC component	Definition
Leadership	Setting clear expectations for employees, creating a culture of accountability and demonstrating a commitment to food safety through communication and actions. Effective leaders prioritise safety, empower employees to speak up about concerns, and ensure that food safety practices are integrated into all aspects of the food businesses operations.
Infrastructure	The physical and organisational elements necessary to ensure food safety. This includes equipment, technology, facilities and resources for monitoring and controlling food safety risks.
Responsibility	Individuals and food businesses acknowledging their role in ensuring food safety practices. This involves taking accountability for maintaining food safety standards, taking appropriate action to prevent food contamination, and promptly addressing any potential risk to food safety.
Risk perception	How individuals and food businesses understand and assess potential dangers associated with food handling and consumption. Risk perception varies among individuals according to their knowledge, experiences and biases. It also affects their attitudes and behaviours towards food safety practices and risks.
Pressure at work	Circumstances where employees feel they need to prioritise productivity or meeting deadlines over food safety practices. This can lead to shortcuts, neglect of safety protocols, and greater risk of food contamination.

FSC component	Definition
Communication	Clear and effective sharing of information and expectations on food safety practices. It includes open dialogue among employees and management; responding promptly to concerns; and ensuring everyone in the company knows about safe practices.
Commitment	The dedication of everyone within a food business to prioritise and uphold food safety practices and standards. It involves investing in training, resources and continuous improvement to create a culture where food safety is non-negotiable.
Teamwork	Where everyone in a business works together to ensure food safety. Teamwork includes effective communication, sharing of responsibilities, and commitment to uphold food safety standards.
Management systems	The processes, policies and procedures put in place to consistently monitor, assess and improve food safety practices. These systems ensure that food safety is integrated into every aspect of food businesses' operations, from sourcing to distribution, to maintain high standards and prevent risks.
Food safety messaging	The messaging and training regarding food safety within the food business.
Food safety culture awareness	The knowledge and understanding of FSC of all staff working within a food business: what it is, what it encompasses and why it is important.

Project aims and objectives

The project aims and objectives were to:

1. Investigate food safety culture interventions and measurement tools in the academic and grey literature
2. Assess perceptions, attitudes and behaviours towards FSC in SFBs on the IOI
3. Identify barriers and motivators to creating and/or improving FSC in SFBs on the IOI
4. Recommend ways to raise awareness of and overcome barriers to FSC within SFBs

Project overview

Stage 1: Rapid evidence assessment review

Aim: To systematically and rapidly review the academic and grey literature to identify key measures and tools used to assess or enhance FSC within a food business. Only intervention studies that were set in a food business and used pre-intervention and post-intervention assessment of staff were included. Key tasks in the review included:

- Identify the scope of rapid evidence assessment (REA).
- Search the literature.
- Analyse and write up a report.

Stage 2: Stakeholder discussions

Aim: To understand current behaviours and attitudes towards food safety and determine how best to engage with small food businesses to achieve a positive FSC. Key tasks included:

- Draw up stakeholder protocols and discussion plans, in light of the REA findings.
- Recruit 10 experts in food safety and conduct in-depth discussions on the topic of food safety and FSC in SFBs.

- Recruit 24 SFB owners and managers from across Northern Ireland and Ireland and from different types of SFB (service, retail and production).
- Transcribe discussions and write up a report.

Stage 3: Food safety culture survey

Aim: To use a large-scale survey of food businesses to investigate perceptions, attitudes and behaviours and practices in establishing an FSC. Key tasks included:

- Develop a survey on FSC using findings from REA and discussions with experts, SFB owners/managers and operatives.
- Recruit owners, managers and operatives from at least 450 SFBs from across the IOI, with the help of a market research company.
- Analyse the findings and write up a report.

Stage 4: Follow-up stakeholder group discussions

Aim: To better understand the relevance of the findings from the survey through follow-up discussions with the owners, managers and experts from stage 2. This involved one-to-one discussions of approximately 30 minutes each with 12 of the participants. Experts from stage 2 were invited to take part in a follow-up discussion about key results, findings and recommendations. In this discussion we would:

- Show key findings from Stage 3 and discuss in more depth with owners and managers.
- Use these findings to better understand aspects of the FSC survey.

2 Stage 1: rapid evidence assessment review

The rapid evidence assessment (REA) review aimed to investigate food safety interventions to gain insights into the knowledge, attitudes, behaviours and outcomes of all employees within a food business. At this stage of the project, all business sizes were included to ensure we met the scope of the overall aims. The REA gave an overview of all academic and grey literature on food safety interventions where the studies measured attitudes and behaviours pre- and post-intervention. Our review highlighted learnings from these interventions.

In March 2021 the European Commission set in place the Commission Regulation (EU) 2021/382, requiring food businesses to have a culture set around food safety known as "food safety culture" (FSC). The regulations list five requirements: commitment of the management, leadership; awareness of hazards, open and clear communication, and availability of sufficient resources. Our review investigated food safety interventions in food businesses looking for practical ways to improve FSC. We found 17 food safety studies that were suitable. Most of these studies showed that knowledge training and workplace demonstrations led to the best improvements. We found that regular staff training over longer time periods gave good results. However, when the training stopped staff returned to their previous behaviours. We also found that most training only looked at one component of FSC and no study addressed all 6. We believe that all aspects of FSC should be looked at, with a focus on leadership skills.

Background

People commonly fall ill due to eating food that has not been cooked properly or has been contaminated with food poisoning bacteria or viruses. Up to one in 10 people

becomes ill after eating bad food (Drudge et al., 2019) and 420,000 die each year, with the cost of treatment at roughly £12 billion (WHO, 2022). Food safety is defined as "the condition of the foodstuffs in all stages of production, processing and distribution, required to guarantee protection of consumer's health, also taking into account normal circumstances of use and information available for the foodstuffs concerned" (Baert et al., 2011). To reduce risks, food businesses must meet food safety and hygiene rules, such as cooking food to the correct temperature; testing it regularly with thermometers and keeping their premises clean (Regulation (EC) 852/2004, 2004; Regulation (EC) 882/2002, 2002). There are also international food safety rules, such as the Global Food Safety Initiative (GFSI), to help food businesses meet these laws. Although these laws and guidelines are in place, not all food businesses meet high standards and so risk causing illness in customers. Great effort has been put into improving food safety management systems (FSMS), but this has not been enough to improve food safety within many food businesses. On 3 March 2021 the European Commission updated its regulation on hygiene and safety of foodstuffs (Regulation (EU) 2021/382) (EU, 2021) to include new guidelines on FSC. The new guidelines state that all food businesses must put a demonstrable food safety culture in place to help improve food safety.

FSC is part of organisational culture within a business. Organisational culture is the "shared perceptions among members of an organisation regarding policies, procedures and practices" (Schein, 1985). So FSC is a type of organisational culture that helps a food business achieve food safety. FSC is defined 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" (Griffith et al., 2010a, p435) and "shared values, beliefs and norms that affect mindset and behaviour toward food safety in, across and throughout an organisation" (GSFI, 2018, p9). It helps create a good workplace with a high level of food safety. This has been shown to improve staff behaviour and reduce food illness risks, and it became law in 2021 (de Andrade et al., 2020; Emond and Taylor, 2018; Griffith et al., 2017; Powell et al., 2011).

Creating a good FSC can be difficult, however. Putting new food safety rules in writing is not enough to make a positive change within a food business (de Boeck et al., 2016). FSC has 6 components: management systems, risk perceptions, leadership, communication, environment and commitment (Griffith et al., 2010b; Yiannas, 2009). Other factors, such as management and co-worker support, work pressure and employees' judgement of risk, are also important (Fatimah et al., 2014). FSC includes employee behaviours, their attitudes, their level of knowledge and their working conditions. The introduction of these new rules on FSC enables food businesses to measure FSC and to improve so that they can make and sell food safely (EU, 2021).

However, although all food businesses have an FSC, many still find it hard to ensure they have a good one (Griffith et al., 2017; Jespersen et al., 2016). Therefore, as there is not much research on improving FSC in food businesses, our report looks at the main results from food safety studies and aims to use them to guide businesses in improving their FSC.

Methods

Search strategy

We carried out a wide search of the literature to find and assess studies of FSC. We used a method called rapid evidence assessment (REA), a search strategy that is seen as a useful way to assess information on practices or policies in a short time, and a method already used by published studies on food safety. Following agreement on our research question and aim, 14 relevant terms were chosen by the lead author and 3 additional authors in the bullet point list below, who all are involved in academic food business and nutrition research. These key search terms were chosen because they fitted the REA aim and are used as keywords in current food safety publications. We carried out our key word searches across 9 scientific databases (Medline, Scopus, ScienceDirect, Hospitality and Tourism Complete, CINAHL Ultimate, Business Source Complete, Emerald Insight, Food and Drink Safety and JSTOR journals). Key terms were truncated to provide best search results, with the search widened to include relevant word endings.

Key search terms

An * was used to represent potential letter(s) that could replace the asterisk adding to the stem word, e.g., train(ing). When used within search engines this allowed for al possible words to be identified.

- Food safety
- Intervention*
- Train*
- Food safety culture 9
- Food contamination 10
- Attitude*
- Food business
- Food service
- Organisation culture
- Risk management
- Value*
- Communication
- Hygiene
- Belief*

Inclusion and exclusion criteria

All searches were to be in the English language, in peer-reviewed journals with full text access. Only literature published between April 2004 and June 2022 was included. This timeframe covered the period between the introduction of the previous Regulation (EC) No 852/2004 on the hygiene of foodstuffs in April 2004 and the new regulation dated 2021 (Regulation (EU) 2021/382) (EU, 2021), which says food safety culture must be established and maintained in a food business. All the literature we studied pre-dates the new legislation. All search terms and their outcomes were recorded. Following this, titles and abstracts were briefly reviewed and those considered to be appropriate and relevant to the research question were saved for further analysis and full review. We excluded from review any titles that indicated that no food safety or FSC intervention or assessment had taken place, or

where the intervention or assessment was not conducted in a food business with food handlers (for example, it might have been with students in a classroom setting).

For titles that met the inclusion criteria, each abstract was screened. To progress to a full review, it needed to both: (i) involve a food safety intervention being implemented in a food business; and (ii) measure results before and after intervention to show outcomes. Papers were excluded at this stage if they did not conduct a food safety intervention in a food business with food handlers or if they only measured food safety knowledge, attitude or behaviour at one time-point rather than making a pre- and post-assessment. A sample of papers was reviewed throughout the screening process by 2 independent researchers to ensure consistency between reviewers and appropriate selection of papers. Seventeen papers passed the abstract screening stage to proceed for full review (Figure 2). The low number of papers selected for review was because many studies only measured the knowledge, attitude or behaviour of food handlers and did not describe an intervention with pre- and post-intervention assessment. Studies that did not conduct both pre- and post-intervention analysis were excluded from the review. It should be noted that our literature search found no studies of full FSC interventions as such, so we focused on interventions involving elements of FSC.

Figure 2. Schematic representation of article selection process data analysis

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┌─────────────────────────────────────┐
│ Key terms (n= 20) searched in relevant │
│ databases (n= 9) using inclusion criteria │
└─────────────────────────────────────┘
              │
              │        ┌──────────────────────────────┐
              ├────────│ Articles excluded (n= 276,681) │
              │        └──────────────────────────────┘
              │
┌─────────────────────────────────┐
│ 311 abstracts saved to server and │
│ fully reviewed using screening   │
└─────────────────────────────────┘
              │
              │        ┌──────────────────────────┐
              ├────────│ Articles excluded (n= 292) │
              │        └──────────────────────────┘
              │
    ┌──────────────────────────────┐
    │ 17 articles included in review │
    └──────────────────────────────┘
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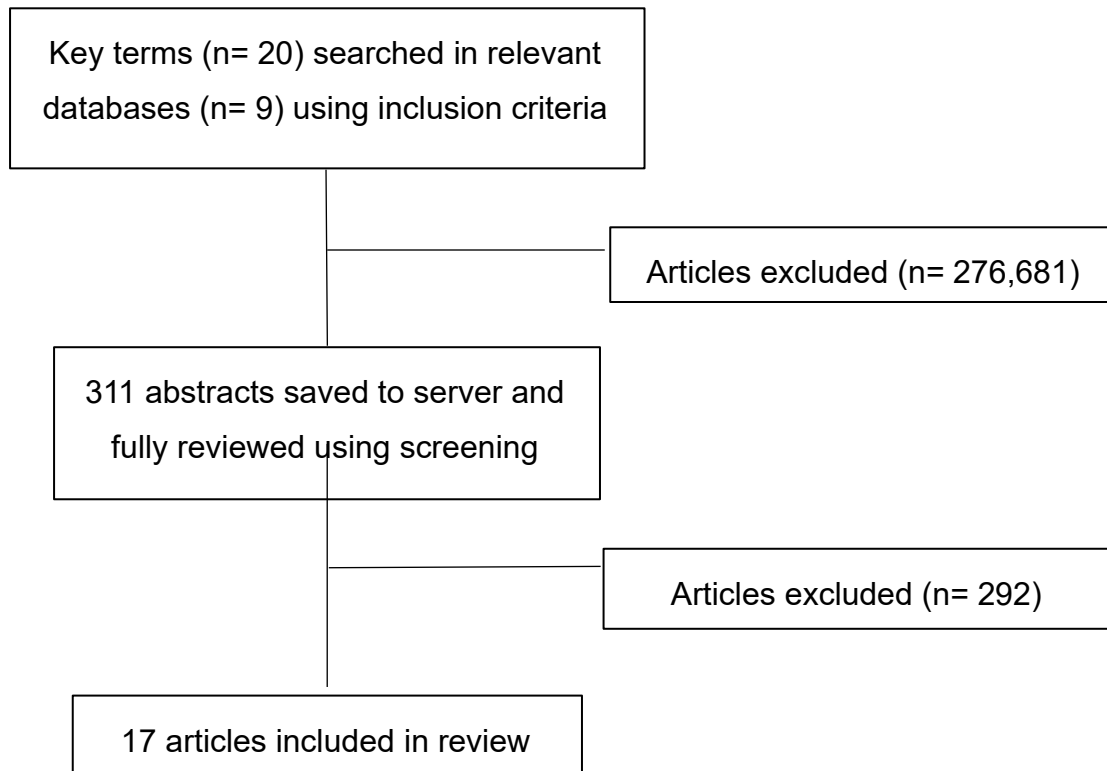
A deductive coding approach was applied, and all papers were analysed for the following information in line with the research objectives:

- Study aim
- Intervention used
- Methodological approach and assessment of intervention
- Target population and sample size
- Outcomes
- Direction for future interventions

Results were collated and summarised so that the study design, interventions and outcomes could be compared within the review (Appendix 1).

Results

Study characteristics

The 17 studies from between February 2005 and June 2021 which met the inclusion/exclusion criteria were reviewed against the identified parameters and summarised (Appendix 1). Any study that only measured food safety knowledge or attitudes towards food safety was excluded, as was any study that measured elements of FSC such as knowledge or behaviour but did not include an intervention with a follow-up assessment. Twelve studies focused on interventions within food service (3 schools, 2 hospitals, 2 restaurants/ cafés, 2 deli counters, one ship, one street vendor, one mixed setting). Three concerned food processing (one cheese, one raw poultry, one vegetable), and two concerned food production (one dairy farm, one fresh produce farm). Sixteen of the 17 interventions focused on food handlers and one study focused on training store managers who managed food handlers. Five interventions were carried out in small food businesses (up to 50 employees, mean 37, range 14-47 participants). Ten studies were in medium food businesses (up to 250 employees, mean 109, range 62-144 participants); and 2 studies were in large food businesses (over 250 employees, mean 382, range 280-500 participants) (European Commission, 2003). Literature from the UK was most prominent (5/17), followed by the US (4/17), Africa (3/17), Canada (2/17), India (2/17) and Brazil (1/17).

Intervention design and barriers identified pre-intervention

Prior to intervention, researchers in 12 of the 17 studies carried out a knowledge assessment to identify the training needs of food handlers which would be focused on during the intervention. Food storage and temperature control were found to be the areas of least knowledge pre-intervention (Ababio et al., 2016; Barjaktarović-Labović et al., 2018). Knowledge of when handwashing should occur was high pre-intervention. However, particular handwashing steps, including length of time of handwashing, the use of soap, and thorough drying after washing, were often found to be to be incorrect (Chapman et al., 2011a; Schroeder et al., 2016). Three studies reported little knowledge on whether watch and jewellery wearing was appropriate (Dudeja et al., 2017; McIntyre et al., 2014; Michaels et al., 2004). Three studies

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reported a low level of knowledge about food waste disposal (Choudhury et al., 2011a; da Cunha et al., 2013; Tóth et al., 2017). One study reported low knowledge of record-keeping pre-intervention (da Cunha et al., 2013). In addition to knowledge assessment, 2 studies used audits of the food business, focusing on hazard assessment and critical control points (HACCP) requirements to identify need for improvements (Ababio et al., 2016; Capunzo et al., 2005). This allowed for the accuracy of paperwork and HACCP documentation to be evaluated, and highlighted any issues raised.

The remaining 5 studies constructed interventions based on gaps identified in the literature. These gaps were very similar to those identified using employee knowledge assessment and audits, showing both methods to be useful for the design of intervention training.

However, conducting their own pre-intervention observations had other benefits and highlighted other areas for improvement, such as availability of supplies, including disinfectant; having adequate sinks, soap and paper towels, which were often unavailable or not in the correct areas within food businesses; and having enough utensils to reduce the risk of cross-contamination (Ababio et al., 2016; Abdul-Mutalib et al., 2012; Rowell et al., 2013; Tóth et al., 2017).

Across the studies, the main focus was on improving participants' food safety knowledge and their ability to minimise risks to food safety while working. No study was designed to address other aspects of FSC.

Food safety interventions and effectiveness

Most of the studies (15/17) focused entirely (11/15) or partly (4/15) on knowledge training to improve food safety within the business (Appendix 1). Training duration varied as follows:

- One-day training being the most frequent (10/17)
- 2 training days (1/17)
- 3 days (1/17 on consecutive days, 1/17 using 1 day per month for 3 months)
- 5 days (1 per month) (1/17)
- 15 days (2 per week for 3 months) (1/17)

Of these 15 studies, 12 used knowledge questionnaires pre- and post-intervention to assess the impact of the intervention. Seven of these 12 studies conducted a follow-up assessment of knowledge immediately after training (Ababio et al., 2016; Acikel et al., 2008; Choudhury et al., 2011b; Ledo et al., 2021; McIntyre et al., 2014; Soon & Baines, 2012; York et al., 2009). The remaining 5 studies conducted post-intervention assessment at a later follow-up time (between 2 weeks and 2 months afterwards) (Barjaktarović-Labović et al., 2018; Dudeja et al., 2017; Malavi et al., 2021; Rowell et al., 2013; Tóth et al., 2017). All 16 interventions which focused on food handlers, regardless of time of follow-up or length of training, resulted in improved knowledge. The greatest improvement was in knowledge of correct food storage conditions and temperature control. This was possibly because these topics had scored some of the lowest pre-intervention knowledge levels, or because staff had become increasingly aware of their ability to control food safety outcomes by simple measures. Two studies, however, showed that when knowledge training lasted more than one day, the greatest knowledge improvement was recorded following the first day with little improvement seen from additional training (Ledo et al., 2021; Tóth et al., 2017).

Low education levels were not identified as a factor preventing improvements in knowledge. Five studies reported that staff had a low level of formal education (Ababio et al., 2016; Abdul-Mutalib et al., 2012; Hennessey et al., 2020; Ledo et al., 2021; Tóth et al., 2017). One study reported that food handlers who had low levels of formal education showed a high level of enthusiasm to learn, with high levels of attendance at the 15 training days (Choudhury et al., 2011b). The only study not to report a change in knowledge was an intervention targeting managers, who had a high level of food safety knowledge pre-intervention (Rowell et al., 2013).

All studies which involved knowledge training in their intervention used a classroom set-up with slide presentation to teach food safety knowledge. To supplement presentations, 6 studies used training videos (YouTube); 4 studies gave information booklets, and 4 studies used practical demonstrations to show correct handwashing and equipment-cleaning techniques. One study compared training methods, using presentations only for one group of food handlers and presentations and videos for

another group; however, the groups showed no difference in terms of knowledge gain (Machado and Cutter, 2017). Four studies used a combination of all these teaching approaches plus PowerPoint presentations; the combination resulted in a high level of knowledge post-intervention (Ababio et al., 2016; Chapman et al., 2011b; Ledo et al., 2021; Soon and Baines, 2012). Furthermore, combining these styles of knowledge training with group discussions resulted in very strong knowledge retention (Ledo et al., 2021).

Food handlers reported that demonstrations were the most enjoyable and useful part of the training as they could put the skills directly into practice (Chapman et al., 2010). However, demonstrations were less effective when they occurred outside the food handlers' work setting (Ledo et al., 2021). One intervention introduced additional equipment (thermometers) and used prize money as an incentive to encourage food handlers to comply with procedures. However, this did not result in better food safety (York et al., 2009). Retraining of food handlers (3 years after their initial training) proved to be successful in one study. It showed a decline in knowledge 3 years after initial training (according to data collected in a previous study), but improvement following retraining (McIntyre et al., 2014).

Six of the 17 studies used observation pre- and post-intervention to measure the impact of the training intervention on food handler behaviours such as handwashing, food preparation, surface and floor cleaning, and watch and jewellery wearing. Interventions that aimed to improve handwashing showed conflicting results. Two studies reported that increased handwashing resulted in fewer direct and indirect cases of cross-contamination (Chapman et al., 2011a; Ledo et al., 2021). However, 3 studies reported that although food handlers had a high level of handwashing knowledge, in practice little handwashing was seen to occur or, when it did, was done incorrectly (Ababio et al., 2016; Rowell et al., 2013; Tóth et al., 2017). Five studies reported that only certain aspects of food safety were improved following training in, for example, handwashing and cleaning, yet these improvements were only short term (less than 2 weeks) and food handlers returned to poor behaviour in all cases. Where training lasted over longer periods (over 3 months or 2 years), the behaviour of food handlers improved while training continued, but no sustained

change was evident at post-intervention follow-up. This suggests that behaviour improves with constant reinforcement but declines without it (Choudhury et al., 2011b; da Cunha et al., 2013). Although knowledge improved in all studies regardless of food handler experience (from under one to over 40 years), transfer of knowledge into practice varied, with one study reporting no change of behaviour in food handlers with an average 9.5 years' experience (York et al., 2009), while another reported improved behaviour in food handlers with up to 10 years' experience (Ababio et al., 2016). This may point to resistance to change among experienced staff in some cases.

Five studies measured microbial levels pre- and post-intervention on food preparation surfaces, walls, floors, drains, workers' hands and utensils. Four of these studies found improvement on certain areas such as food preparation surfaces; however, walls, floors and drains surrounding food preparation areas still had high levels of harmful microbes' post-intervention, showing knowledge had not been transferred into practice. One study that measured microbial levels on food contact surfaces (table-tops and chopping boards) and no-food contact areas (floors, walls and drains) for 2 groups of food handlers reported that food handlers who received knowledge training performed no better than those who did not (Machado and Cutter, 2017).

Three studies used signage as their intervention. Two of these used only signage to encourage improved food safety practices (Chapman et al., 2010; Schroeder et al., 2016), while one used signage in addition to knowledge training (York et al., 2009). Signage provides repetitive training on specific food safety practices for food handlers without necessarily needing words (Schroeder et al., 2016). One study introduced pictogram signage in place of standard written signage, with photographs being more effective than cartoons as they reflected reality more closely (Schroeder et al., 2016). Signage colour was important: red was associated with dangerous and dirty, while green and blue suggested cleanliness and hygiene (Schroeder et al., 2016). The second study reported that signage hung in high traffic areas raised most awareness, with persuasive messaging stressing the serious consequences of non-compliance (York et al., 2009). Food safety information sheet signage was used in

the third study; this consisted of timely and relevant food safety narratives taken from media sources and produced weekly to supplement food safety training (Chapman et al., 2010). The effectiveness of the signage on handwashing was directly measured in all 3 studies by using video cameras hung over sinks and food preparation areas. It indicated that signage worked effectively over short periods lasting between several days and 2 weeks. After that point, however, signage became commonplace and compliance fell, with no overall risk reduction seen longer term (Chapman et al., 2010; Schroeder et al., 2016).

Time was reported as a barrier to carrying out adequate food safety practices in 5 studies, with heavy workloads meaning food handlers often omitted food safety and hygiene tasks. This led to a lack of proper handwashing or floor and surface cleaning and disinfecting, and failure to change utensils and chopping boards when working with different foodstuffs (Chapman et al., 2010; Dudeja et al., 2017; Malavi et al., 2021; Rowell et al., 2013; Schroeder et al., 2016). Busy staff were seen to misuse thermometers in one study, paying little attention to the temperature of food when short of time during busy service periods (Tóth et al., 2017).

Staff turnover was high in 2 studies, with 40-63% of food handlers working in the role for less than one year (Malavi et al., 2021; Tóth et al., 2017). Two studies showed the opposite, however, with average length of time in food service being 9 years in one study (York et al., 2009) and 60% having over 5 years' experience in another (Dudeja et al., 2017). Language barriers were reported in 2 studies to put food safety and hygiene at risk, where a poor understanding of the English language made it difficult to explain food safety needs (McIntyre et al., 2014; Rowell et al., 2013).

Summary

This REA finds that the areas of knowledge most lacking were handwashing, cleaning practices and temperature control of food. Food handlers' food safety knowledge improved following training. Teaching methods that used a range of techniques, especially demonstrations in the workplace and group discussions, were most effective. Similar topics were covered in training, regardless of whether the researchers had carried out prior assessment and audits or had used only gaps identified in the literature. This shows that commonly identified training needs make a suitable basis for planning interventions.

Training that took place over a longer period had greater success in changing behaviour. However, improved knowledge did not guarantee a transfer into improved behaviour on food safety, as no study reported sustained behavioural change. This finding underlines the need for practical training to be repeated. It shows that the presumption in the current literature – that better knowledge will improve food safety – seems to be inaccurate.

Furthermore, no intervention focused on FSC as a whole, or focused on more than one aspect of it. Wider consideration of all aspects of FSC, however, would ensure the integration of key policies to manage barriers such as knowledge, time, language, staff turnover, communication and leadership. With FSC now a legal requirement within the EU, food businesses need to ensure effective leadership within management to enable the growth and maintenance of a strong multifaceted FSC.

Key findings

- Writing the rapid review offered insight into how best to structure interviews with external experts, influencers and operatives by helping us understand:
    - Common aspects of FSC that are targeted during food safety interventions
    - Aspects of food safety that are often seen as barriers or facilitators to food safety practice and can be further investigated in discussion groups (for example, level of knowledge and staff training; methods of communication within the food business; and available resources).

- Seventeen food safety interventions with measured outcomes were identified and investigated.

- No intervention focused on FSC as a whole or addressed more than one component of FSC.

- Most interventions had the primary aim of improving the knowledge of food handlers.

- When selecting areas for intervention similar training topics were identified, regardless of whether there had been a pre-intervention assessment or audit of needs or a review of the literature. This indicates that food businesses are facing similar food safety-related issues, and that standardised knowledge training may be a suitable intervention.

- Most interventions focused on improving knowledge of proper handwashing technique, cleaning practices and temperature control of food, as knowledge and/ or compliance in these areas was found to be lacking across food businesses.

- The food safety knowledge of food handlers improved following food safety training, especially when different teaching techniques were combined. Group discussion and workplace demonstrations were found to be the most effective techniques.

- Food safety knowledge increased regardless of training duration. However, training that took place over longer periods (more than three months) had the most success in changing the behaviour of food handlers.

- No sustained behavioural change was reported following any intervention, showing that knowledge training alone was not enough to make lasting change.

- Handwashing, cleaning practices and temperature control of food were insufficient across food businesses, as was effective management. These are areas that could be focused on in future interventions.

3 Stage 2: stakeholder discussions

Stakeholder discussion groups and interviews were held with food safety experts and owners/managers of SFBs, including food manufacturers, retailers and foodservice outlets on the IOI (n = 33). The findings provided a wealth of information on the perceptions, awareness and understanding of FSC and its associated barriers and facilitators. This chapter has 2 parts: (1) Expert interviews, and (2) Owner/manager discussions.

Part 1: Expert interviews

Ensuring a robust food safety culture in food businesses is paramount in safeguarding public health and maintaining the integrity of the food industry (Griffith et al. 2010). Seeking expert opinions on FSC is indispensable for SFBs for several reasons. Firstly, experts can offer specialised knowledge and experience, offering insights into emerging risks, best practices and new technologies (Stehr and Grundmann, 2011).

Secondly, expert opinions serve as a crucial benchmark for evaluating and improving existing food safety practices. Experts can conduct thorough assessments of a food business' processes, identifying vulnerabilities and recommending tailored solutions (Moeller, 2011). They encourage a proactive approach to food safety and can prevent contamination incidents and mitigate risks before they escalate.

Furthermore, expert opinions carry weight in achieving regulatory compliance and certification. Collaboration with recognised experts demonstrates a commitment to excellence while enhancing a food business' credibility within the industry and among consumers (Bigliard and Galati, 2013). This trust is fundamental for maintaining customer loyalty and protecting brand reputation, which can be severely

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compromised by a lapse in food safety. In essence, the importance of expert opinions on FSC cannot be overstated. Their guidance not only ensures compliance with stringent regulations but also contributes to the overall wellbeing of consumers and the sustainability of the food industry (Powell et al. 2011). Therefore, as experts in food safety can act as guides to SFBs, their input for this project was considered highly important and their experience can provide deep insight into FSC.

Methods

Recruitment of external experts

External experts (EEs) from Ireland and Northern Ireland were identified by the funder and research team and invited to participate in the project. If they showed interest, they were sent the participant information sheet (PIS) (Appendix 2) and asked to complete a digital consent form for participation. Once the EE had given their consent, an online discussion was arranged. Discussions were conducted one to one on Microsoft Teams and lasted approximately one hour.

> EEs had to be currently involved in teaching food safety, the inspection of food businesses for food safety, or consultancy work or legislation relating to food safety within food businesses. Ten EEs were recruited for this stage of the project (6 in Northern Ireland and 4 in Ireland). EEs recruited from Northern Ireland included 2 environmental health officers (EHOs) based in Belfast; 2 food safety consultants for SFBs; one university lecturer (at Queen's University, Belfast) involved in food safety legislation; and one leader in a large food distribution group. EEs recruited from Ireland included one food safety consultant; one food safety lecturer (at Dundalk Institute of Technology); one EHO based in Dublin; and one food safety expert involved in food safety legislation.

Procedure and measures

Each discussion was facilitated by the project research associate (RA) and began with an ice-breaker activity where participants were requested to introduce themselves, stating their current role and relevant employment history. The RA then used a series of guided open-ended questions to structure discussions. Results from

the REA informed the development of the topic guide. Key topics covered within the guide included:

- Awareness of FSC
- Opinions of food safety and hygiene training and how it could be improved
- Current barriers and facilitators to the implementation of FSC in SFBs (Appendix 4)

Each interview lasted between 55 and 65 minutes, and audio and video were recorded. At the end of each discussion, participants were thanked and paid an honorarium (£50/€50) for their participation.

Analysis

All discussions were digitally recorded, transcribed and uploaded to the qualitative analysis software NVivo 10 (QSR International Pty Ltd, Victoria, Australia). Thematic analysis identified a comprehensive set of evolving codes to: (1) summarise the raw data, and (2) establish links between the research aim and the raw data. Using a sample of 3 transcripts, initial codes were generated independently by 2 researchers (SMcC and CG) and discussed through triangulation (using multiple datasets and methods) to develop a codebook for use with the remaining data. To ensure intercoder reliability, a further 3 transcripts were coded and agreed. Codes were then grouped together to form potential themes in relation to the aim of the study. Verbatim quotes are displayed, followed in parentheses by the study participant number, role and location (Braun et al. 2016).

Results

Four main themes emerged from the discussions with the expert group. These were:

1. Understanding FSC as a strategic imperative
2. Investing in FSC focused capacity building activity
3. Prioritising FSC alongside business survival
4. Cultivating a culture of continuous food safety communication.

Theme 1: Understanding food safety culture (FSC) as a strategic imperative

This theme centred on respondents' awareness and knowledge of the concept of FSC and their understanding of how to define and measure FSC within an SFB. Many EEs believed there was a lack of awareness of FSC among the staff of SFBs. This was reinforced by how many of the EEs themselves showed little awareness and knowledge of FSC or had even heard of it. Interestingly, FSC was also something they said was not actively discussed during their work with SFBs.

On the importance of FSC to SFBs, EE08 discussed how busy SFBs are:

"SFBs will only do what they need to do. And because of that, I don't think many people [staff of SFBs] even know [about FSC]. That word, food safety culture, I doubt that thought would impact the daily work, daily life, in an SFB. I think as we currently are post pandemic at the moment, I don't think it would be priority to them."

As EE08 had commented, SFBs will only do what they need to and often not strive to do any more than required, but this may be because FSC is not specifically measured within SFBs. This was mentioned by EE04, an EHO:

"You can go tell someone to operate a fridge at X degrees, that's very black and white, but culture is very difficult to define and it's very difficult to measure numerically, and at present we don't measure it during inspections."

In following up on this comment by email, it was confirmed by all 3 EHOs who took part in this study that FSC is not measured in the SFBs they currently inspect. Therefore, as was mentioned by EE08, if SFBs are not required to ensure a strong FSC, they may be unlikely to pursue it or prioritise it.

However, changing FSC is possible once awareness exists. EE09 commented how they believed that FSC can be difficult to change but can be done with the right person leading the SFB and shifting it to a positive culture where everyone prioritises food safety.

"Culture is hard to change. Culture is all about the habits and rituals and behaviours and reactions and how you regard things. But culture is basically the person at the top. OK, so he or she dictates and determines and changes and influences and

positively or negatively impacts the culture of the organisation. That means culture can be changed with the right person."

This shows the power of good leadership in achieving a better FSC.

Theme 2: Investing in FSC-focused capacity building activity

This theme centred on the need for SFBs to build capacity to help strengthen their workforce while fostering and maintaining a strong culture of food safety. Results identified several capacity-building activities relating specially to FSC training and resources.

Staff training

To improve on FSC awareness and FSC overall, it was discussed whether FSC training needed to be incorporated into the current food hygiene and safety training or if some new training course would need to be developed to help raise awareness of FSC.

 EE02 commented:

"When it comes to food safety, and creating food safety culture, I think a big part is needing to check for understanding. There's no point in just telling somebody or providing them with a nice glossy book or a little card to put in their pocket. You need to check how they interpret that instruction. Do they understand why it's important? That's why training is needed."

Refreshment of food safety and hygiene training was often mentioned throughout all discussions. Many EEs highlighted a lack of clarity on the timing required for retraining. EE08 stated:

"I think that there's a very distinct lack of clarity in that area. I think sometimes different individual independent trainers are going out there and they're training and they're saying my certificate is valid for three years and other trainers are saying it's valid for five years. I definitely think five years is too long."

Overall, the importance of refreshing food safety training was agreed by all EEs. EE07 stated:

"To make sure that they're basically kept on their toes and they're aware. And to re-emphasise the importance of highlighting any changes in legislation like additives, allergens and high-risk foods. There's always new things in there."

Reporting on whether retraining should be conducted every 3 or 5 years, EE05 commented:

"Ideally every three years would be an acceptable time period because it's good to test yourself and good to refresh your basic knowledge and because the legislation changes as well. Legislation changes all the time in terms of what we are being asked to do. The landscape of food hygiene now compared to 20 or 30 years ago is totally different, totally changed in terms of what they need to do and what risk assessments and risk approach to food business operations."

Although all EEs believed that food safety and hygiene training were important, EE06 reported that they believed some SFBs feel refresher training is not useful and that it is not conducted in all SFBs as it should be:

"I spoke to a chef friend of mine who's the head chef in a four-star hotel and I asked him when was the last time he did basic hygiene training, and he said 30 years ago."

These findings show a continued need to reinforce the importance and continual use of refresher food safety training in SFBs to ensure that all staff are up to date with training.

Available resources

The resources available to SFBs can contribute to building capacity by imparting knowledge, helping to enhance skills and providing the tools to implement a positive FSC. Resources are available to SFBs in several ways. In addition to training as discussed above, there are 3 main ways in which an SFB can receive and use food safety resources: a hard copy manual, online resources such as food safety websites, and face-to-face discussions with an expert, as in an EHO visit. These were all discussed by EEs, with all shown to be important and having both positives and negatives. EEs discussed in detail the resources that were available and their

relevance in providing SFBs with up-to-date information relating to food safety and maintaining proper food safety documentation.

Hard copy resources are often given to SFBs to allow them to use as a resource of information and as a record of processes such as fridge temperatures. However, not all EEs thought these manuals useful. For example, EE07 commented that in this present day using large hard copy textbooks is not helpful:

*"*They are giving SFBs a food safety pack with 180 pages. It is full of text, which most of will never be read. These books often just sit on a shelf, gathering dust."

EE06 also mentioned the problems with giving technical documents to chefs:

"Giving chefs a large manual of text is no good to them. These people are great with their hands and are very creative but often they struggle to read and write technical language. Yet the books they get in the kitchen are full of long text they don't use – they're pointless."

The reliability of these books was also questioned by EE02:

"I know all the tricks chefs use. They use a few different pens to fill in the blanks of days' worth of blanks in their temperature log."

This therefore highlights the need to update the provision of information to SFB owners and managers. Although hard copies have their place, from the experience of EEs they are outdated and unused by many SFBs at present except for necessities such as temperature logs, whose reliability was also in question.

Many of the EEs believed that online resources were useful and said they had used several websites in the past to update their knowledge or read information on new recommendations or regulations, and that these were of use for working roles, for example for EHOs and food safety consultants. They also felt that for SFBs these resources would be a great help. EE08 stated:

"The more the better and push it. There are great resources freely available with lots of great up-to-date information."

However, when discussing if they felt that SFBs used these resources, they felt that there was either no awareness that these resources existed or that they would be of no use to the SFB. EE03 commented:

"There are so many resources out there, but businesses don't seem to go for it themselves. They go through a trainer to get their information or get it from an EHO."

This suggests that the advertising approach currently in use by food safety governing bodies may not be reaching SFBs, who may not often access these resources.

One online resource that EEs believed was used widely by SFBs, however, was online food hygiene training courses. EE05 stated:

"You can do the training in your own time and get a certificate, it's all automated. It's easy and the younger generation could do that in the blink of an eye. They can get online and learn that way."

Which was supported by EE10 commenting:

"It allows staff to complete food safety and hygiene training out of work hours, and then businesses can compensate them afterwards, whether it's payment or time in lieu for it. So, there's really no excuse anymore, and online is definitely becoming a very popular mechanism of training the staff."

Some EEs also stated that online resources may be better used to keep staff up to date with refresher training:

"Once the staff have completed a food safety and hygiene training, using the online courses are a great and convenient way to refresh staff knowledge".

Although, as discussed, online resources are viewed positively and believed to be used by many SFBs for food safety and hygiene training, some EEs felt that solely using online methods for staff training lacked specific elements only achieved by face-to-face training. If a trainer comes into the SFB to conduct training, it gives the staff an opportunity to ask questions; and to have their training delivered in person is a more specific way tailored to their SFB. EE02, who acts as an EHO consultant to SFBs, commented:

"I find the on-site training is much more effective. I think the online was important to be able to offer, particularly at that time where they didn't want staff coming onto site [during Covid19]. However, onsite training allows for a much more immersive and specific training to be offered."

This was also reinforced by EE07:

"I do think when you do the on-site training, particularly where it's tailored for one business, staff are much more open and willing to ask questions, and they're much more interested because the subject is focused on what they're doing. For example, if they're not handling any raw meat, then you're able to mention it, but not go into detail on it, but then you're able to completely focus on what they're doing, like producing sandwiches with cooked meat etc."

Theme 3: Prioritising FSC alongside business survival

Balancing the needs of an SFB with a long-term commitment to FSC can be challenging. Discussions within this theme covered some of the operational challenges SFBs currently face in this post-Covid environment and how certain constraints may make it difficult to foster an FSC. Key challenges included staffing difficulties and related costs, including recruiting and keeping staff, as well as finding time and money to train them.

Staff shortages had been a problem ever since Covid-19, as experts such as EE03 (an EHO) explained:

"I'll go in and I'll ask them how the business is going. Most of them say, we are working ourselves to the bone here because we've got so few staff. It is just us. This is us!!"

Finding replacements for staff who leave is also a great difficulty, as EE06 stated:

"It's at a danger zone. I mean, you can't get staff because staff are getting opportunities elsewhere and pay rates and everything else [better shift hours, no evening or weekend work] are better, and now SFBs are employing people who, just two years before, you wouldn't even have interviewed."

Staffing issues increase workloads for remaining employees, leading some to become over-worked and arguably having negative overall effects on SFBs. EE02 reported one SFB owner stating:

"All the jobs still need done, you can't walk out of a kitchen and leave without washing the floor. You can't just walk away because you have less staff today and so you can't wash the counters down or clean the fridge?"

In addition, EE09 highlighted the added pressure for SFB owners and managers regarding staffing numbers:

"Given the pressures that there are in the labour market it's really hard because it's quite a high cost to serve some SFBs I've dealt with, as they are always near to recruiting 100% of people over the course of the year. When they want a work force of 20 people, an SFB had to employ 40 people to maintain that level of staff over the year. All those people needed an induction, basic training, manual handling, health and safety, and basic food hygiene training, so those SFBs are put under pressure."

These statements by the EEs who regularly work with SFBs in inspections or consultations shows how staffing issues are affecting SFBs and likely damaging FSC. Interestingly, all 3 EHOs commented on how they felt that they are also short staffed, with many EHO staff being sent to ports (the ship docks) to help with the new legislation on imports and exports. This puts time pressure on EHOs, who now must inspect the SFBs with fewer staff. It also means EHOs now have less time to spend in each SFB and only focus on essential requirements, with less time to help and educate SFB owners and managers. EE04 underlined this:

"We're under pressure, time pressure, and if we're not doing the educating, where does that extra layer of advice, education and persuasion come from?"

In contrast is the other side of the EHO inspection. Many of the EEs who advise SFBs on things such as upcoming EHO inspections believe that SFB owners and managers find EHO inspections very stressful. EE06, who consults SFBs, said:

"If I ask any member of staff who is your EHO, the answer is, I don't know, across the board. These people [EHOs], they're sort of bogey men in the industry; people

feel afraid when they visit. And then in between visits, you hear nothing, it could be three years before they appear again."

Another commonly raised topic was the cost of food safety training. EE07 recalled a conversation they had with one SFB owner:

"In the current climate, businesses, especially SFBs, say that's an easy one [food safety training] to cut."

While EE03 recalled a conversation with one SFB owner who said:

"I don't have to pay for training, I'll just try and train the new staff myself. I won't pay for someone to take them out of my business for two days, a day, half a day to get that training, we will just muddle through."

This also shows another factor affecting SFBs: the extra financial pressures where businesses may need to close to facilitate training.

Theme 4: Cultivating a culture of communicating food safety

Findings linked to this theme centred on the importance of effective communication within an organisation to encourage awareness of food safety, compliance and continuous training and development for staff. Results highlighted the challenges around technical language, the need for multilingual resources for staff training and changes in how people communicate nowadays, moving to more online training.

Understanding the technical language associated with food safety

Language was highlighted as a barrier to food safety and hygiene training and FSC.

Food safety and hygiene training was reported to often use language not in day-to-day use. EE02 explained that when carrying out food safety training:

"There's a lot of jargon associated with the food safety. A lot of the terminology and words that are used can be difficult for individuals because when you go in, especially individuals with no experience of food safety, you're going straight in and you're using words that aren't used daily, for example, bacteria, the names of the

bacteria, the contaminations, the hazards, the control measures. All those words can be confusing for the individuals."

EE01 agreed:

"Some of them are sitting nodding and you think, right they understand, then you ask them a question and they don't understand, and you know you have to go about it two or three different ways to re-word the question so that they understand it, and then determine whether or not they actually do know the question and the answer to the question."

This may be a bigger factor for some trainees than others, as EE09 mentioned:

"Often employees of food businesses are educated to a lower level compared to some other industries and this can lead to learning difficulties in the classroom."

Technical language is difficult for some native speakers to understand and worse for people whose first language is not English.

Multilingual communication difficulties

EE06 highlighted that many staff members are from other countries, most often Eastern Europe, and English is not their first language:

"I just feel that in our industry there's a lot of different nationalities, with different abilities and different levels of understanding of the English language."

This adds to the language difficulties in food safety and hygiene training, as learning will not take place if the language used is not understood.

Regarding training format, EEs said staff in many SFBs were accessing training via their smartphone) or tablet. In discussing the use of apps to communicate with staff about food safety issues, EE04 commented:

"If an SFB owner gets any new information in an email, like an announcement about allergens, they just put it into the WhatsApp group of chefs. They can also send group messages to all staff for any aspect of the business. It makes it all very straightforward to communicate."

EE06 expanded on the use of digital resources by noting that apps could be created to improve access to food safety documentation and resources:

"Every chef has a mobile phone. And if a program can be done on an app to get the new information out it would be great. For a restaurant it may be about food hygiene, because something's changed or the EHOs are looking for something different or we [food authorities] want this or want that. It gets it out to the masses quickly."

This indicates potential scope for using technology to improve access to and usability of food safety resources for all staff.

Barriers and facilitators

Across the 4 themes, the barriers and facilitators of FSC adoption are summarised in below

Barriers

- Lack of awareness and knowledge of FSC concept
- No clear definition or measurement of FSC
- FSC not viewed as a priority or necessity
- Limited refresher training in food safety means employees are not kept up to date with any new changes
- Hard-copy resources are often outdated and unused
- Limited awareness of the support resources available to SFBs on the websites of governing bodies (e.g. Safefood)
- Staffing and other costs can affect the prioritisation of FSC
- Training on FSC can be costly to SFBs
- The technical language associated with food safety can be difficult to understand.

Facilitators

- Requires strong leadership advocating for FSC
- Embed the concept of FSC into staff training
- Develop new courses on FSC

- Develop new refresher courses on food safety and hygiene training for long-term employees
- Online resources were useful and kept up to date
- Face-to-face training allows content to be tailored to the SFB
- Development of multilingual resources
- Making communication about FSC a regular occurrence.

The barriers attitudes and facilitators to establishing a strong food safety culture in small food businesses.

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Part two: Discussions with SFB owners and managers

SFB owners and managers have a number of roles within the business, often covering many different aspects including overseeing daily operations, managing staff, managing finances, maintaining compliance with food health and safety rules, and organising logistics (Visotsky, 2015). Often SFB owners and managers work closely with staff to ensure food is safe for sale, and therefore have a good understanding of the importance and requirements of food safety.

Discussions, whether one to one or in a focus group, are an excellent way to acquire knowledge and understanding of a topic. These interactive sessions provide a dynamic platform for information exchange, allowing individuals to delve into a subject, gather insights and uncover nuances that may otherwise be elusive (Latkovikj and Popovska, 2019).

Engaging with SFB owners and managers allows a direct exchange of experiences and knowledge, giving researchers practical insights into the daily operations of the SFBs. Through probing questions and open-ended discussions, key aspects of food safety management, such as hygiene practices, communication, resources, leadership and inspections, can be explored in depth. Furthermore, in-depth discussion about barriers and facilitators can explore ways to maintain and develop an optimum FSC. This approach considers the dynamic nature of the food industry, meaning that discussions allow a real-time understanding of SFBs' needs and wants and enable owners and managers to share their experiences, attitudes and beliefs.

Therefore, this study aimed to recruit SFB owners and managers from a variety of food business types for one-to-one and focus-group discussions. The purpose was to gather in-depth insight into the FSC of SFBs on the IOI, their attitudes and beliefs, and the barriers and facilitators to creating and strengthening FSC.

Methods

Recruitment of small food business owners and managers

The following recruitment methods were undertaken:

- Announcements via social media
- Announcements in industry newsletters
- Direct emails via government-based partner organisations
- Direct emails via industry-based membership organisations

All SFB owners and managers from Northern Ireland and Ireland were identified by the research team and were invited to participate in the project. If interested, they were sent the participant information sheet (PIS) (Appendix 3) and asked to complete a digital consent form for participation. Once they had given consent, a time was scheduled for an online discussion. Discussions were conducted in focus-group format if a suitable time allowed, or in a one-to-one format. All focus groups and discussions were conducted on Microsoft Teams and lasted approximately one hour.

SFB owners and managers were recruited according to the following criteria. They must:

- Currently own or manage an SFB operating in food service, food retail or food production
- Currently handle food personally or oversee staff who handle food, e.g. chef, waitress, deli assistant

Twenty-three SFB owners and managers were recruited for this stage of the project (12 from Northern Ireland and 11 from Ireland). Those from Northern Ireland included 5 producers (3 farms, 2 factories); 4 in food service (3 street-food restaurants, one hotel); and 3 food retail (3 delis). Those from Ireland included 5 in food service (4 hotels, one restaurant); 3 food producers (2 seafood, one confectionery); and 3 food retail (3 delis).

Procedure and measures

Each discussion was led by the research associate (RA) and began with an ice-breaker activity where participants were requested to introduce themselves by stating their current role and relevant employment history. Results from the REA and discussions with EEs informed the development of the topic guide. Key topics covered within the guide included:

- Awareness of FSC
- Details on how their SFB arranges food safety and hygiene training
- How useful they feel food safety and hygiene is
- Experience of food inspections
- Current barriers and facilitators to the implementation of FSC in their SFBs (Appendix 5).

Each interview lasted between 55 and 65 minutes, and was audio and video recorded. At the end of each discussion, participants were thanked and paid an honorarium (£25/€35) for their time.

Analysis

See Stage 2, Methods Section part one for details on analysis.

Results

In total there were 6 group discussions with a total of 23 participants 4 events in Northern Ireland, 2 in Ireland) and 7 one-to-one discussions (all in Ireland). Five main themes emerged, 3 of which were identified within part one of the EE discussions:

1. Embedding a mindset of FSC culture
2. Investing in FSC-focused capacity building
3. Prioritising FSC alongside business survival
4. Striking the balance between regulation and reassurance
5. Cultivating a culture of communicating food safety

Theme 1: Embedding a mindset of FSC culture

This theme is about the general awareness and implementation of FSC across SFBs. A main question asked of SFB owners and managers was whether they were aware of FSC and did they know what it was (Appendix 5, Question 1). Four owners/managers reported they were aware of FSC and were able to describe it in detail.

When asked about FSC, one SFB manager (SFB20) reported:
"I suppose it's something [FSC] we've been working on here for a bit. I think when you put these things around culture, it's starting to put terms around something that is already happening within the place and I think sometimes bodies [e.g., Safefood] like to bring terms to these things. But the term helps link it all together."

Questioned further about why they had incorporated FSC into their SFB, SFB16 stated:
"We are BRC certified and issue nine this year included food safety culture. So, it was an audit requirement and we had to get ourselves clued up with it and make sure that we get on the bus because we want our BRCGS certification, and that's where it stemmed from."

Going further into the practical side of FSC, SFB06 stated:
"It's just use whatever channels we have available. What's challenging in production is most of our workforce is deskless and most of our workforce have different nationalities. So, their understanding of English would be vastly different. To overcome this, we need to train people from different nationalities up to be team leaders and they then act as a middleman between management and operatives to explain requirements etc. So, we can show evidence of this for example."

SFB16 also commented on the indefinite scope of FSC in its description and terminology but felt for their business it was a positive and needed to be constantly reinforced:

"I think that's the thing with culture. It's not something that you say, oh, today we're doing culture and at the end of the day that job is done. It is something that you continuously must do in different ways and different forms. And people need to keep hearing it in various areas, not just in the training room or not just on the notice board. So, yes, I think the tricky part for me was the grey area but then I think there was a niceness in it because it gave me room to apply it to my own business."

Interestingly, apart from these SFBs involved in food production, no other owner/manager (19/23) had heard the term FSC, and none was aware of what it was – showing the large difference between SFB types. SFB02 said,
"No, I've never heard of it. I did some food hygiene a few months ago but that never came up. I'd guess it's something to do with how all the staff get on together, like a teamwork thing."

When this was investigated further, it became clear that for SFBs who are involved in food production a knowledge of FSC is now a requirement. This is because, during their audits with bodies such as the British Retail Consortium (BRC) and Safe and Local Supplier Approval (SALSA), their SFB needs to show evidence of FSC. Similarly, when asked about the new EC Regulation, only the same small percentage of SFB owners and managers (n = 4) were aware of it.

The responsibility that staff place on the importance of food safety was also discussed. SFB01 commented:

"I would say maybe some of the newer or younger members of staff wouldn't find it [food safety] just as important, they would think, oh that's fine. Whereas we've had guys who have been with us maybe eight or nine years. They would have very much our ethos on how the business should run and I would say they would run it as well as me if I'm not here."

This shows that encouraging staff to stay in the same SFB may be beneficial for FSC overall

Theme 2: Investing in FSC-focused capacity building

As with theme 2 in the EE interviews, results from the owner/manager interviews highlighted capacity building as a key theme. Interestingly, while this theme does discuss staff training (as noted in the EE theme), it also probes further to reveal owners/managers' reflections on their own food safety education; how they believed food safety and hygiene training was useful to them and how it impacted their staff.

The majority of SFB owners and managers reported that they had completed level 3 food safety training and found it of use to them as leaders of their SFB. SFB01 commented:

"Both me and my manager, and my head chef have the level three. And the rest of the guys have two. I feel it really helps you as an owner to understand the reasons behind why certain practices need to happen and why a kitchen needs to be laid out in a certain way etc."

Owner SFB12 also said:

"It means I can give really good inductions to my staff and help them if they have any food hygiene questions as I feel I learnt a lot in the level 3 training."

However, another interesting finding was that some SFB owners and managers had not heard of level 3 food safety and hygiene training but were interested in completing it once the idea was raised. Manager SFB02 commented:

"I wasn't aware that there were higher levels of food safety training. I always thought it was just level 2 and that covered everything. I'm relatively new to the food business [1 year] so it's good to hear this as it's something I think I'll do."

And the owner of SBF04 said:

"I'm going to go on and sign up for a level 3 course after this discussion. It sounds really practical and useful."

Continuing the discussion of food safety training, SFB owners and managers had differing preferences towards training staff. Many said they still preferred to use an accredited trainer, who would come into their SFB and train the staff in-house.

"We'll always get a person in, and they'll spend a half day with the staff. It's a course, but it's done every year. And it's updating them on the new things. They go through everything, how it [new updated changes] could be done if you wanted to do it, if you wanted to spend a lot of money and stuff."

Other SFB owners and managers felt differently: that online training ticked the box as it allowed their staff to do their training very quickly and conveniently. SFB04 commented:

"Yes, I thought it was pretty good, I did it first before any of my staff. It took me just shy of two hours. It cost like £15, so pay someone two hours plus £15, you're giving them like £35, £40 to do this. It's great value for money."

However, SFB08 commented on the limitations of the online food safety and hygiene training:

"I thought, like it's a really good start. It doesn't teach you everything you need to know, but it probably teaches you 80%. For the cost, it was fine for us though."

Some reported difficulty in finding a reputable trainer who would come into their SFB, and so they preferred to do it online for ease even if they felt it might not be the same experience for their staff. Owner SFB10 commented:

"I've been online and have done searches and still couldn't find anyone in my area to come in and teach a course so I just went for the online option but would have preferred in-person if I could have got it."

Theme 3: Prioritising FSC alongside business survival

Again, reflecting similar concerns as highlighted in part one by the EEs, this theme summarises the key challenges currently facing SFBs in terms of rising costs and staff turnover. These could potentially lead to gaps in food safety training and knowledge and make it difficult to keep consistently to food safety principles across the workforce.

All owners and managers discussed the rising costs of operating an SFB, with costs such as rent, ingredients and services like electricity all increasing in recent years. Although no SFB reported this put them at risk of closure, they said it had caused

them to become more price aware, cut back on certain aspects of their business and increase their prices for customers.

SFB03 commented:

"The biggest problem is financial and the cost of ingredients. It's our biggest problem at the minute. I don't think, we have stopped doing anything and we haven't cut any corners, but you're very wary of cost all the time, and waste, and turn that off, don't waste that, be careful when you're cutting cheese, these sort of things. That is a definite challenge."

Another factor is that staff are asking for increased wages. SFB09 said:

"Staff are happy to work longer hours but only if they are paid at a higher rate, which is understandable but hard financially for the businesses."

Staff turnover differed between SFBs depending on the size and sector of the business. Some larger SFBs with more than 10 employees (44%) reported that they had an increased staff turnover in recent years for varying reasons, including employing more non-native staff, or younger staff members tending to move job more regularly. Although not all larger SFBs reported this, approximately half said they had experienced it. SFB20 discussed the high level of staff turnover in their business:

"We have a high level of staff turnover mostly because a lot of our staff are from other countries, so they come here and work for a while and then change job type or go somewhere else."

However, those with fewer than 10 employees reported that they had a low rate of staff turnover. SFB09 reported that:

"Fortunately, we don't have a high turnover of staff, which is good. Everybody's been here a while and has been, I guess, ingrained in the business so maybe they don't want to leave."

A manager from SFB21 commented:

"You have to keep your staff interested. In our kitchen I can move staff around to do different roles, which means they are always learning something new and trying new skills. If staff get bored, they are more likely to move on.

The barriers attitudes and facilitators to establishing a strong food safety culture in small food businesses.

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Theme 4: Striking the balance between regulation and reassurance

Results highlighted the importance of SFBs' relationship with their local EHOs and the positive role of compliance within a business's FSC. EHO visits were also discussed with SFB owners and managers. There were contrasting viewpoints, with some finding their EHO to be very helpful and on hand for answering questions while others found the experience very stressful and unpleasant and said EHOs were quite unhelpful. SFB04, who had a good experience with the EHO before even opening the SFB, commented:

"I came into this industry never having worked a day in my life in hospitality. I'd always worked like retail, student jobs and stuff. So, I very much just went to the EHO and said, tell me exactly everything I have to do and I'll do it. And that's kind of been our viewpoint since. It's do as they say, and then we'll never get in trouble."

Other SFBs had different experiences, however, with SFB15 commenting:

"I always feel like they're out to get us. They come in, and there's no pleasantries, and they often come at lunchtime when we are super busy, and it feels like they want to find stuff that's wrong. For that reason, I would never contact them if I was looking for advice."

The food hygiene rating was discussed with SFB owners and managers. Users in Northern Ireland feel it allows them to advertise their high level of food hygiene to customers:

 "I think the food hygiene scores are great. It gives businesses something to strive for and lets customers know the business take hygiene seriously. I've always had a 5 and would hate to go down."

Currently in Ireland the food hygiene rating does not exist. However, all SFB owners and managers from Ireland said they felt the rating would be a benefit to their business. SFB14 commented:

"I've worked in NI and Ireland, and I really like the scores on the doors. I think that's a great idea and a great initiative for people to keep their premises in tip-top shape. It would be great to see it here [Ireland] too."

Theme 5: Cultivating a culture of continuous FS communication

As with the EE discussions, this theme highlighted the importance of communicating FS information to keep staff members up to date. Interestingly, very few SFB owners and managers (17%) reported using any form of online resources (Safefood website) or emails to keep up to date or increase knowledge of food safety matters, with most reporting that any new information came from EHOs during inspections. SFB18 said:

"I don't have time to go online and read all the new reports that are coming out and updated information. If it's of importance the EHO will be telling me."

Although this was the case, many SFB owners and managers also said that they would welcome a way of disseminating food safety information in a straightforward manner. As now most individuals have a smart phone, the use of an app was discussed as a possible way of receiving this information, and also being able to link with food safety measures in the SFB such as fridge temperatures, which could 'ping' the app if, for example, temperatures went out of optimal ranges.

"I think an app is a great idea. I used to work in larger kitchens where a lot of the information for the job was on an app and you only had to open when you went to work and all updates etc. were there for you to read before you started your shift. It would also ping if sensors were out of range; it was really useful. It would be too expensive to use in our kitchen though, as I had it priced."

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Barriers and facilitators

Across the 5 themes the barriers and facilitators of FSC adoption are summarised in below

Barriers

- Lack of awareness and knowledge of FSC concept.
- No clear definition or measurement of FSC
- Lack of awareness of FSC legislation
- FSC not viewed as a priority among new staff compared to more experienced staff
- Online training doesn't teach you everything you need to know
- Difficulty finding a reputable trainer in FSC
- Staff turnover and other costs can affect the prioritisation of FSC
- Timing and nature of EHO visits perceived as not supportive
- No Food Hygiene Rating Scheme or similar system operating in Ireland
- Not regularly communicating FS information to staff
- Limited awareness of the support resources available to SFBs on the websites of governing bodies (such as safefood)
- Owners/managers unaware of Level 3 and above in food safety training

Facilitators

- Auditing requirement for certification (e.g. BRCGS and SALSA)
- Development of multilingual training
- Requires strong leadership advocating for FSC
- Staff morale and engagement is important to keep them interested in the role
- Online training can be quicker and better value
- Face-to-face training allows content to be tailored to the SFB
- Fewer SFBs with under 10 employees report a low rate of staff turnover
- Working in partnership with the EHO

- Maintaining high scores as part of the Food Hygiene Rating Scheme (FHRS)
- Making communication about FSC a
- regular occurrence

Key findings

Results from the EE discussions identified 4 themes in relation to FSC:

1. Understanding FSC as a strategic imperative
2. Investing in FSC-focused capacity building
3. Prioritising FSC alongside business survival
4. Cultivating a culture of communicating food safety

Results from the SFB owner/manager discussions identified 5 themes in relation to FSC:

1. Embedding a mindset of FSC
2. Investing in FSC-focused capacity building
3. Prioritising FSC alongside business survival
4. Striking the balance between regulation and reassurance
5. Cultivating a culture of continuous food safety communication

Three of these themes were common to EE and SFB discussions. Part one (EE) and part two (SFB) discussions identified a total of 13 barriers and 14 facilitators.

4 Stage 3: Food safety culture survey

FSC encompasses values, behaviours, and practices that collectively contribute to safe food production. To be effective, FSC needs to be implemented from farm to fork, in other words by producers, food retailers and food service outlets such as restaurants and cafés. Recognising the multifaceted nature of FSC, we aimed in this study to investigate several of its key themes in all types of SFBs across the IOI, using a survey approach.

Based on findings from the review, expert interviews and industry discussions, we identified 11 components essential to FSC (Fig. 1): leadership, infrastructure, responsibility, risk perception, pressure at work, communication, commitment, teamwork, management systems, food safety messaging and FSC awareness. All are important in establishing a positive and successful FSC within a food business.

Methods

We drew up 46 questions for the survey (Appendix 6). These included demographic questions for the food business and the respondent. We asked the respondent to evaluate the 11 components of FSC within their food business: communication, infrastructure, pressure at work, risk perception, management systems, leadership, teamwork, responsibility, commitment, awareness of FSC, and food safety messaging. Nine of these components were selected using an FSC maturity index, which uses validated questions to measure FSC maturity in food businesses (Tomei and Russo Tomi, 2019). The other 2 components (awareness of FSC and food safety messaging) were developed at Ulster University to collect additional measurements on factors we deemed important in measuring FSC. The questionnaire used both yes/no questions and a 7-point Likert scale with 7 representing "strongly agree" and 1 representing "strongly disagree". Each question

had 2 variants, with one aimed at owners/managers and one aimed at operatives (Appendix 6).

Survey development and piloting

Cognisense, a Northern Ireland-based market research company, was employed to conduct the large-scale survey on the IOI. They were tasked to recruit 500 SFBs with 50 or fewer employees from all types of food businesses (food service, food production and food retail) and with an even distribution of owners, managers and operatives. Standard Industrial Classification (SIC) was used to identify suitable SFBs, including codes for retail, food and beverage service activities, manufacturing of food products and wholesale of food stuffs. Cognisense spent 2 days piloting the survey by phone with 20 SFBs to gauge duration and the relevance of the questions; no changes were made to the content. Cognisense then conducted the full survey, with discussions lasting approximately 15 minutes. All survey responses were anonymised, and no staff member name or company name was recorded.

Inclusion criteria

Participants were required to:

- Be aged 18 years or over
- Work within an SFB of up to 50 employees on the IOI
- Be either the owner/manager of the SFB or a staff member handling food
- Have good competency in the English language

No incentive was provided to participants completing the survey.

Analysis

- Results of the survey were presented using descriptive analysis and differences between groups were evaluated using cross analysis.
- The mean FSC maturity index was calculated for each of the 9 FSC components.
- Each component consisted of 4 questions scored using a 7-point Likert scale. If "don't know" was selected, this response was removed, and scores were

transformed so that the maximum possible score was 6 and the minimum score was 0.

- A total mean FSC maturity index score was then calculated from the 9 mean scores.

- Statistical comparisons were made between themes and cross analysis based on demographics.

- Data normality was tested using the Shapiro-Wilk Test. As data was determined to be normally distributed, an ANOVA, with Tukey post-hoc tests (3 variables), or independent t-tests (2 variables) was used to assess differences between groups. Level of significance was taken as $p \leq 0.05$ and results were presented as mean (SD).

Results

Four hundred and fifty-nine (459) SFBs participated in the phone survey. All demographic information is shown in Table 2. Representation of SFBs across the IOI was well distributed between Northern Ireland (34%) and Ireland (66%). At least one SFB from each county on the IOI participated, meaning all counties were represented. The county with the greatest representation was Dublin (14%) and the lowest was Offaly (<1%). There was also a good distribution of micro businesses with up to 10 staff (53%) and small businesses with 11 – 50 staff (47%). Regarding type of food business, there was higher recruitment from food service businesses (70%), followed by food retail (16%) and food production (14%). However, this was to be expected given the proportion of food production and retailers vs. food service businesses currently operating on the IOI. Of all SFBs who participated, 58% were privately owned (owned by shareholders who do not necessarily have input in the day-to-day running of the business) and 41% were family owned (owned by family members who are involved in the day-to-day running of the business), with the remaining being local government funded (1%).

Of the participants who took part, males represented 51% and females 49%. Their age ranged from 18 to 70 years with the most common age group being 35–49 years (41%) and the least common 65–70 years (2%). Staff were educated to a wide

variety of levels from secondary to post-graduate, with the most common being a professional qualification of degree level (29%) and the least common being post-graduate degree level (2%). There was also good representation from all types of staff member, with operatives (39%) being the most highly represented, then SFB owner (32%) and finally SFB manager (29%). Length of experience within the food industry ranged from one to 10 years, with the most common being 3–4 years and least common 9–10 years. When asked had they experience in the food industry before joining their current food business, 74% said yes and 26% said no. The employment status of these staff members included full time (74%) and part time (11%), showing that full-time employment was most common. The remainder, mainly business owners, were self-employed.

Table 2 Demographics of market survey participants

Demographic	% (n)	% (n)	% (n)
	Total	Northern Ireland	Ireland
Total	100 (459)	100 (157)	100 (302)
Food business type			
Food service	70 (320)	71 (112)	69 (208)
Food retail	16 (73)	24 (38)	12 (35)
Food production	14 (66)	4 (7)	20 (59)
Location			
Northern Ireland	34 (157)		
Ireland	66 (302)		
Food business size			
Small (11-50)	47 (216)	15 (63)	33 (153)
Micro ($\leq$10)	53 (243)	20 (94)	32 (149)
Ownership type			
Family owned	41 (189)	14	26 (122)
Privately owned	58 (266)	19 (88)	39 (178)
Local Government funded	1 (4)	1 (2)	1 (2)
Gender			
Male	51 (236)	16 (74)	35 (162)
Female	49 (223)	18 (83)	30 (140)

Demographic	% (n)	% (n)	% (n)
	Total	Northern Ireland	Ireland
Age (years)			
18-24	7 (32)	3 (16)	3 (16)
25-34	14 (64)	5 (24)	8 (40)
35-49	41 (188)	12 (57)	28 (131)
50-64	20 (92)	5 (25)	14 (67)
65-70	2 (8)	1 (2)	1 (6)
Refused	16 (72)	7 (31)	9 (41)
Education status			
Secondary	6 (27)	5 (23)	1 (4)
GCSE/Junior Cert	12 (55)	4 (20)	8 (35)
A Level/Leaving Cert	23 (105)	6 (28)	17 (77)
College	22 (103)	8 (39)	14 (64)
Professional qualification	29 (131)	5 (24)	23 (107)
University degree	6 (28)	5 (22)	1 (6)
Post-graduate education	2 (10)	1 (1)	2 (9)
Current job role			
Business owner	32 (146)	10 (47)	21 (99)
Manager	29 (135)	8 (35)	22 (100)
Operative	39 (178)	15 (75)	22 (103)
Length of experience (years)			
<1	4 (17)	1 (7)	3 (10)
1-2	18 (81)	6 (30)	10 (51)
3-4	26 (118)	9 (44)	16 (74)
5-6	18 (83)	10 (26)	12 (57)
7-8	11 (51)	3 (18)	7 (33)
9-10	2 (11)	0 (2)	2 (9)
10+	21 (98)	7 (30)	15 (68)
Prior food industry experience			
Yes	74 (339)	25 (115)	49 (224)
No	26 (120)	9 (42)	17 (78)
Employment status			
Employed full time	74 (338)	27 (124)	46 (214)
Employed part time	11 (50)	4 (20)	6 (29)

Demographic	% (n)	% (n)	% (n)
	Total	Northern Ireland	Ireland
Self-employed	15 (71)	3 (12)	13 (59)

Level of FSC awareness

To measure FSC awareness, participants were asked whether they had heard of the term "food safety culture" and if they were aware of the new Commission Regulation (EU) 2021/382 (EU, 2021) that states that evidence of FSC is now a requirement in all food businesses within the EU as shown in figure 3 below. Most respondents (79%) said that they were aware of the term FSC (owners: 76%, managers: 77% and operatives: 81%), and 64% of all participants said that they were aware of the new EU regulation that was in place (owners: 70%, managers: 62%, operatives: 61%) (Figure 3).

Figure 3. Participants' awareness of (a) food safety culture (FSC), and (b) new EU FSC legislation
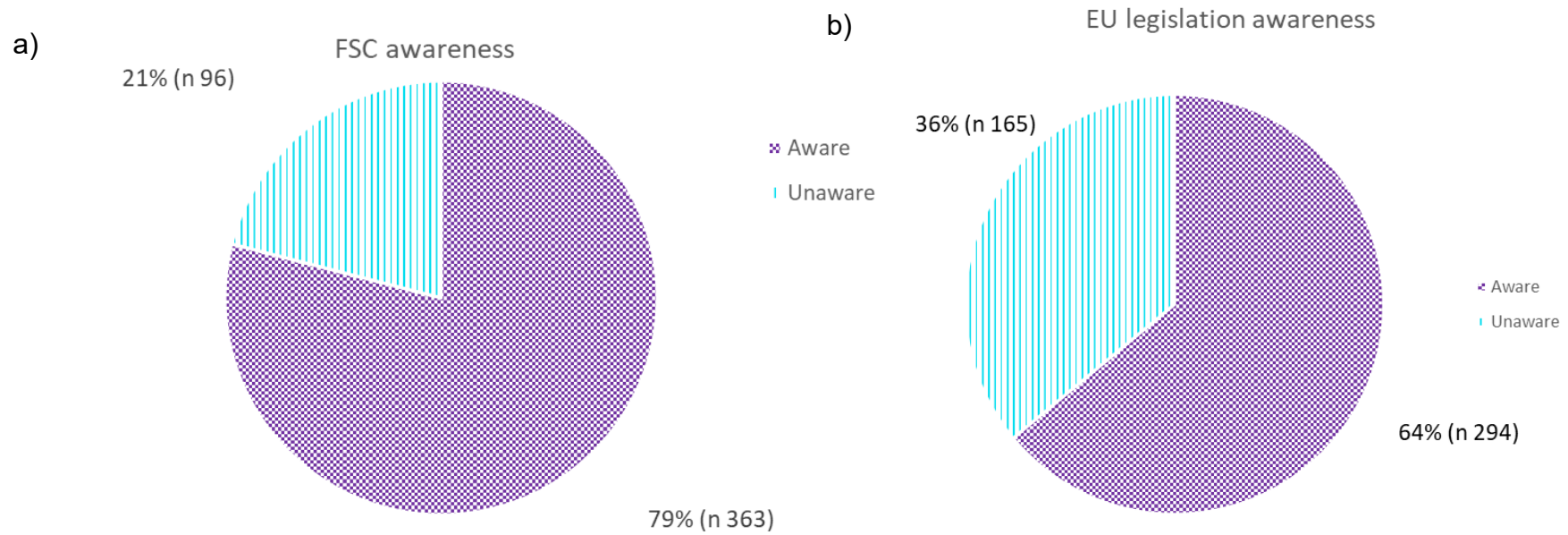

Figure 3 (a) show 21% of respondents (96) were unaware of food safety culture. And 79% of respondents (363) were aware of food safety culture. Figure 3 (b) shows that 36% (165) were unaware of EU legislation and 64% of respondents (294) were aware of EU legislation.

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Respondents' assessment of FSC culture within their food business

Overall, respondents perceived that there was an excellent FSC within the food business they worked in and the total mean FSC maturity index score was 5.18 (0.77) (range: 1.1-6.0) (Table 3). This score did not differ across county (p=0.39), business type, size, age or ownership (p>0.11), or across respondent age, gender, education, experience or FSC awareness (p>0.17). However, business owners/managers did score FSC within the business lower than operatives (5.10 (0.89) vs 5.31 (0.49) (p=0.001), for owners/managers and operatives respectively).

Table 3: Survey respondents' overall assessment (mean score (SD)) of their food businesses' food safety culture (FSC) using an FSC maturity index score

	Total mean score (SD)	p-value*
Total (n459)	5.18 (0.77)	
Food business demographics **Food business type**		
Food service (n320)	5.21 (0.71)[b]	0.40
Food retail (n73)	5.07 (1.04)[b]	
Food production (n66)	5.16 (0.68)[a]	
Location		
Northern Ireland (n157)	5.13 (1.13)	0.39
Ireland (n302)	5.21 (0.47)	
Food business size		
Small (n216)	5.12 (0.89)	0.11
Micro (n243)	5.23 (0.63)	
Ownership type		
Family owned (n189)	5.08 (0.99)	0.64
Privately owned (n266)	5.24 (0.55)	
Local government funded (n4)	5.44 (0.48)	
Respondent demographics		
Gender		
Male (n236)	5.17 (0.78)	0.88
Female (n223)	5.18 (0.75)	

	Total mean score (SD)	p-value*
Age (years)$		
16-24 years (n32)	5.31 (0.49)ab	<0.001
25-34 years (n64)	5.11 (0.58)a	
35-49 years (n188)	5.13 (0.86)a	
50-64 years (n92)	5.02 (0.79)a	
65+ years (n8)	4.81 (1.24)ab	
Refused (n72)	5.57 (0.46)ab	
Education status		
Secondary (n27)	5.13 (1.08)	0.24
GCSE / Junior Cert (n55)	5.37 (0.65)	
A-level / Leaving Cert (n105)	5.27 (0.43)	
College (n103)	5.12 (0.74)	
Professional qualification (n131)	5.07 (0.82)	
University degree (n28)	5.12 (1.18)	
Post-graduate education (n10)	5.02 (1.11)	
Current job role		
Business owner/manager (n281)	5.10 (0.89)	0.001
Operative/technical (n178)	5.31 (0.49)	
Length of experience		
Less than 1 year (n17)	5.05 (0.99)	0.17
1-4 years (n98)	5.27 (0.59)	
5-10 years (n145)	5.12 (0.87)	
10+ years (n199)	5.11 (0.86)	
Less than 1 year (n17)	5.05 (0.99)	0.17
1-4 years (n98)	5.27 (0.59)	
5-10 years (n145)	5.12 (0.87)	
Awareness of term 'food safety culture'		
Yes (n215)	5.16 (0.81)	0.48
No (66)	4.88 (1.09)	
Awareness of food safety culture EU regulations		
Yes (n186)	5.13 (0.85)	0.35
No (n95)	5.03 (0.97)	

Scores calculated from the mean FSC maturity index scores of the 9 food safety culture components assessed within the survey. Maximum possible score 6.0, minimum possible score 0. Differences assessed using independent t-score (variables with 2 categories) or ANOVA (variables with 3 categories) with tukey post

hoc tests (values with unlike superscript letters are significantly different from each other). $^\$$missing data n3

Mean scores across the 11 FSC components ranged from 4.96 to 5.46 (Table 4). For the owner/manager group the highest mean score (5.24) related to **Leadership,** which was statistically higher than the score for **Management systems communication** (4.96) (*p*= 0.0012). Among the operatives' group, the highest scoring FSC component was **Responsibility** (5.46) which was statistically higher than the score for **Communication** (5.17) (*p*= 0.001). Overall, mean scores were higher across all FSC components in the operatives' group than the owner/manager group. Only **Communication**, the lowest-scoring component (5.17) in the operatives' group, scored lower than any of the owner/manager group component scores.

Table 4 Food safety culture maturity index component scores* assessed by small food business owners/managers and operatives

Food safety culture component	Owners and managers mean score (SD)	Operatives mean score (SD)
Leadership	5.24 (0.94)	5.30 (1.02)
Infrastructure	5.20 (0.86)	5.29 (0.92)
Responsibility	5.20 (0.88)	5.46 (0.76)
Risk perception	5.12 (0.98)	5.40 (0.88)
Communication	5.08 (0.89)	5.17 (0.97)
Commitment	5.04 (0.97)	5.33 (1.09)
Teamwork	4.99 (1.04)	5.32 (0.74)
Management systems	4.96 (0.89)	5.25 (0.82)

*The maximum score achievable was 6 and the lowest score achievable was 0.

Further analysis indicated only one statistical difference between the components of **Leadership** and **Management systems** in the owner/manager group (*p*= 0.0012). In the operatives' group there was also one statistical difference identified between components **Responsibility** and **Communication** (*p*= 0.001).

The Likert score responses for each FSC components for both groups of owners/managers and operatives combined is shown in Figure 4. **Responsibility** was found to have the highest percentage of "strongly agree" (47%) and **Pressure at work** and **Teamwork** had the lowest total percentage of "strongly agree" (34%).

Figure 4. Owner/manager and operative Likert responses assessing the maturity of food safety culture within their food business
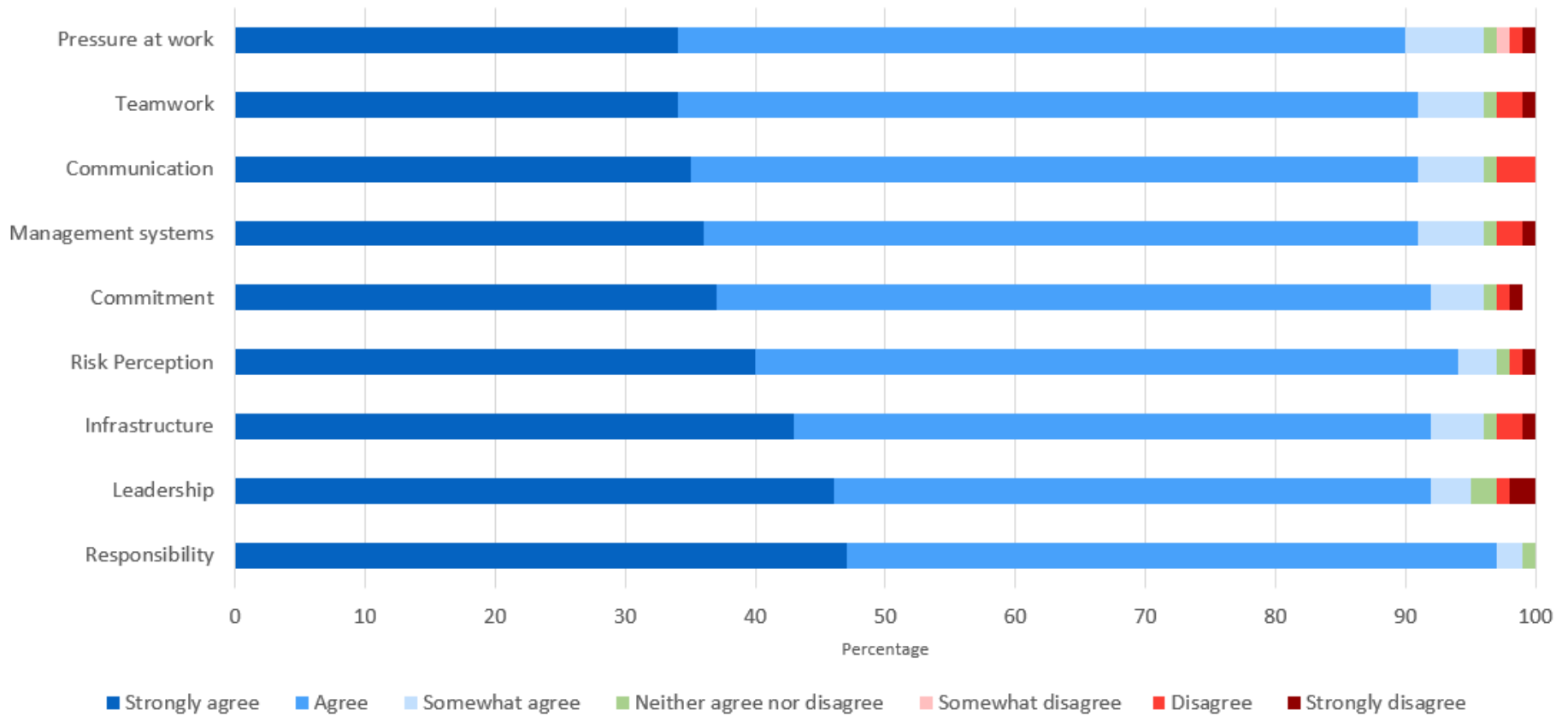
The bar chart in figure 4 Owner/manager and operative Likert responses assessing the maturity of food safety culture within their food business under 9 headings as documented below

Communication: Strongly agree (30%, n= 139), Agree (61%, n= 279), Somewhat agree (3%, n= 12), Neither agree nor disagree (1%, n= 5), Disagree (4%, n= 18), Strongly disagree (1%, n= 6).

Infrastructure: Strongly agree (30%, n= 138), Agree (61%, n= 281), Somewhat agree (3%, n= 14), Neither agree nor disagree (1%, n= 5), Somewhat disagree (1%, n= 4), Disagree (1% n= 5), Strongly disagree (2%, n= 8), Don't know (1%, n= 4).

Pressure at work: Strongly agree (30%, n= 139), Agree (59%, n= 272), Somewhat agree (4%, n= 20), Neither agree nor disagree (1%, n= 4), Somewhat disagree (1%, n= 3), Disagree (3%, n= 14), Strongly disagree (2%, n= 7)

Risk perception: Strongly agree (36%, n= 168), Agree (55%, n= 252), Somewhat agree (3%, n= 13), Neither agree nor disagree (1%, n= 6), Disagree (2%, n= 10), Strongly disagree (2%, n= 10)

Management systems: Strongly agree (28%, n= 127), Agree (61%, n= 278), Somewhat agree (4%, n= 20), Neither agree nor disagree (2%, n= 9), Disagree (4%, n= 20), Strongly disagree (1%, n= 5)

Leadership: Strongly agree (49%, n= 226), Agree (43%, n= 200), Somewhat agree (1%, n= 6), Neither agree nor disagree (1%, n= 6), Disagree (2%, n= 8), Strongly disagree (3%, n= 13)

Teamwork: Strongly agree (27%, n= 124), Agree (62%, n= 285), Somewhat agree (5%, n= 23), Neither agree nor disagree (2%, n= 7), Disagree (4%, n= 17), Strongly disagree (1%, n= 3)

Responsibility: Strongly agree (43%, n= 197), Agree (49%, n= 227), Somewhat agree (2%, n= 10), Neither agree nor disagree (1%, n= 5), Disagree (3%, n= 13), Strongly disagree (2%, n= 7)

Commitment: Strongly agree (30%, n= 137), Agree (59%, n= 270), Somewhat agree (4%, n= 18), Neither agree nor disagree (2%, n= 10), Disagree (3%, n= 15), Strongly disagree (1%, n= 5), Don't know (1%, n= 4)

These charts show the combined responses from owners/managers and operatives and are ranked by the themes that had the highest percentage of "strongly agree" on the Likert scale.

Preferences for food safety and hygiene training

Each participant was asked to report the level of food safety and hygiene training they had completed (Figure 5). For owners (n= 146), managers (n= 135) (a total of 281 owners and managers) and operatives (n = 178), the level ranged from none to level 4. Only 8% of owners/managers and 20% of operatives had not completed any accredited food safety and hygiene training. Of those who had completed such training, L3 was the most common in the owner/manager group (38%) and level 2 was the most common in the operatives' group (36%).

Participants were also asked to rate their preference of delivery format for the training (Figure 6). Owners/managers ranked the options very similarly. Bespoke training for their own SFB ranked the highest (41% and 45%) and "can complete in own time" the lowest (3% and 2% among owners/managers and operatives respectively). Also ranking highly was face-to-face training (29% and 23% for owners/managers and operatives respectively).

Figure 5. Level of food safety and hygiene training attained by (a) owners/ managers, and (b) operatives
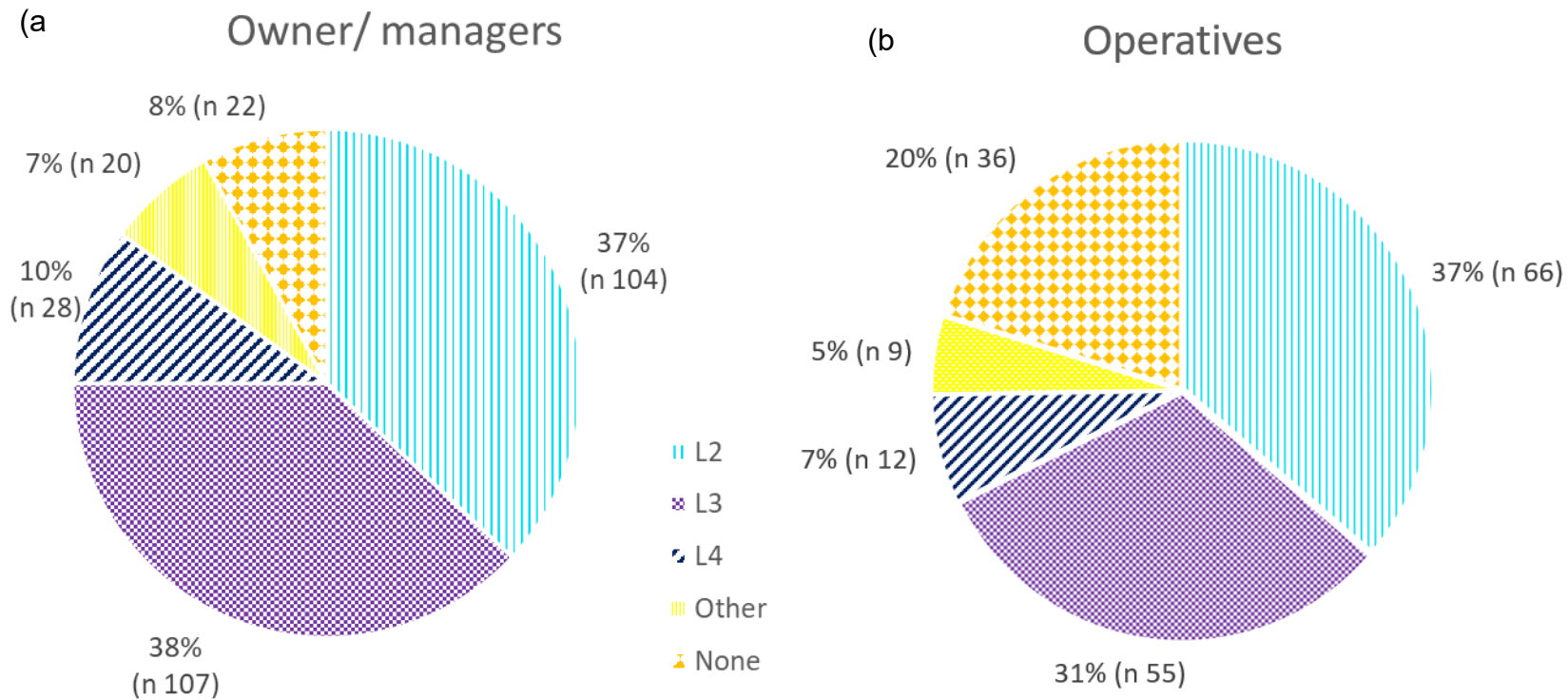
Levels (L) include level 2 (blue), level 3 (purple), level 4 (black) and "other" (yellow) referring to a different qualification relating to food safety. "None" (orange) refers to staff members who have not completed any formal food safety and hygiene training.

The barriers attitudes and facilitators to establishing a strong food safety culture in small food businesses.

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Figure 5 shows two pie charts labelled a and b.

Pie chart a shows the level of food safety and hygiene training attained by owners and managers to the following levels. Level 2 37% (n 104), Level 3 38% (n107),

Level 4 10% (n 28), Other level 7% (n 20), no formal training 8% (n 22).

Pie chart b shows the level of food safety and hygiene training attained by operatives as Level 2 37% (n 66), Level 3 31% (n 55), Level 4 7% (n12),   other 5% (n 9) and no formal training 20% (n 36)

Figure 6. Format of food safety and hygiene training preferred by (a) owners/managers, and (b) operatives

A

b

Owner/ Managers

1% (n 1)

22% (n 45)

29% (n 57)

4% (n 9)

3% (n 6)

41% (n 82)

Operatives

1% (1)

16% (n 27)

23% (n 39)

13% (n 21)

2% (n 4)

45% (n 75)

- Face-to-face training
- Specified for SFB
- Can complete in own time
- Can complete quickly
- Can be completed online
- None of these

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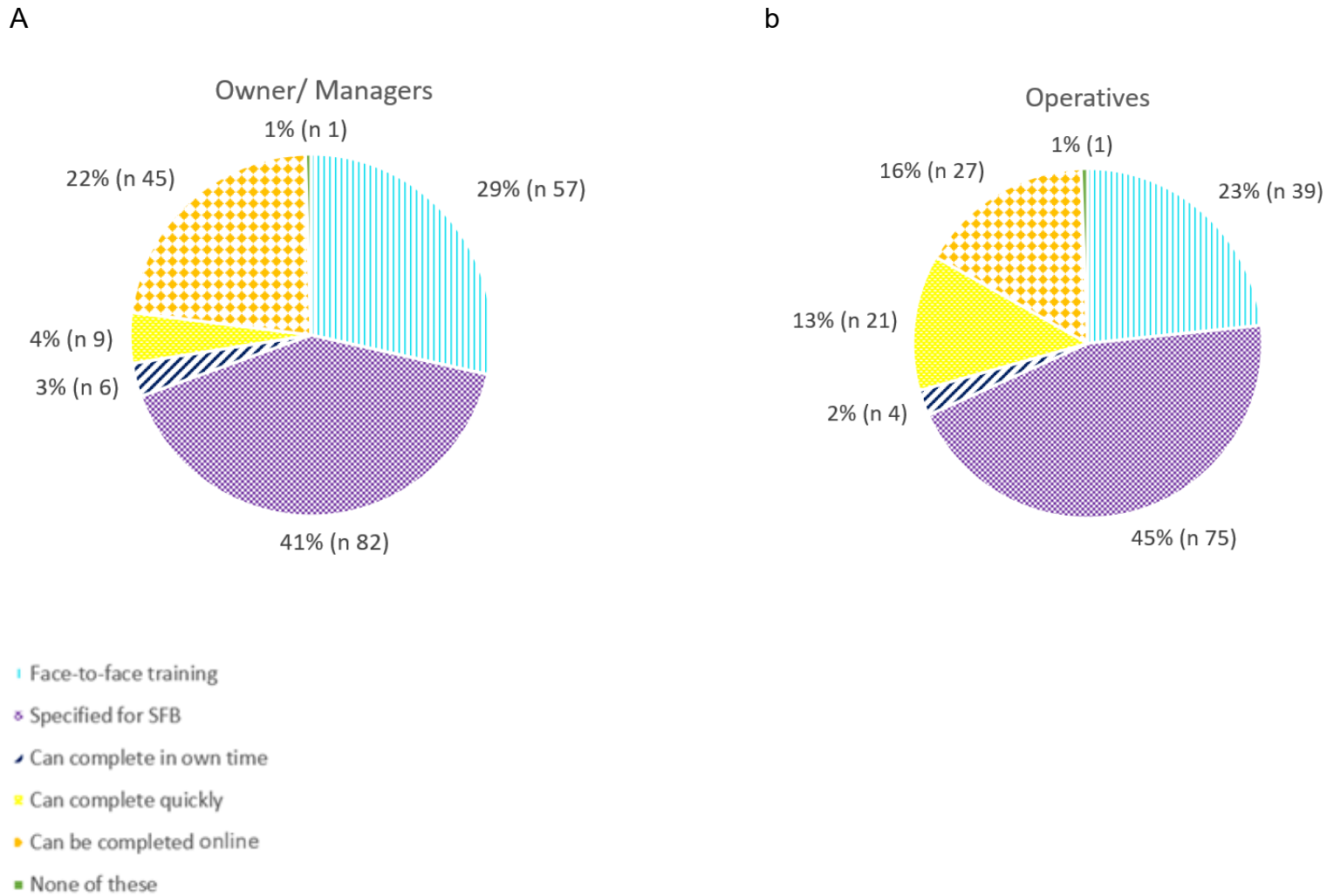
Figure 6 shows 2 pie charts labelled a and b.

Pie chart a shows the format of food safety training by preferred by owners and Managers (Face-to-face training 29% (n 57), specified for SFB 41% (n 82), can complete in own time 3% (n 6), can complete quickly 4% (9), can be completed online 22% (n 45), none of these 1% (n 1)

Pie chart b shows the format of food safety training preferred by operatives (Face-to-face training 23% (n 39), specified for SFB 45% (n 75), can complete in own time 2% (n 4), can complete quickly 13% (21), can be completed online 16% (n 27), none of these 1% (1)

Key findings

- A high percentage of owners/managers and operatives were aware of the term FSC (79%). Fewer respondents were aware of the EU legislation on FSC (61%).none of these 1% 9n 1)

- Managers, owners and operatives all considered their food business had a mature FSC (FSC maturity index score: 5.18 out of maximum of 6). However, owners/managers scored their business lower than operatives.

- FSC component scores:
  - Operatives believed everyone in their food business took on **responsibility** to encourage safe food practices (highest FSC components score: 5.46).
  - Managers/owners believed that there was strong **leadership** within the business in viewing food safety as a non-negotiable value (highest FSC component score: 5.24).
  - **Communication** and information sharing about food safety practices throughout the business, to ensure expectations are met and safety concerns are addressed, was identified as a barrier across the businesses (lowest FSC component score: 5.17).
  - For owners/managers the **business's management systems,** including processes, policies and procedures in relation to food safety,

were highlighted as an area which may benefit from support (lowest FSC component score: 4.96).

- 20% of operatives and 8% of owners/managers reported having had no food safety and hygiene training. Level 3 training was the highest level of training undertaken by the majority of owners/managers, indicating an opportunity for further development and training.

- Training formats that can be tailored to the needs of the business and can be delivered face to face were preferred by both operatives and owners/managers.

5 Stage 4: Follow-up stakeholder group discussions

Following in-depth discussions with EEs and SFB owners and managers, the value of discussing the findings of Stage 4 was appreciated, as some results highlighted in the market research survey did not closely match previous findings. Discussion of these was seen as crucial to understand the differences. The main points of difference between Stage 2 and 3 findings and Stage 4 included:

1. Awareness of FSC among SFB owners, managers and operatives
2. Methods of food safety training and the levels of food safety and hygiene training among staff
3. Leadership in a small food business
4. Resources

To assess this, we aimed to re-recruit EEs and SFB owners and managers from Stage 2 and Stage 3 to discuss these topics in more detail in a focus group or one-to-one format.

Methods

Design and sampling

EEs and SFB owners and managers who had participated in Stage 2 or 3 were re-contacted to ask if they were willing to participate in a follow-up discussion, with a PIS detailing the nature of the discussion (Appendix 2 and 3). If they were willing, EEs were invited to attend an online focus-group discussion lasting approximately

one hour. If willing to participate, SFB owners and managers were invited to attend a one-to-one online discussion lasting approximately 30 minutes. All focus groups and discussions were conducted on Microsoft Teams.

Nine EEs attended focus group discussions (7 from Northern Ireland, 2 from Ireland). Twelve SFB owners and managers (6 each from Northern Ireland and Ireland) attended one-to-one discussions.

Procedures and measures

Each discussion was led by the project research associate (RA) and began with an ice-breaker activity where participants introduced themselves and stated their current role and relevant employment history. The RA then used a series of guided open-ended questions to structure discussions. Results from the REA, discussions with EEs, SFB owners and managers, and the market research survey informed the choice of topics. Key topics covered included: awareness of FSC, levels of food safety and hygiene training, leadership, and availability of resources (Appendix 6). Each EE focus group lasted between 60 and 70 minutes, and audio and video were recorded. Each SFB owner and manager discussion lasted between 25 and 35 minutes, and audio and video were recorded. At the end of each discussion, participants were thanked and paid an honorarium (EEs £50/€50 and SFB owners and managers £25/€35) for their time.

Analysis

See *Stage 2, Methods Section 2.1.3* for details on analysis

Results

The group discussions yielded 3 broad themes:

1. Harnessing a holistic approach to FSC
2. Cultivating a clear understanding of FSC
3. Supporting small businesses with appropriate resources

Theme 1: Harnessing a holistic approach to FSC

Awareness of FSC and how it differed between stages 2 and 3 was of great interest in these follow-up discussions (stage 4). Referring to fig. 3, most EEs and SFB owners and managers felt that many stage 3 participants might be mistaking the concept of FSC for simply food hygiene and HACCP practices and therefore might feel, inaccurately, that they knew about the topic. EE10 commented on how she was currently working with SFBs to improve FSC:

"I'm trying to show them [SFBs] ways they could do it, and they're going, oh, I thought FSC was just the same as hygiene. So, I found that really surprising that it was such a high percentage for awareness because I feel like there's, maybe, a misunderstanding on what food safety culture actually is."

EE02, who also works with SFBs, commented:

"There's definitely a gap, and I would agree, I find it so interesting. There definitely is, in production and manufacturing and that, there's definitely more of an awareness. With restaurants and chefs, there's a gap. I mean, it's not that they don't have good hygiene practices, but it's that culture, or how they're showing that they have implemented a culture of food safety that's missing."

SFB010 said:

"Before I participated in this project, I'd never heard of food safety culture so I'd be surprised if it was that high and I was completely unaware."

Theme 2: Cultivating a clear understanding of food safety culture

To improve on this possible lack of understanding in SFBs, EE04 commented:

"An awareness raising campaign would be something that would be needed, and again, that would be from all different aspects. It could be advertisements by the bodies themselves like Safefood, or food safety agencies and that, and the EHOs going in, just to improve awareness of what food safety culture is, and what it entails, and possibly additional training for small food businesses."

EE04 commented:

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"I think it could be improved by better more definitive definitions of food safety culture. As an EHO I'm still not 100% sure and wouldn't know where I'd start to measure it."

This shows that EHOs currently need additional support to allow for measurement of FSC during inspections. In addition, SFB01 said:

"Having a good clear definition of FSC and how it can be incorporated by food businesses and how we [EHOs] can measure it in a realistic way would definitely be useful."

SFB02 mentioned the importance of having a clear guide that is easily understood but also time efficient:

"How would I record the evidence, I already spend a lot of time recording things and wouldn't want to have to start recording lots of other information too, it's so time consuming."

This efficiency would also be welcomed by EHOs. EE05 described their current staffing issues:

"As I had said previously in our first discussion, as EHOs we are short staffed and short on time too so this needs to be something we can monitor in a time-efficient way."

Overall, this was summarised well by EE04 who works as an EHO:

"But I also do feel, when it comes to food safety culture, it's one of those ones where there's a lot of businesses who are currently just keeping their head above water. They're trying to pay their bills and their overheads. They're trying to keep the business going, and anything that could be over and above what they have to do to keep the wolves like us from the door, they're not doing it. They're not doing it at all. Therefore, it all needs to be really straight-forward for them and if possible, actually beneficial for them [SFBs]."

Theme 3: Supporting small businesses with appropriate resources

Resources that are available for learning about FSC were also discussed. It was mentioned that although some resources are available online, these are not effectively advertised and so are unknown to some EEs and many SFBs. In addition to advertising these resources more effectively, participants discussed the need for a better resource area. As EE10 commented:

"If I want some information, I normally have to use multiple sites and use online search engines to find all the information I'm looking for even it is all on one topic area. Surely this could all be put on one website."

Therefore, both groups saw the usefulness of developing a practical area for online resources for EEs and SFBs. EE08 commented on how this could improve FSC:

"So, the food safety hygiene training is there. However, it lacks quite a number of the different elements now of food safety culture, which is so much more than just the hygiene itself. And I think, for it to go the next step and actually make its way into food businesses, the staff need to be educated on it, especially the management, who can then put resources in place or trickle that information down to staff."

Another good suggestion by SFB13 was:

"Maybe we need to do a blueprint, that if you're a business starting, these are the resources that would get you started, and so on and so forth, moving up that trajectory as the business grows. This could be templates and paperwork resources too."

SFB18 suggested more efficient ways to use these resources in the kitchen:

"I have a tablet [Android/iPad] in my kitchen for checking emails. If these resources were online, it would be really handy to quickly check things using a quick search. Even books like the food hygiene logbooks we all kept could go online and could be easily updated using a digital form."

EEs and SFB owners and managers also mentioned a need for language resources to help with foreign national employees. SFB20 commented:

"We have a lot of staff who come from Eastern Europe, and some have good English and some have poor English. When we do our in-house training and even

our staff contracts it would be great to be able to get resources in a few commonly spoken languages in our business. I know quite a few other businesses who struggle with this too. A lot of the food safety stuff can be lost in translation."

This resource area could also offer additional learning and training for differing aspects of FSC. One such aspect was leadership skills, which many said were something newer SFB owners and managers struggled with. This was highlighted by EE07, who commented on the differences of perception between SFB owners/managers and operatives:

"The one thing I would say, is that kind of difference between the people who are the management and the people who are on the ground. Definitely, I think there's a lot of the time, and I find it in enforcement where people believe that this is happening on the ground in the business, saying this is the way that it is always done, and quite clearly, it's not when I'm actually inspecting and speaking with the staff."

This was expanded on by EE05, who said that owners and managers needed to create the cultural change that is necessary to get owners, managers and operatives all working on culture together:

"Management taking the lead would be really good, making staff feel like they are not just seen to do something, just tick this box etc and having to do it because they were told. It is actually a cultural change that is needed. It is inspiring that change or the employees to feel value and pride within the company. Online resources on this could easily be developed and used to help owners and managers learn these skills."

Another resource suggestion were ways for EEs or owners/managers to get live feedback or results on their questions. Two possible solutions were given. First, SFB22 described how he felt it would be useful to have a mobile app:

"They could maybe have a chatbot. All the frequently asked questions could be stored in like a data bank and questions could probably just get a generated answer for something that someone else might have asked previously. And then a mapping tool that could find local accredited trainers etc. So, it could be as simple as, like, a Google Map-type thing showing the area they operate."

Secondly, one participant outlined the creation of a network that would allow SFB owners and managers to share a space with food safety experts on a non-judgemental safe platform, where they could learn and discuss ideas and find new information. Both EEs and SFB owners and managers were enthused by this idea and felt it would work well. SFB20 said:

"I often visit very large factories in Europe to see how they operate and to learn up-to-date techniques. They are very helpful and engaged and I get a lot from those trips."

EE02 said:

"Yes, I love the idea, as a food safety expert I'd be happy to log into an interactive online discussion and answer questions or give updates on current policies if it was set up. The main thing would be that it was easily accessible and convenient to attend."

Key findings

- There was a general belief that the survey results (Stage 3) differed from participants' (EEs and owners/managers in Stage 3) experiences of FSC in small food businesses, and that the term FSC was being confused with food hygiene practices.

- A clear definition of FSC must be developed, with guidance on how to translate this into practice – regarding how EHOs would assess and measure it and how SFBs would implement it.

- A dedicated online area for multilingual training material on FSC and related topics (such as food hygiene) would be welcomed.

- Greater and more positive relationships between EHOs and SFBs through shared activities would be welcomed (for example, an FSC network, workshops and online discussions).

Project modifications

1. We had planned to conduct a focus group of all 10 experts in Stage 1. However, this was difficult due to logistical issues in getting all experts available at a

suitable time. Instead, we held one-to-one discussions, which proved to be worthwhile and provided us with much useful data.

2. We aimed to recruit greater numbers of SFB owners and managers to participate in focus groups. However, we found that engagement from SFBs was poor, often because they had limited time to participate. However, this meant we were able to conduct more in-depth interviews with those who did take part, allowing us to gather a deep level of data.

3. We initially planned to have paired discussions with food business operatives to discuss their attitudes and behaviours relating to FSC. We found, however, some resistance from owners/managers towards arranging these meetings with operatives, due to many factors including language barriers and time restraints.

Discussion and key findings

This project aimed to investigate the current level of knowledge, attitudes and beliefs towards FSC within SFBs on the IOI. It also aimed to identify barriers and facilitators for the implementation of FSC in SFBs to enable a better understanding of the direction to take in future interventions and training, and the direction of future FSC policies to aid SFBs. For the purposes of this study, food safety culture is defined as "the shared values, beliefs and norms that affect mindset and behaviour toward food safety in, across and throughout an organisation" (GFSI, 2018). It has been discussed in scientific literature for over a decade and has recently been written into the updated European Commission Regulation (EU) 2021/382 (EU, 2021), which states that evidence of its presence must be seen in all food businesses. This shows the level of importance that is now placed on FSC and how it goes above and beyond food hygiene, which would represent only one aspect of FSC overall. This chapter will discuss the results across each stage of the project under key themes.

Current evidence on FSC

A rapid evidence assessment (REA) of available academic studies and grey literature (including EU regulations: Commission Regulation (EC) No 852/2004,

Commission Regulation (EU) 2021/382) yielded 17 papers published between 2005 and 2021, that aimed to improve food safety in food businesses and measured outcomes post-intervention. These studies were selected as they assessed the impact of food safety (FS) interventions within food businesses. Several interesting results were identified:

1. Sixteen of the 17 studies targeted food handlers and one targeted management.
2. Knowledge-based interventions were the most used intervention type, with a variety of training styles including classroom-based learning, demonstrations and discussions.
3. Training within interventions was found to be most effective if it was over a longer period and included a range of teaching techniques, particularly demonstrations in the workplace and group discussions.
4. Food safety training may be of most benefit when given over a longer period of time to reinforce learning. Review results highlighted 2 studies of training that lasted over longer time periods (3 months and a 2-year period) (Choudhury et al., 2011b; da Cunha et al., 2013). They showed improved food handler behaviour throughout the training period, indicating that training duration may affect behavioural outcomes and that continued training may be useful.
5. Knowledge and behaviour lapses were reported in several studies, with signage no longer noticed and food handlers becoming complacent over time. This highlights the need for dynamic and ongoing training to continually reinforce positive food safety practices. Training carried out over longer durations in shorter bouts may be the most useful.
6. No study intervention identified within this review included incentivisation, meaning further investigation is warranted.
7. Various barriers affect food handler behaviour and are reported widely in food safety literature. They include a lack of equipment and resources, time, food handler knowledge, leadership, care of co-workers for food safety and a lack of consequences for not complying with food safety procedures (Baş et al., 2006b; Howells et al., 2008; Yapp and Fairman, 2006).
8. No sustained behavioural change was reported following any intervention. This shows that knowledge training alone was not enough to make lasting change.

9. Targeting one aspect of FSC alone is not adequate to promote sustained change, and that a business-wide approach is required to overcome additional barriers including lack of time, new employee support and language difficulties.

10. No intervention attempted to improve the leadership of management staff in FS within a food business, yet it is a main component of FSC (Griffith et al., 2010). Interestingly, within the studies none mentioned FSC or that they were trying to improve it, but rather that they were trying to improve food safety.

11. One study highlighted the high level of managerial food safety knowledge that existed pre-intervention and that following food safety training no knowledge improvement was observed, suggesting it might be better to improve FSC by focusing on leadership and staff management skills rather than food safety training (Richard et al., 2013; Yu et al., 2021).

12. No intervention identified in this review aimed to improve FSC as a whole. This may be partly because all studies within this review were conducted prior to the new Regulation (EU) 2021/382 requiring food businesses to ensure FSC is established (EU, 2021). This new regulation sets out definitive guidelines on this requirement, which should therefore become the focus of future research.

13. The definition of FSC varied within the literature, and therefore it may have been difficult to develop an intervention aiming for a precise definitive outcome. However, the new EU regulation offers clarity for all EU member states, which will aid research in addition to commercial business. With the recent development of auditing tools to measure FSC within a food business (de Boeck et al., 2019; Jespersen et al., 2016; Tomei and Russo, 2019), an intervention to investigate FSC may be a next step for research.

14. Few intervention studies measured pre- and post-intervention data.

15. Sixteen out of the 17 studies within this review focused on food handlers, and only one study focused on management. This may be because training for food handlers was assumed to have more impact on food safety. However, this review has highlighted and discussed the importance of strong management and leadership.

16. No intervention attempted to improve the leadership of management staff in FS within a food business.

17. Food production businesses were poorly represented in this review, with only 2 studies focusing on this category of food business (Ledo et al., 2019; Malavi et al., 2021). Interestingly, these studies were the most recent of those listed, suggesting that researchers may now be focusing on this type of food business, yet further studies are needed.

These findings highlight the need for an alternative approach to interventions, one that encompasses all aspects of FSC and is dynamic and ongoing to ensure lasting behavioural change within an SFB. Development of a complex intervention, to include a number of interacting components of FSC, should be considered for further research.

Awareness, attitudes and beliefs towards FSC

Overall, the qualitative results displayed positive attitudes towards food hygiene and food safety practices. However, businesses showed limited awareness about how this differs from FSC. The broader concept of FSC was not familiar to most SFBs (n=19) However, throughout the discussions SFBs were open and interested to learn more about the concept. Quantitative results were positive in relation to participants' awareness and attitudes towards FSC within their company, both for owners/managers and operatives. Key findings showed:

1. All 10 EEs (n=10) believed there is limited awareness of FSC in SFBs.
2. EEs believed that FSC is not a priority for SFBs as they are still in survival mode following the Covid-19 pandemic.
3. Across the SFB discussions there was no awareness of FSC among food retailers and food service providers (n=19). However, good awareness was evident in food production businesses (n=4).
4. Survey results showed that most SFBs' staff members (79%) stated they were aware of FSC and 61% were aware of the new EU regulations on FSC. All participants felt that the level of FSC within their SFB was high.
5. Owners/managers perceived that food safety leadership was the best implemented element of FSC within their SFBs. However, operatives scored leadership as the 5th most successful element within the survey. This may

mean owners and managers think more highly of their management skills than operatives do, possibly showing a need for increased leadership training.

6. Operatives considered shared responsibility for food safety the most successful element of FSC in their SFB, while owners/managers ranked it 3rd. This indicates a mismatch in how staff perceive their level of responsibility. Using a co-design approach in implementing FSC may help to align these mismatched perceptions.

7. Stage 4 results indicated that all participants felt that several FSC components (such as hygiene systems) are present in SFBs but may not be perceived collectively as part of FSC.

Knowledge and understanding of FSC

Overall, qualitative results (Stages 2 and 4) displayed a lack of knowledge on FSC among both SFBs and EHOs. While the survey results indicated a good level of awareness of the term FSC, fewer participants were familiar with the EU legislation on FSC. Key findings showed:

1. All 10 EEs (n=10) believed that FSC as a concept is not well understood in SFBs.

2. FSC is currently not measured by EHOs during inspections or monitored by SFBs as they do not understand what the term means and how to consistently and fairly assess it.

3. Stage 4 results showed that SFBs still lack high-level knowledge of FSC in theory or practice.

Barriers to FSC

Within stage 2 of the project, several barriers to the implementation of FSC within SFBs. The main barriers include the following:

1. As reported by EEs, EHO staff shortages, SFB staff turnover and increased costs have affected FSC practices.

2. Differences between the types of SFBs: some of the larger SFBs had commented that high staff turnover affected FSC. In contrast, micro

businesses (up to 10 staff members) did not have the same level of staff turnover and felt they had a strong team spirit, with all members feeling involved and part of the SFB.

3. Two aspects of FSC where SFBs may need support are in communication on food safety and how to incorporate FSC effectively into management systems, as these were the aspects which were scored the lowest by operatives, managers and owners.

4. Pressures at work affected managers' ability to demonstrate FSC.

5. Some SFB owners and managers said they would not contact an EHO in case this led to increased inspections or scrutiny.

Facilitators of FSC

1. Digital records could make record-keeping and safety checks more efficient.

2. Incentives to implement FSC, plus correct resources, could help SFBs increase their knowledge on the topic. For example, SFBs who had to meet FSC guidelines to gain accreditation by BRCGS and SALSA had a high level of knowledge on FSC.

3. A co-design approach for implementing FSC may help to align mismatched perceptions of FSC practice among owners/ managers and operatives.

4. Increased contact between EHOs and SFBs could enable them to work more effectively on FSC.

Training and resources on FSC

1. EEs and SFBs highlighted that increased training for EHOs and SFBs on FSC may be useful. Survey results supported this insight, revealing that 86% felt food safety and hygiene training was important.

2. Only one-third of owners and managers in the survey (38%) and the discussion groups (n=7) had completed food safety and hygiene training to level 3 (n=7), compared with those in the discussion groups who had not (n=16). The latter said the main reason for not completing higher levels of training was that they were not aware that these were available.

3. Survey results showed that 20% of operatives and 8% of owners/managers had not completed any food safety and hygiene training led by a food safety trainer. This proportion was surprisingly high as staff handling food are required to be trained in food safety and hygiene.

4. EEs and SFBs viewed both in-person and online training relating specifically to FSC as useful and said they would welcome it. Survey results also supported this finding, with more preferring in-person training (26%) than online training (19%).

5. Both the literature review and the survey highlighted the effectiveness and acceptance of on-site training which was bespoke to the company.

6. Any food safety training needed to be made more inclusive of employees who did not have English as their first language.

7. Greater awareness and promotion of current available online resources was needed.

8. Within the qualitative discussions, no SFB reported actively using food safety websites for information, such as Safefood, or keeping up to date on food safety.

9. SFBs felt an accessible list of reputable accredited food safety trainers would be useful.

10. SFBs had mixed views on whether an email newsletter would be useful, as some seldom used email.

11. Stage 4 results indicated that most participants had no awareness of the food safety resources that were available from Safefood, such as funding for training and free courses.

12. Stage 4 results highlighted the need for resources that accommodate a range of knowledge and abilities among SFB owners/managers and the range of sectors included under the umbrella term of food business, such as production, food service and food retail.

Policy development

1. SFBs and EEs (stages 2 and 4) felt there should be better documentation to measure FSC.

2. SFBs in Ireland (stages 2 and 4) believed that the food hygiene rating scheme would enhance FSC. Stage 4 results also indicated that a food hygiene rating score is useful and could be built on to include FSC. An alternative for non-

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customer-facing businesses was also mentioned (for example, many used BRCGS or SALSA certifications).

6 Conclusion

This study has provided insight into the awareness and understanding of FSC among SFBs on the IOI and has identified the barriers and facilitators to its adoption and implementation.

- The rapid review has highlighted the lack of FSC interventions addressing more than one component of FSC.
- The stakeholder discussions with EEs and SFBs allowed for an in-depth exploration of the perceptions, attitudes and behaviours associated with FSC in SFBs.
- The survey provided a snapshot of the level of awareness of FSC and associated legislative requirements, and an understanding of the various components of FSC in relation to current management styles, practices and culture, as well as an understanding of how these variables relate to the type of SFB.
- The follow-up discussions allowed us to compare the stakeholder discussion and the survey, yielding further insight into how SFBs understand FSC.

The insights gained through this research, specifically in relation to the lack of awareness and understanding of FSC among SFB and EHOs, suggest a pathway to supporting both groups in promoting a positive FSC. This could be done by developing relevant training material and resources and the use of a business-to-business communication campaign alongside activities to encourage engagement.

Added value and anticipated benefits of research

There has been no comprehensive study of FSC on the IOI, hence the need for the current project. This project highlighted a lack of research on FSC in Europe, and

more specifically on the IOI. The significance and relevance of this research can be demonstrated in the following ways.

Awareness raising

Project findings have indicated a potential lack of understanding among SFBs about FSC and what it involves. This project:

- Provides baseline data on the level of awareness and understanding of FSC and associated legislation
- Identifies key components of FSC and the level of FSC maturity within the business
- Identifies key tools, resources and communication messages to support SFBs in learning about and implementing FSC

The project has also provided the opportunity to raise the issue of FSC among all the businesses and the experts involved in the study

It is recommended that some sort of business-to-business multimedia campaign is developed to help SFBs better understand the issue of FSC.

Attitudinal impacts

We found that while food safety was a consideration for SFBs, tensions existed between some of the businesses and EHOs. While both groups hold a similar vision (ensuring safe food for consumers) their relationships could be improved. This might be done by bringing them together in activities such as workshops or network building to discuss food safety issues, or to cooperate in designing an FSC tool or similar resource.

Policy impacts

We noted that businesses from both Ireland and Northern Ireland were receptive towards the Food Hygiene Rating System (FHRS) as a guide to help them maintain food hygiene standards. They saw it as a useful marketing tool. An Ireland-based FHRS might encourage businesses to improve food hygiene standards. Also, a measuring/ rating system to support EHOs in their assessment and companies in their understanding of FSC would have significant impact on food businesses.

Capacity impacts

We identified the preferred methods of training and styles of delivery in teaching food safety. These findings could help Safefood to develop a new training programme for owners, managers and operatives on FSC. SFBs and EHOs were in favour of creating a dedicated webpage to host online resources, including multilingual versions, templates, news updates and webinars.

Limitations of the research

The review focused on intervention studies to determine what components of FSC were in use. This may have led us to exclude more general studies on FSC, such as attitudinal surveys and review papers.

Regarding stakeholder discussions, the EEs and SFBs had many competing demands on their time. This meant that despite agreeing to participate in the discussion, often they would cancel or reschedule at the last minute. As a result, the researcher at times had only from one to 4 SFBs in any given group. As it was difficult to get SFBs to engage in the first instance and the period for collecting data was limited, we decided that the group discussions would still go ahead, even if other participants cancelled and the events turned into individual interviews. The data, whether from a group or individual, still yielded useful insights about the SFB and their understanding of FSC.

The consumer survey allowed for a large-scale quantitative measure of FSC awareness, understanding and practice. Its insights helped us frame our recommendations. However, the survey did rely on the accuracy of self-reported data. It was conducted via phone with no incentive provided to participants. As people working in SFBs were pressed for time, we were concerned that they might rush their responses and not take time to consider the questions. Also, given the nature of the survey topic and respondents' role within the company, we felt they might provide socially desirable answers for fear of being identified.

As previously stated, some of the survey results conflicted with the results of stakeholder interviews. We therefore proposed to do a follow-up interview with

participants in stages 2 and 3 to clarify the survey results and help us make appropriate recommendations. At the final stage of this research, the follow-up discussions, our only concern was about the number of results which were presented during the discussion. On reflection, we might have done better to send preliminary results to the individuals beforehand and then summarise them briefly at the start of the discussion. This would have allowed more time to discuss the results of each stage with participants, as they seemed very engaged and willing to speak about FSC.

Future research

This project provides a basis for further research in the following areas:

1. The design, development and implementation of interventions within SFBs to improve their FSC
2. An investigation of environmental health officers' understanding and measurement of FSC in practice, involving the design and testing of a user-friendly scoring scheme to help businesses establish FSC
3. Setting a baseline of FSC awareness and implementation, which can be used to measure the effectiveness of a business-to-business campaign about FSC and its components

7 References

Ababio P F, Taylor K D A, Swainson M., Daramola B A (2016). Effect of good hygiene practices intervention on food safety in senior secondary schools in Ghana. Food Control. 2016; 60:18–24. Available from: https://doi.org/10.1016/J.FOODCONT.2015.07.013

Abdul-Mutalib NA, Abdul-Rashid MF, Mustafa S, Amin-Nordin S, Hamat RA, Osman M. Knowledge, attitude and practices regarding food hygiene and sanitation of food handlers in Kuala Pilah, Malaysia. Food Control. 2012; 27(2);289–293. Available from: https://doi.org/10.1016/J.FOODCONT.2012.04.001

Acikel CH, Ogur R, Yaren H, Gocgeldi E, Ucar M, Kir T. The hygiene training of food handlers at a teaching hospital. Food Control. 2008; 19(2):186–190. Available from: https://doi.org/10.1016/J.FOODCONT.2007.03.008

Baert K, van Huffel X, Wilmart O, Jacxsens L, Berkvens D, Diricks H, Huyghebaert A, Uyttendaele, M. Measuring the safety of the food chain in Belgium: Development of a barometer. Food Research International. 2011; 44(4): 940–950. Available from: https://doi.org/10.1016/J.FOODRES.2011.02.005

Ballentine A, McKenzie N, Wysocki A, Kepner K. The role of monetary and non-monetary incentives in the workplace as influenced by career stage. EDIS. 2003(8). Available from: https://doi.org/10.32473/EDIS-HR016-2003

Barjaktarović-Labović S, Mugoša B, Andrejević V, Banjari I, Jovićević L, Djurović D, Martinović A, Radojlović J. Food hygiene awareness and practices before and after intervention in food services in Montenegro. Food Control. 2018; 85:466–471. Available from: https://doi.org/10.1016/J.FOODCONT.2017.10.032

Baş M, Şafak Ersun A, Kivanç G. The evaluation of food hygiene knowledge, attitudes, and practices of food handlers' in food businesses in Turkey. Food

Control. 2006a; 17(4):317–322. Available from:
https://doi.org/10.1016/J.FOODCONT.2004.11.006

Brand Reputation Compliance Global Standards (BRCGS). Available from:
https://www.brcgs.com/our-standards/food-safety/

Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, *11*(4), 589–597. Available from:
https://doi.org/10.1080/2159676X.2019.1628806

Capunzo M, Cavallo P, Boccia G, Brunetti L, Buonomo R, Mazza G. Food hygiene on merchant ships: the importance of food handlers' training. Food Control. 2005; 16(2):183–188. Available from: https://doi.org/10.1016/J.FOODCONT.2004.01.010

Chapman B, Eversley T, Fillion K, MacLaurin T, Powell D. Assessment of food safety practices of food service food handlers (risk assessment data): Testing a communication intervention (evaluation of tools). Journal of Food Protection. 2010; 73(6):1101–1107. Available from: https://doi.org/10.4315/0362-028X-73.6.1101

Chapman, B., Maclaurin, T., & Powell, D. (2011a). Food safety infosheets: Design and refinement of a narrative-based training intervention. *British Food Journal*, *113*(2), 160–186. https://doi.org/10.1108/00070701111105286/FULL/PDF

Chapman B, Maclaurin T, Powell D. Food safety infosheets: Design and refinement of a narrative-based training intervention. British Food Journal. 2011b; 113(2):160–186. Available from: https://doi.org/10.1108/00070701111105286/FULL/PDF

Choudhury M, Mahanta LB, Goswami JS, Mazumder MD. Will capacity building training interventions given to street food vendors give us safer food?: A cross-sectional study from India. Food Control. 2011a; 22(8):1233–1239. Available from:
https://doi.org/10.1016/J.FOODCONT.2011.01.023

Choudhury M, Mahanta LB, Goswami JS, Mazumder MD. Will capacity building training interventions given to street food vendors give us safer food?: A cross-sectional study from India. Food Control.2011b; 22(8):1233–1239. Available from:
https://doi.org/10.1016/J.FOODCONT.2011.01.023

Central Statistics Office (CSO). Ireland's Retail Economy 2022. Available from: [Food & Beverage Service Activities Ireland's Retail Economy 2022 - Central Statistics Office](#)

da Cunha DT, Fiorotti RM, Baldasso JG, de Sousa M, Fontanezi NM, Caivano S, Stedefeldt E, de Rosso VV, Camargo MCR. Improvement of food safety in school meal service during a long-term intervention period: A strategy based on the knowledge, attitude and practice triad. Food Control. 2013; 34(2):662–667. Available from: https://doi.org/10.1016/J.FOODCONT.2013.06.003

de Andrade ML , Stedefeldt E, Mariano Zanin L, da Cunha DT. Food safety culture in food services with different degrees of risk for foodborne diseases in Brazil. Food Control. 2020: 112. Available from https://doi.org/10.1016/j.foodcont.2020.107152

de Boeck E, Jacxsens L, Bollaerts M, Vlerick P. Food safety climate in food processing organizations: Development and validation of a self-assessment tool. Trends in Food Science & Technology. 2015; 46(2):242–251. Available from: https://doi.org/10.1016/J.TIFS.2015.09.006

de Boeck E, Jacxsens L, Vanoverberghe P, Vlerick P. Method triangulation to assess different aspects of food safety culture in food service operations. Food Research International. 2019; 116:1103–1112. Available from: https://doi.org/10.1016/J.FOODRES.2018.09.053

Emond, Bertrand & Taylor, Joanne. (2018). The importance of measuring food safety and quality culture: results from a global training survey. Worldwide Hospitality and Tourism Themes. 10. 00-00. Available from https://www.researchgate.net/publication/325129903_The_importance_of_measuring_food_safety_and_quality_culture_results_from_a_global_training_survey

Drudge C, Greco S, Kim JH, Copes R. Estimated annual deaths, hospitalizations, and emergency department and physician office visits from foodborne illness in Ontario. Foodborne Pathogens and Disease. 2019; 16(3):173–179. Available from: https://doi.org/10.1089/FPD.2018.2545/SUPPL_FILE/SUPP_DATA.PDF

Dudeja P, Singh A, Sahni N, Kaur S, Goel S. Effectiveness of an intervention package on knowledge, attitude, and practices of food handlers in a tertiary care hospital of north India: A before and after comparison study. Medical Journal Armed Forces India. 2017; 73(1): 49–53. Available from: https://doi.org/10.1016/J.MJAFI.2016.10.002

EU. EUR-Lex - 32021R0382 - EN - EUR-Lex. 2021. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/?toc=OJ%3AL%3A2021%3A074%3ATOC&uri=uriserv%3AOJ.L_.2021.074.01.0003.01.ENG

European Commission. SME definition. Search. 2003; 2007 Sept 18:3–4. Available from: https://single-market-economy.ec.europa.eu/smes/sme-definition_en

European Commission (EC). 2021. [accessed 2023 Oct 4]. Available from: https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en

Ungku Zainal Abidin Ungku Fatimah & Strohbehn, Catherine & Arendt, Susan. (2014). An empirical investigation of food safety culture in onsite foodservice operations. Food Control. 46. 255–263. 10.1016/j.foodcont.2014.05.029.

GSFI. A culture of food safety: A position paper from the Global Food Safety Initiative (GFSI). 2018.

Gov.UK, Department for Business, Energy and Industrial Strategy. BEIS small and medium enterprises (SMEs) action plan: 2022 to 2025. Available from: https://www.gov.uk/government/publications/beis-small-and-medium-enterprises-sme-action-plan-2022-to-2025/beis-small-and-medium-enterprises-smes-action-plan-2022-to-2025-accessible-webpage

Griffith CJ, Jackson LM, Lues R. The food safety culture in a large South African food service complex: Perspectives on a case study. British Food Journal. 2017; 119(4):729–743. Available from: https://doi.org/10.1108/BFJ-11-2016-0533/FULL/PDF

Griffith CJ, Livesey KM, Clayton D. The assessment of food safety culture. British Food Journal. 2010; 112(4):439–456. Available from: https://doi.org/10.1108/00070701011034448/FULL/PDF

Griffith CJ, Livesey KM, Clayton D. (2010b). Food safety culture: The evolution of an emerging risk factor?. British Food Journal. 112. 426-438. Available from: https://www.researchgate.net/publication/235311945_Food_safety_culture_The_evolution_of_an_emerging_risk_factor

Health Protection Surveillance Centre (HPSC) 2021. HPSC Annual Epidemiological Reports. Available from: Annual Reports - Health Protection Surveillance Centre (hpsc.ie)

Hennessey M, Kim S, Unger F, Nguyen-Viet H, Dang-Xuan S, Nguyen-Thi T, Häsler B. Exploring the potential of using nudges to promote food hygiene in the pork value chain in Vietnam. Preventive Veterinary Medicine. 2020; 181:105003. Available from: https://doi.org/10.1016/J.PREVETMED.2020.105003

Holland, D. and Mahmoudzadeh, N., 2020. Foodborne disease estimates for the United Kingdom in 2018. Food Standards Agency, 27. Available from foodborne-disease-estimates-for-the-united-kingdom-in-2018_0.pdf

Howells AD, Roberts KR, Shanklin CW, Pilling VK, Brannon LA, Barrett BB. Restaurant employees' perceptions of barriers to three food safety practices. Journal of the American Dietetic Association. 2008; 108(8): 1345–1349. Available from: https://doi.org/10.1016/J.JADA.2008.05.010

Jacob C, Mathiasen L, Powell D. Designing effective messages for microbial food safety hazards. Food Control 2010; 21(1):1–6. Available from: https://doi.org/10.1016/J.FOODCONT.2009.04.011

Jespersen L, Griffiths M, Maclaurin T, Chapman B, Wallace CA. Measurement of food safety culture using survey and maturity profiling tools. Food Control. 2016; 66:174–182. Available from: https://doi.org/10.1016/J.FOODCONT.2016.01.030

Latkovikj MT, Popovska MB. Online research about online research: advantages and disadvantages. E-methodology. 2019; 6(6):44-56.

Ledo J, Hettinga KA, Bijman J, Kussaga J, Luning PA. A tailored food safety and hygiene training approach for dairy farmers in an emerging dairy chain. Food Control. 2021; 124:107918. Available from: https://doi.org/10.1016/J.FOODCONT.2021.107918

Ledo J, Hettinga KA, Bijman J, Luning PA. Persistent challenges in safety and hygiene control practices in emerging dairy chains: The case of Tanzania. Food Control. 2019; 105:164–173. Available from: https://doi.org/10.1016/J.FOODCONT.2019.05.011

Lee JC, Neonaki M, Alexopoulos A, Varzakas T. Case studies of small-medium food enterprises around the world: Major constraints and benefits from the implementation of food safety management systems. Foods. 2023; 12(17):3218.

Machado RAM, Cutter CN. Sanitation indicators as a tool to evaluate a food safety and sanitation training program for farmstead cheese processors. Food Control. 2017; 78: 264–269. Available from: https://doi.org/10.1016/J.FOODCONT.2017.02.039

Malavi DN, Abong GO, Muzhingi T. Effect of food safety training on behavior change of food handlers: A case of orange-fleshed sweetpotato purée processing in Kenya. Food Control. 2021; 119:107500. Available from: https://doi.org/10.1016/J.FOODCONT.2020.107500

McIntyre L, Peng D, Henderson SB. Retraining effectiveness in FOODSAFE trained food handlers in British Columbia, Canada. Food Control. 2014; 35(1):137–141. Available from: https://doi.org/10.1016/J.FOODCONT.2013.06.028

McIntyre L, Vallaster L, Wilcott L, Henderson SB, Kosatsky T. Evaluation of food safety knowledge, attitudes and self-reported hand washing practices in FOODSAFE trained and untrained food handlers in British Columbia, Canada. Food Control. 2013; 30(1): 150–156. Available from: https://doi.org/10.1016/J.FOODCONT.2012.06.034

Michaels B, Keller C, Blevins M, Paoli G, Ruthman T, Todd E, Griffith CJ. Prevention of food worker transmission of foodborne pathogens: risk assessment and

evaluation of effective hygiene intervention strategies. Food Service Technology. 2004; 4(1):31–49. Available from: https://doi.org/10.1111/J.1471-5740.2004.00088.X

Nerín C, Aznar M, Carrizo D. Food contamination during food process. Trends in food science & technology. 2016; 48:63-68.

Northern Ireland Statistics and Research Agency (NISRA). 2023 Northern Ireland Business; Activity, Size, Location and Ownership. Available from https://www.nisra.gov.uk/publications/current-publication-and-idbr-tables-1

Powell DA, Jacob CJ, Chapman BJ. Enhancing food safety culture to reduce rates of foodborne illness. 2011. Food Control, Volume 22, Issue 6, 817-822. Available from: https://doi.org/10.1016/j.foodcont.2010.12.009

Regulation (EC) 852/2004. Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. Official Journal of the European Union.2004; 1–23.

Regulation (EC) 882/2002. General Food Law 882/2002. 2002; 178:1–40. Available from: https://ec.europa.eu/food/horizontal-topics/general-food-law_en

Richard AE, Brown JL, Radhakrishna RB, Yoder EP, Nieto-Montenegro S, Cutter CN. Development and implementation of a "counter-top" training program to increase retention of food safety knowledge, alter behavior, improve attitude and increase skills of Spanish-speaking retail employees. Food Protection Trends. 2013; 33(1): 10–19.

Rowell AE, Binkley M, Alvarado C, Thompson L, Burris S. Influence of food safety training on grocery store employees' performance of food handling practices. Food Policy. 2013; 41:177–183. Available from: https://doi.org/10.1016/J.FOODPOL.2013.05.007

Schein, Edgar, Organizational Culture and Leadership (1985). University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship, Available from
SRN: https://ssrn.com/abstract=1496184

Schroeder M, Yang L, Eifert J, Boyer R, Chase M, Nieto-Montenegro S. Evaluation of how different signs affect poultry processing employees' hand washing practices. Food Control. 2016; 68: 1–6. Available from: https://doi.org/10.1016/J.FOODCONT.2016.03.019

Sedyastuti K, Suwarni E, Rahadi DR, Handayani MA. Human resources competency at micro, small and medium enterprises in Palembang Songket industry. In 2nd annual conference on social science and humanities (ANCOSH 2020). Atlantis Press; 2021. p. 248-251.

Soon JM, Baines RN. Food safety training and evaluation of handwashing intention among fresh produce farm workers. Food Control. 2012; 23(2):437–448. Available from: https://doi.org/10.1016/J.FOODCONT.2011.08.012

Stehr, N., & Grundmann, R. (2011). Experts: The Knowledge and Power of Expertise (1st ed.). Routledge. https://doi.org/10.4324/9780203829646

Tomei PA, Russo GM. Food safety culture maturity index [FSCMI]: Presentation and validation. Revista Ibero-Americana de Estratégia. 2019; 18(1):19–39. Available from: https://doi.org/10.5585/IJSM.V18I1.2709

Tóth AJ, Koller Z, Illés CB, Bittsánszky A. Development of conscious food handling in Hungarian school cafeterias. Food Control. 2017; 73:644–649. Available from: https://doi.org/10.1016/J.FOODCONT.2016.09.011

UK Government 2020. Small and medium-sized enterprises action plan 2020 to 2022. Department for International Trade. Available from: Small and medium-sized enterprises action plan 2020 to 2022 (publishing.service.gov.uk)

van Ruth SM, Huisman W, Luning PA. Food fraud vulnerability and its key factors. Trends in Food Science & Technology. 2017; 67:70-75.

Visotsky A. The business owner defined: A job description for the business owner: How to do your job and have an expanding company. VISOTSKY CONSULTING INC; 2015.

Walker, E., Pritchard, C. and Forsythe, S., 2003. Food handlers' hygiene knowledge in small food businesses. Food control, 14(5), pp.339-343. Available from: Food handlers' hygiene knowledge in small food businesses - ScienceDirect

WHO. Five keys to safer food manual. International Journal of Environmental Research and Public Health. 2009; 6(11): 2833–2842. Available from: https://www.who.int/publications/i/item/9789241594639

WHO. Foodborne diseases. 2022. Available from: https://www.who.int/health-topics/foodborne-diseases#tab=tab_1

Yapp C, Fairman R. Factors affecting food safety compliance within small and medium-sized enterprises: implications for regulatory and enforcement strategies. Food Control. 2006; 17(1):42–51. Available from: https://doi.org/10.1016/J.FOODCONT.2004.08.007

Yiannas F. Educating and training to influence behavior. Food Safety Culture. 2009; 1–9. Available from: https://doi.org/10.1007/978-0-387-72867-4_5

York VK, Brannon LA, Shanklin CW, Roberts KR, Howells AD, Barrett EB. Foodservice employees benefit from interventions targeting barriers to food safety. Journal of the American Dietetic Association. 2009; 109(9):1576–1581. Available from: https://doi.org/10.1016/J.JADA.2009.06.370

Yu H, Guchait P, Achyldurdyyeva J, Paşamehmetoğlu A. A multilevel investigation of the leadership factors on food safety promotive and prohibitive voices through food safety consciousness. Journal of Hospitality and Tourism Management. 2021; 47:343–352. Available from: https://doi.org/10.1016/J.JHTM.2021.04.007

Appendices

Appendix 1: Studies reviewed for food safety or food safety culture intervention or assessment.

1. **Author:** Ledo et al., 2021

Aim: Develop a training intervention on the Theory of Planned Behaviour (TPB) and analyse the effectiveness of an intervention to influence dairy farmers' behaviour to perform safety and hygiene control practices.

Intervention: 3-day training using 3 methods: (i) slides covering shed and floor sanitation, milk cooling and storage, udder and teat care, and personal hygiene (15 minutes/ section) and discussion groups (45 minutes); (ii) videos, pictures and story analysis of personal hygiene, on-farm safety and expected behaviour; (iii) practical demonstrations of real-life situations on farm.

Method used and assessment of intervention: Questionnaires were used pre-intervention (morning of first training session) and post-intervention at end of each of the 3 training days). 21 multiple-choice questions (MCQ) (Yes, No, Don't know) on knowledge, attitudes, subjective norms, perceived behavioural control, and intentions on safety and hygiene practices. TPB (5-point scale) on personal hygiene, udder and teat care, milk cooling, and storage, and shed and floor sanitation practices.

Target population and sample size: 107 food handlers from a dairy farm in Tanzania. Most farmers had 40+ years' experience and primary-level education.

Outcome:

- Increase in knowledge in hand washing, teat dipping, cleaning the shed, and milk storage
- Increase in the level of planned behaviour post-intervention
- greatest increase in knowledge observed following day 1 training.

Comments: Group discussion was considered useful for reinforcing theory on slides, and combined with videos, pictures and storytelling was shown to be an

effective way of learning. A limitation of the study was that demonstrations were not conducted in a farm environment, yet on-site demonstrations may be more useful.

2. **Author:** Malavi et al., 2021

Aim: Evaluate the impact of food safety training on food safety knowledge and hygiene practices of food handlers and in the control of microbial contamination.

Intervention: A one-day training session covering areas of weakness identified by the literature: personal hygiene, cross-contamination, environmental hygiene, food storage and process control, pest control, cleaning and sanitation. Also used: theory classes, and pictorial, video, and practical demonstrations on personal hygiene, handwashing, cleaning and sanitation of food processing equipment and environmental hygiene.

Method used and assessment of intervention:

Questionnaires: pre-intervention (morning of first training session) and post-intervention, 2 months following training).

Knowledge: 35 multiple-choice questions on food safety and 13 hygiene practices.

Microbial levels: 62 samples were taken from equipment, drains walls and floors after cleaning had occurred; and from workers' hands during shift.

Target population and sample size: 14 food handlers (aged 18-35, most educated to secondary-level education) from a sweet potato processing plant in Kenya.

Outcome

- Increase in knowledge at 2-month follow-up, specifically in cross-contamination, cleaning and sanitation; ↓
- Decrease in microbial levels on workers' hands, equipment and surfaces.
- No change on walls, drains and floors.

Comments: Food handlers with less than 6 months' experience had the lowest pre-training scores, showing they are a key cohort to target with training. Motivated staff had greater knowledge than unmotivated staff, showing motivation to be important

for knowledge retention. Cleaning of walls, drains and floors may need to be highlighted as these areas still had high microbial levels post-intervention.

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3. **Author:** Barjaktarović-Labović et al., 2018

Aim: Assess food handler knowledge on hygiene and food handling before and after intervention

Intervention: 2 days' training, covering 3 modules. Module 1: Good Management Practice (GMP), Good Hygiene Practice (GHP) and Hazard Analysis and Critical Control Point (HACCP). Module 2: storage training. Module 3: temperature control and monitoring and record keeping. Training was carried out in small groups (16 participants). Teaching materials included video, audio recordings, films and presentations in addition to interactive lectures.

Method used and assessment of intervention:

Knowledge questionnaires: pre-intervention (morning of training) and post-intervention (2 weeks). 29 closed-ended questions (Correct, Wrong, Don't know) that covered hygiene, contamination, time-temperature control, and cleaning and sanitation that was specific to the population and developed from the literature.

Target population and sample size: 128 food handlers from 32 food services (restaurants, bakeries and pastry shops) in Montenegro. 57 males, aged 18-54, most educated to secondary level.

Outcome:

Increase in knowledge at 2-week follow-up in contamination, storage conditions, temperature control and maintaining hygiene, with the greatest increase seen in storage conditions. The lowest knowledge level of all tested was for storage conditions.

Comments: The lowest knowledge level of all tested was for storage conditions. This may be an area for future focus as knowledge was greater following training.

4. **Author:** Tóth et al., 2017

Aim: Develop a food safety training model for improving food handlers' consciousness.

Intervention: Training was given on 3 days, one month apart (3 months in total). Training sessions lasted 2 hours, focusing on areas of weakness from the initial questionnaire, including cleaning, food waste, receiving and storing food, and personal hygiene.

Method used and assessment of intervention:

Knowledge questionnaires: pre-intervention (one month prior to 1st training session) to highlight weaknesses for focusing training; and post-intervention (one month after final training session).

Target population and sample size: 144 kitchen staff from 33 school cafeterias in Hungary. 85% female, 75% > 40 years, 40% < 1 years' experience.

Outcome: Increase in knowledge in receiving food, food waste, food handling practice, food storage, dishwashing, cleaning, and personal hygiene and consciousness. The lowest area of initial knowledge was about receiving food from external food businesses; this improved greatly post-intervention.

Comments: Food handlers had low pre-intervention knowledge of receiving of food. However, in practice they were seen to be able to carry out the task effectively. This highlights the need for knowledge assessment but also practical assessment for identifying areas of weakness to be targeted in training.

5. **Author:** Dudeja et al., 2017

Aim: To ascertain the determinants of knowledge, attitude, and practices of food handlers regarding food safety; and to document the effectiveness of an intervention package on food safety.

Intervention: Self-instruction manual in local language given to staff and video presentation of content made for food handlers, titled 'Extra Gravy' and 'Food Safety Farm to Fork'. The training was given over one day.

Method used and assessment of intervention: Questionnaires assessing knowledge and attitude: (pre- and post-intervention, 2 months after training) using situational knowledge-based questions and 9 attitudinal questions (1-5 scale of agreement).

Target population and sample size: 280 hospital kitchen staff in North India. Mean age 35, 62% had low level of education, and 60% >5 years' experience.

Outcome: Increase in Knowledge and attitude towards handwashing, jewellery wearing and safety practices.

Comments: Just over half of staff (56%) reported enjoying their job and said that food handlers are important in food safety within the business. The aim should be to improve job satisfaction by better understanding and improve food safety by changing workers' attitude to their food safety role.

6. **Author:** Machado & Cutter, 2017

Aim: To identify if increased food safety knowledge will reduce sanitation indicators (microbial loads) in a cheese-making environment.

Intervention: Two different training methods and control cohort measured.

1) 5 farms had food safety and sanitation training with a video (to incorporate a story into the training).

2) 5 farms had food safety and sanitation training without video.

3) 6 farms received no training.

Training included two modules: (i) basic food safety and sanitation applied to small cheese producers; (ii) a step-by-step demonstration of how to clean cheese vats. Training was given over one day.

Method used and assessment of intervention: Microbial levels: (pre-intervention and 3-4 months post-intervention), with environmental sampling conducted on surfaces in cheese-making rooms including surfaces in contact with food and surfaces without food contact such as floors, drains and handles. Levels measured were of aerobic bacteria counts, Enterobacteriaceae, yeast and moulds, listeria species, and adenosine triphosphate.

Target population and sample size: 45 food handlers from 16 small dairy/ cheese producing farms in Pennsylvania, US.

Outcome: Decrease in microbial levels on floors and drains in the group who had training with video. No improvement on other sampled surfaces was seen across all groups. Training with or without a video had little impact on microbial levels compared to the control cohort.   The lack of improvement in microbial levels was believed due to a lack of workplace policies to avoid cross-contamination from outside the factory floor. This highlights the need for good policies to be in place in addition to training reinforcement. A knowledge ceiling effect was observed, suggesting that staff who have previously received training may not improve behaviour simply from more training.

Comments: The lack of improvement in microbial levels was believed due to a lack of workplace policies to avoid cross-contamination from outside the factory floor. This highlights the need for good policies to be in place in addition to training reinforcement. A knowledge ceiling effect was observed, suggesting that staff who have previously received training may not improve behaviour simply from more training.

7. **Author:** Ababio et al., 2016

Aim: Investigate the effect of Good Hygiene Practice training on hygiene knowledge and practices of senior secondary school kitchen staff.

Intervention: An audit of 45 schools: 11 schools were chosen to be on the intervention, with 4 scoring 'good', 4 'medium' and 3 'poorly' on the audit. Each school was given 3-4h of training using 3 methods: (i) PowerPoint presentation of results of the audit, GHP training and reported cases of countrywide food borne disease; (ii) video presentation on Safer Food Better Business (V3); and (iii) demonstration and practical on effective handwashing.

Method used and assessment of intervention:

Knowledge questionnaires: pre-intervention (morning of training) and post-intervention (immediately after training).

Observed practice: cooking temperature and waiting time before service.

Microbial levels: aerobic colony count, coliforms, yeast and moulds, staphylococcus aureus and bacillus cereus in rice pre- and post-intervention but times were not specified.

Target population and sample size: 180 secondary school kitchen staff from 45 schools in Ghana. 93% female, aged 19-49, 20% basic education (highest reported education level) and 66% had 1-10 years' experience.

Outcome:

- Increase in knowledge score in all schools including avoidance of jewellery during food prep, hair covering, handwashing technique, temperature control and cleaning procedures. Improved food cooking temperatures
- Decrease in food waiting times
- Decrease in microbial levels in rice.

Comments: Schools who had performed well in the audit made improvements to knowledge and practice showing positive outcomes from training even when audit results were positive. This highlights the importance of training in even well-operating food businesses. Many of the food handlers in this study had no previous food safety training, even after years of employment. This highlights the importance of providing food training for staff.

8. **Author:** Schroeder et al., 2016

Aim: To evaluate the effectiveness of newly developed hand washing pictograms on employees' handwashing behaviour using video observation.

Intervention: involved 2 handwashing pictograms used on signage placed in high traffic areas, with writing explaining handwashing technique written in English and Spanish.

Method used and assessment of intervention: Observation: video recording of staff at sinks (not including bathroom sinks). 5 employee habits were measured: 1) soap use; 2) wash completeness; 3) wash time; 4) complete rinsing; and 5) towel use. Hand washing frequency and technique were measured pre-intervention (day before), and post-intervention (1 day after and 2 weeks after).

Target population and sample size: Raw poultry slaughter facility and poultry further processing facility in US. Facilities each employed >500 food handlers.

Outcome:

- Increase in Soap use and towel use for hand drying at the 2-week follow-up;
- Decrease in hand washing time and rinsing at 2 weeks compared to one-day post-intervention.

Comments: Although signage was seen to be useful, staff reverted to old habits after 2 weeks.

9. **Author:** da Cunha et al., 2013

Aim: Evaluate the development of food safety scores in school meal services during the application of a systematic intervention based on the knowledge, attitude and practice triad.

Intervention: 2 years' intervention comprising 3 stages:

1) knowledge training (5 x 12-hour sessions) carried out every 6 months covering food contamination, storage, wastage, pest control and hygiene.

2) Site-specific action plans updated every 3 months.

3) Weekly monitoring visits to promote motivation.

Method used and assessment of intervention: Observation: review of HACCP documentation, food storage, processes and procedures, waste management, health and safety of staff, water control, and equipment and utensils were all measured on each visit. Findings directed the intervention. Services assessed every 3 months, totalling 8 visits.

365 kitchen staff from 68 public schools in São Paulo, Brazil.

Outcome: Improvements were seen in buildings and facilities, processes and procedures, integrated pest management, records, health and safety of employees and equipment and utensils.

Comments: Food handlers showed resistance to completing records and controls and tended to have worse performance following holiday periods. Frequent visits by researchers were shown to motivate staff to carry out tasks showing that increased

frequency of visits and training improves behaviour. Future training interventions may focus on the timing of training and whether to choose more frequent rather than one longer training session.

10. Author: McIntyre et al., 2014

Aim: Examine the effectiveness of food handler re-training one-year post-training using the FOODSAFE training programme.

Intervention: FOODSAFE training course: was retaught 3 years after initial training as a refresher to staff. Intervention group and 2 control groups (control group 1 had previously completed FOODSAFE training but not the refresher; control group 2 had no prior food safety training). Training lasted one day.

Method used and assessment of intervention: Knowledge questionnaires: (FOODSAFE exam) used for assessment. Exams were completed immediately after training and compared to control group scores.

Target population and sample size: 63 food handlers (18 intervention group, 19 control group 1, 26 control group 2) from food services in Canada.

Outcome:

- No change in knowledge of intervention group compared to initial exam 3 years before retraining
- Decrease in knowledge in control group one 3 years after initial training. Control group 2 had the lowest exam scores.

Comments: Re-training food handlers 3 years after initial training showed ↑ knowledge in comparison to control groups. This shows regular retraining improves knowledge over longer timeframes. Language was a barrier, with many staff speaking English as a second language, and having difficulty taking in all the information in the training session.

11. Author: Rowell et al., 2013

Aim: To determine the effectiveness of manager training and how this training impacted the grocery stores' performance on hot/cold self-serve bars.

Intervention: An 8-hour SafeMark food training course was taught by SafeMark trainers to managers. The managers were given a training kit containing information on how to train their staff.

Method used and assessment of intervention:

Knowledge questionnaires: were completed by 1 manager and 2 employees per store (pre-intervention in the days before and post-intervention 4-6 weeks after intervention).

Observation: monitoring food set up and the cleaning of hot/cold deli areas by employees (including product handling, temp. control, utensil usage, cleaning practices). A food service audit form was used to measure preparation, maintenance, cleaning and sanitising.

Target population and sample size: 45 grocery store managers in US (24 managers in the intervention group, who received training, and 21 in the control group, who received no training).

Outcome:

- No improvement observed in set up or clean down of hot/cold self-serve food bars or in cleanliness of storage rooms.
- Increase in cleaning supplies available in control stores, believed due to staff being aware of monitoring. Deficiencies remained after training.

Comments: Management scored higher than employees in knowledge tests, showing a high level of knowledge existed before training.   No knowledge or performance improvement post-training. As managers were already knowledgeable on food safety, management training may be better aimed at improving management style and staff management.

12. **Author:** Soon & Baines, 2012

Aim: Investigate handwashing intentions among fresh produce farm workers using the TPB.

Intervention: One day training, including 4 types of educational material: 1) education booklet including slides for in-depth knowledge explanation; 2) farm safety

slides that were presented to the food handlers; 3) YouTube video (9.5 minutes) on farm safety; and 4) hand washing demonstration and practical session.

Method used and assessment of intervention: Knowledge and attitudinal questionnaires: pre-intervention (1 week before training), post-intervention (directly after the training).

Target population and sample size: 62 fresh-produce food handlers from 6 farms in UK. Ages 18-60, 34% male, 71% educated to secondary or tertiary level, and 31% with 1-3 years' experience.

Outcome: Increase in knowledge between pre- and post- intervention. Perceived behaviour by most staff was positive. However, social pressure also existed, showing its importance when trying to create positive change.

Comments: Food handlers preferred the YouTube video and hand hygiene demonstration, reiterating the need for practical hands-on sessions to create lasting memory. Food handlers reported that handwashing would be more frequent if barriers were removed, for example by allowing more access to sinks on the farm.

   13. **Author:** Chapman et al., 2011
Aim: Investigate whether posting food safety info-sheets in highly visible locations, such as kitchen work areas and hand washing stations, would improve safe food handling behaviours of food service staff.

Intervention: Five food safety info-sheets were used as a standalone intervention. Food safety information sheets were placed throughout each facility in high visibility and highly trafficked areas. Information sheets were changed weekly for 7 weeks.

Method used and assessment of intervention: Observations made using video observation for 2 days (348 hours) pre- and post-intervention. Cameras were placed above grills, deli and food preparation areas. Behaviours were coded and hand washing, and cross-contamination risks noted.

Target population and sample size: 47 food handlers from 8 food service facilities in Ontario, Canada.

Outcome: Increase in correct attempts at hand washing. However, many were not correct, missing steps in handwashing and often failing to dry hands properly. No improvement was seen in the number of indirect cross-contamination events during busy periods.

Comments: Cross-contamination was more common at busy periods, showing adequate time for food safety practices to be a factor.

14. **Author:** Choudhury et al., 2011

Aim: Evaluate knowledge, attitude and practice regarding food safety and hygiene, and the change in these after training interventions.

Intervention: Fifteen 4-hour training sessions (2 per week for 3 months) on personal hygiene; food hygiene; environmental hygiene; health and nutrition; and specific product training were given. Presentations, videos, role plays, demonstrations, puppet shows and handouts were used.

Method used and assessment of intervention: Knowledge questionnaires: 25 open -ended questions – pre-intervention (on first training day) and post-intervention (on the day following the final training day). Observations: researchers attended stalls and food carts of participants post intervention to measure improvements in cleanliness and food waste.

Target population and sample size: 80 street-food vendors from mobile vendors and small restaurants in Guwahati, India.

Outcome:

- Increase in knowledge in all areas and observation
- Increase in cleaning and food waste management.

Comments: No food handler had previous food safety training, yet all were eager to learn to improve the quality of their service. This highlights that many food handlers may want the opportunity to learn if training is available, and that such training can improve practice.

15. **Author:** York et al., 2009

Aim: Investigate the effectiveness of traditional ServSafe food safety training and a Theory of Planned Behaviour intervention programme targeting employees' perceived barriers and attitudes toward important food-safety behaviours.

Intervention: A 2-year study targeting handwashing, thermometer use and proper handling of food in two stages.

1) Training: 4-hour ServSafe food safety covering a range of food-safety topics followed by group discussion to highlight barriers.

2) Intervention (8 months after training): signage in high traffic areas with persuasive messaging; provision of thermometers; and an incentive programme for best compliant staff member.

Method used and assessment of intervention:

Questionnaires: pre-training (in the weeks before training) and immediately following training (on the training day).

Observations: pre-training (in the weeks before training) and post-training (1 week after training and 1 week after intervention). Behavioural observations were made on hand washing, thermometer use and handling of work surfaces.

Target population and sample size: 33 food handlers from 16 food service establishments in Missouri, US. Mean age 32, 61% male, average employment time 9.5 years.

Outcome: Increase in handwashing knowledge post- training and post- intervention. No improvement in knowledge or compliance in thermometer use or surface cleaning post-training or post-intervention.

Comments: The intervention phase (signage, thermometers and incentives) was required to improve compliance in handwashing, showing that knowledge training alone may not be enough to bring about a sustained change.

16. **Author:** Acikel et al., 2008
Aim: To analyse the efficacy of the training by determining the level of knowledge and the number of bacteria growing on cultures obtained from the hands.

Intervention: One-day knowledge training. Training material included theoretical presentations on personal hygiene, food hygiene and hand washing and a handwashing demonstration. Participants carried out training in groups of 8.

Method used and assessment of intervention:

Knowledge questionnaire: 39 questions on food hygiene and demographics. It was given pre-intervention (morning of training day) and post-intervention (one day after and one month after training).

Microbial levels: measured on hands to evaluate food handler behaviour.

Target population and sample size: 83 kitchen staff at an army facility in Turkey. 86% male, 84% educated to secondary level.

Outcome: Increase in knowledge - only watch and jewellery-wearing behaviour changed.

Comments: No improvement on microbial levels on hands. One-month post-training, knowledge levels remained high. However, behaviour was not shown to change, highlighting that an increase in knowledge alone may not be sufficient to improve food handler behaviour.

17. **Author:** Capunzo et al., 2005
Aim: To assess if a re-training intervention could reduce levels of foodborne illness bacteria in kitchens on-board merchant ships

Intervention: 3 x 90-minute knowledge training sessions involving a refresher training course of GMP and HACCP including examples of how to use these in practice. This included knowledge of risk, identifying CCP, and hygiene. Training was carried out in groups, with audio-visual support, animated images and comic strips. In high-risk areas on the ship, posters were used to highlight risk using images and words.

Method used and assessment of intervention:

Knowledge questionnaires: (pre- intervention to measure knowledge to direct training). Observation: pre-intervention prior to training and post-intervention 4-7 months post- training. Checklist to identify if correct HACCP documentation was present, including procedures and operating instruction for food preparation and cleaning.

Microbial: pre-intervention before training and post-intervention 4-7 months post-training. Food hygiene conditions were measured before and during food preparation and immediately after cleaning. Kitchen utensils, surfaces, food handlers' hands, storage areas, refrigerators and kitchen furniture were sampled.

Target population and sample size: 137 kitchen staff on 22 merchant ships based in UK.

Outcomes: Decrease in harmful microbial levels immediately after training and at the 4–7-month follow-up. Greatest improvement seen during food manipulation and preparation, with large reduction in harmful microbial levels.

Comments: All food handlers had previously completed food hygiene training, although not in the previous 12 months. This highlights the need for regular training.

Although correct HACCP documentation was present, some procedures, such as temperature recording, were not carried out effectively. This highlights that having systems in place does not ensure compliance.

Appendix 2: Participant Information Sheet (External expert)

Title of study: Establishing a strong food safety culture in small food businesses: attitudes, barriers and facilitators
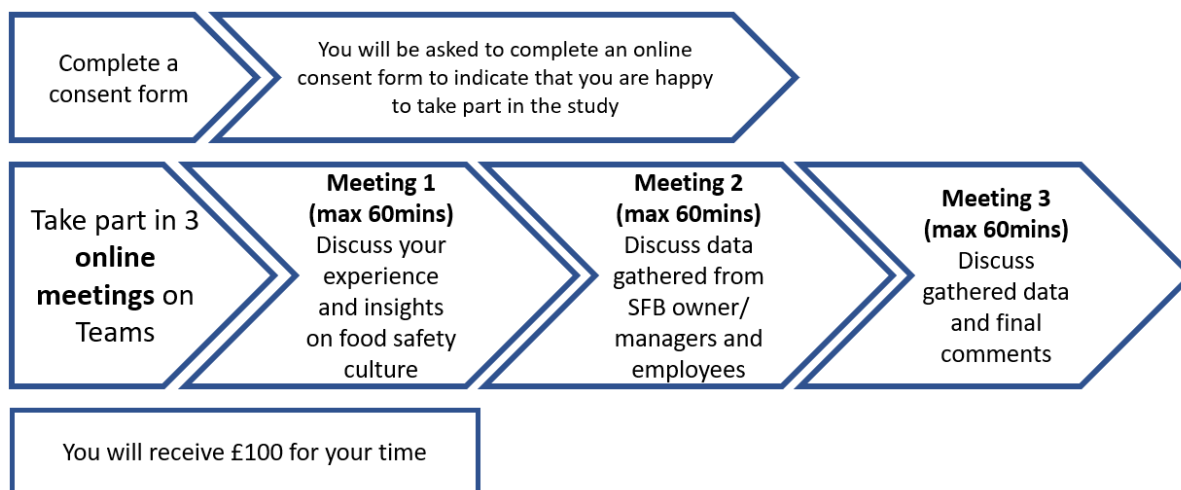
Invitation

You are being invited to take part in a one-to-one meeting or to form part of a focus group discussing food safety culture, but before you decide whether or not you want to take part, it is important you understand what the research is for, and what you will be asked to do. Please read the following and do not hesitate to ask any questions about anything that might not be clear. Make sure that you are happy before you decide whether or not to take part.

What is the purpose of this study?

This project is interested in understanding the level of knowledge and attitudes towards food safety culture in individuals working within small food businesses on the island of Ireland. As an expert in the field of food safety you will be aware food safety culture is a term used in the new EU regulations, we are interested to know your opinions and experiences on the establishment of a food safety culture within small businesses on the IOI. We are interested to know how you think this new legalisation is impacting both owner/ managers and operatives within small food businesses your experience of potential barriers and facilitators to establishing a positive food safety culture. We recognise that your experience is very valuable as you will be working closely with multiple businesses/ employees or potential employees and so your contribution to this project regarding the gaps (barriers and areas for improvement), and successes (interventions, training and case studies) in establishing a food safety culture are of great relevance to this project and we would be very grateful for your time and input.
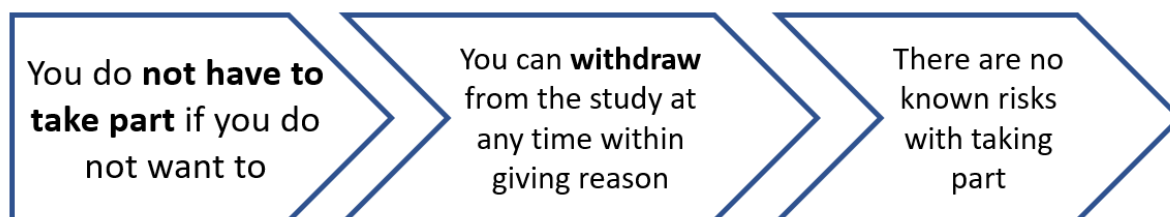
What do I have to do?

| Complete a consent form | You will be asked to complete an online consent form to indicate that you are happy to take part in the study |

| Take part in 3 **online meetings** on Teams | **Meeting 1 (max 60mins)** Discuss your experience and insights on food safety culture | **Meeting 2 (max 60mins)** Discuss data gathered from SFB owner/ managers and employees | **Meeting 3 (max 60mins)** Discuss gathered data and final comments |

You will receive £100 for your time

You will take part in a one-to-one interview/ paired interview/ focus group (depending on which is appropriate for each meeting) to discuss the topic of food safety culture, with the research associate (Sean McCallion) moderating. Meetings will be conducted online on Microsoft Teams and consent will be sent prior to the meeting for you to complete electronically. The dates of the three timepoints throughout the project are proposed as August 2022, February 2023 and July 2023 however these may change slightly.

At the first meeting we will ask you for your insight and experience on food safety culture within small food businesses including barriers and facilitators to its implementation. The second meeting will be held after we have interviewed small food businesses owners/ managers and employees. In this meeting we will discuss the data we received from those interviews including knowledge and awareness of food safety culture and the barriers and facilitators these participants reported. The third meeting will then discuss the results of an e-survey which will be conducted across the island of Ireland and the proposed recommendations which we will put forward to Safefood. Each meeting is estimated to last a maximum of 60 minutes and will be audio recorded for transcription and analysis purposes.

Do I have to take part?

| You do **not have to take part** if you do not want to | You can **withdraw** from the study at any time within giving reason | There are no known risks with taking part |

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep. You will also be asked to sign a consent form.

What if I want to withdraw?

If you have chosen to take part, you can still change your mind at any time and withdraw from the study without giving any reason. However, if you chose to withdraw any data that you have given up to that point may not be able to be withdrawn. If you choose to withdraw you will however not be compensated.

Are there any risks?

There are no risks associated with taking part in this focus group.

Are there any benefits?

You will receive a £100 contribution to thank you for your time. Other than the £100 there are no other direct benefits. We hope participation in this project will also benefit you in your role in food safety and that it will give you a deeper insight into the current knowledge, areas for more work and best practice models. You are free to use any of the data collected (anonymously) if it is helpful to the work you are undertaking.

Who is conducting this research?

This project is being conducted by the Ulster University Business School, on behalf of Safefood. Safefood is a cross-border agency that aims to promote awareness and knowledge of food safety and nutrition issues, throughout the IOI.

The Principal investigator for this project is Dr Lynsey Hollywood (l.hollywood@ulster.ac.uk), and the research associate is Sean McCallion (s.mccallion2@ulster.ac.uk). If you have any questions or queries or complaints about the project, please contact Sean McCallion directly. You can also ring Sean directly on +44 (0)28 70123568.

Alternatively you can complain directly to the University using this link: Complaints procedure (ulster.ac.uk)

What will happen to my data?
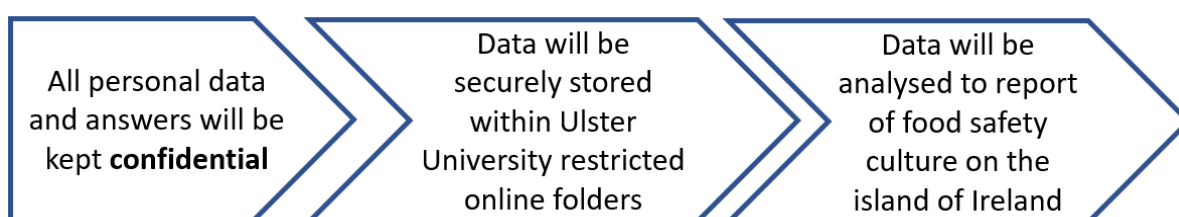
The results of this study will be kept in a secure restricted access online folder at Ulster University.

To find out more about how we use your information visit the Ulster University website:

https://www.ulster.ac.uk/about/governance/compliance/gdprGDPR at Ulster University - Ulster University

What will the data be used for?

The data will be used to make a report for Safefood about the current knowledge and attitudes towards food safety culture on the island of Ireland. From the data collected recommendations will be put together to support small food businesses across the island of Ireland in establishing a positive food safety culture. These recommendations will have input that is applicable and relevant to small food businesses on the island of Ireland to aid in the implementation of food safety culture within their business. It will also be used to write papers for peer reviewed journals. In neither of these forms will you be personally identifiable

Will my taking part in this study be kept confidential?

Yes. You will not be identified or identifiable in the dataset. If you happen to mention any identifying features of yourself or others, they will be removed or anonymised in the dataset.

Who has reviewed the research?

This research has been reviewed by the School Research Ethics Committee of the Business School, Ulster University {*Project ref to be inserted*}.

Many thanks for taking your time to read our study information. Please feel free to contact Sean McCallion if you have any queries or if you would be happy to take part in the research.

Sean McCallion: (E) s.mccallion2@ulster.ac.uk or (T) +44 (0)28 70123568

Appendix 3 **Participant information sheet (influencer)**

Title of study: Establishing a strong food safety culture in small food businesses: attitudes, barriers and facilitators

Invitation

You are being invited to take part in this focus group, but before you decide whether or not you want to take part, it is important you understand what the research is for, and what you will be asked to do. Please read the following and do not hesitate to ask any questions about anything that might not be clear. Make sure that you are happy before you decide whether or not to take part.

What is the purpose of this study?

This project is interested in individuals working within small food businesses (SFBs) on the island of Ireland and their knowledge and attitude towards food safety and food safety culture. As you are probably aware new EU legislation has been introduced to ensure a 'food safety culture' is present in all food businesses and as an owner/ manager of a small food businesses we are interested to know your experiences and opinions on the topic of food safety and food safety culture. This may include any barriers or facilitators you have found to implementing food safety into your business, difficulty in ensuring employees adhere to food safety protocols and areas you feel could be supported by regulators to improve food safety and FSC within small food businesses. We would also be interested in hearing what activities you feel work well to promote food safety e.g. food safety training, and how you incorporate this into your business.

Appendix 4. External expert question guide for used for discussions in stage 3

Awareness of food safety culture

- From your experience do you feel there is a good understanding of food safety in small food businesses?
- Are there any tools you use or are aware of for measuring food safety or food safety culture and do you feel it is an important thing to measure?

Food safety training, gaps and usefulness

- Do you feel there is a best approach to food safety training e.g., online, independent, certified and how often do you feel food safety training should be undertaken?
- Do you feel there are any gaps in current food safety training?
- Are you aware of the Safefood online e-learning for food safety?
- Food safety culture is a relatively new term. Are you aware of what food safety culture is and how would you define it?
- Are you aware of the new EU regulation on food safety culture? If so, how do you feel it is being implemented into food businesses, particularly small food businesses on the island of Ireland (IOI).

shared values, beliefs and norms that affect mindset and behaviour toward food safety in, across and throughout an organisation" (GSFI, 2018)

- Have you seen any changes in food safety in the last year since the introduction of the new legislation?

Food safety communication

- How do you feel food safety is best communicated within a small food business and does this differ from larger food businesses?
- Do you feel food safety is well communicated within small food businesses e.g. from owners/ managers to employees?
- Do you feel small food businesses respond well to changes in regulations?

Engagement of all staff in food safety systems

- Do you feel food business employees should be involved in food safety management system decisions? If so, how should this be done?
- Do you have any success stories from businesses that do this well?

Management of food safety incidents

- How do you feel food safety incidents are best managed?
- Do you have any success stories for dealing with food safety incidents?

Barriers and facilitators to attaining a positive food safety culture.

- What barriers do you feel exist to attaining food safety and food safety culture in small food businesses for both owners/ managers and employees
- What facilitators do you feel exist to attaining a food safety and food safety culture in small food businesses for both owners/ managers and employees
- What period of time do you feel a small food business would need to incorporate/ improve FSC?
- Do you feel owners/ managers or employees, or both are more important to influence FSC?

Positive interventions which improved FSC e.g. incentives, awards and recognition

- Are you aware of interventions that have been used to improve FSC in small food businesses?
- Do you feel awards, incentives help to promote compliance with food safety?

Appendix 5. Owner/ manager question guide for discussions in Stage 4

1. Recently, the term 'food safety culture' has come to be used. Have you heard the term before? If so, where and in what context.

Give definition of FSC - *"shared values, beliefs and norms that affect mindset and behaviour toward food safety in, across and throughout an organisation"*

Ask do they feel this concept is useful.

2. As a manager what food safety training have you completed, to what level and when was the last time you undertook training?

Was the training delivered online or in person?

How useful was this training for your role as owner/ manager.

In what ways if any, did the training change any aspects of how you conducted your business?

Other than formal training on food safety are you aware of any development or awareness sessions on food safety?

3. Do you cover food safety practices in your inductions with staff?

Do you require your staff to complete formal food safety training?

Do you pay for staff to undertake FS training?

If so, did they give you any feedback about the usefulness of the food safety training?

Did you notice any employee changes of behaviour following training where employees go above and beyond to ensure food safety?

Do you use any on-site training to ensure food safety, and do you think this is better done formally or informally?

4. How do you identify food safety risk within your business? Is this separate from normal H&S risks?

5. How do you keep up-to-date with food safety practices? Do you use online resources?

Do you feel an email newsletter or app from a food safety body would be useful for finding out this information?

6. How do you communicate food safety measures and updates to your staff?
7. Would you ask staff for their opinions on food safety procedures, or do they ever offer input?
8. What barriers do you feel exist to attaining food safety and food safety culture in small food businesses?
9. What do you feel already exists to help you attain food safety and food safety culture in small food businesses?
10. How often would you get a visit from an EHO? What do the EHOs look for when they visit so you can achieve a high score?
11. Have you ever incorporated any changes into your food business which you feel has improved food safety and food safety culture?

If so, what prompted you to make these changes e.g. FS training/ EHO.

- How embedded are food safety practices within your business? (e.g., signage, worksurfaces regularly cleaned, etc). Does food safety feature in your mission, vision or values?
- In what ways do you keep staff accountable when implementing safe food practices?
- Thinking about motivating your employees to implement good food safety practices, are there any metrics you use to measure their performance?
- Aside from the food hygiene rating scheme, do you use any measures or metrics to assess the food safety standards within your business?
- A successful food safety culture must resonate with both the employer and employee, what aspects of your current food safety practices do you think you do well/should be retained and which aspects could be improved?
- Leading by example is key in achieving a successful food safety culture, how do you feel you do this?

- Have there been any recent developments in science, technology or best practice that have assisted you in improving your businesses food safety culture?

The barriers attitudes and facilitators to establishing a strong food safety culture in small food businesses.

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Appendix 6. Table of questions asked during the market research survey in stage 4.

Themes	Indicators	Owner/ manager	Operative
Awareness of FSC		1. I have heard of the term food safety culture. (Y/ N) 2. If so, please state where you heard the term. Options: In the media, on a food safety website e.g. Safefood, at a training course, other (please state) 3. I am aware that new EU regulation was introduced in 2021 regarding food safety culture. (Y/ N) 4. Food safety culture is defined as the "shared values, beliefs and norms that affect mindset and behaviour toward food safety in, across and throughout an organisation".	1. I have heard of the term food safety culture. (Y/ N) 2. If so, please state where you heard the term. Options: In the media, on a food safety website e.g. Safefood, at a training course, other (please state) 3. I am aware that new EU regulation was introduced in 2021 regarding food safety culture. (Y/ N) 4. Food safety culture is defined as the "shared values, beliefs and norms that affect mindset and behaviour toward food safety in, across and throughout an organisation".

Themes	Indicators	Owner/ manager	Operative
		Given this definition, at (management/operating) level how easy do you feel it would be for your company to implement this legislation? Options: Very easy, fairly easy, difficult, very difficult 5. Does your company use systems or reporting tools to measure Food Safety Culture? (Y/ N)	Given this definition, at (management/operating) level how easy do you feel it would be for your company to implement this legislation? Options: Very easy, fairly easy, difficult, very difficult 5. Does your company use systems or reporting tools to measure Food Safety Culture? (Y/ N)
Introduction to each scale question: Using a 7-point scale where 7 = strongly agree and 1 = strongly disagree			
Communication	▪ Quality ▪ Content ▪ Openness	6. As an Owner/Manager I provide employees with adequate information and guidelines at the right moment regarding food safety norms and procedures.	6. My manager provides me with adequate information and guidelines at the right moment regarding food safety norms and procedures. 7. I can speak freely with my manager about any subject that affects food safety at the company.

Themes	Indicators	Owner/ manager	Operative
	▪ Dialogue	7. I can speak freely with my employees about any subject that affects food safety at the company. 8. I have an open dialogue with my staff about any subject related to food safety. 9. I often make time for communication on issues related to food safety with all the employees in my company.	8. I have an open dialogue with my manager about any subject related to food safety. 9. My manager often makes time available for communication on issues related to food safety with all the employees in my company.
Infrastructure	▪ Quality ▪ Processes ▪ Training ▪ Equipment	10. In my work company, the quality of the clothes, handwashing locations, anterooms and processing areas is adequate for food safety practices. 11. In my company, processes are executed in a way that reduces food safety risks. 12. Food safety training is compulsory for all employees in my company.	10. In my company, the quality of the clothes, handwashing locations, anterooms and processing areas is adequate for food safety practices. 11. In my company, processes are executed in a way that reduces food safety risks. 12. Food safety training is compulsory for all employees in my company.

Themes	Indicators	Owner/ manager	Operative
		13. In my company, the equipment, tools and general resources that aid adequate behaviour to ensure food safety are always available. 14. Please state what level of qualification (if any) you have completed for food safety and hygiene training? Options: Level 2, Level 3, Level 4, Other (please state) 15. Please state the year you last completed food safety and hygiene training from outside of your food business. Options: 2023, 2022, 2021, 2020, Prior to 2020 16. In-house refreshment training on hygiene and food safety is performed.	13. In my company, the equipment, tools and general resources that aid adequate behaviour to ensure food safety are always available. 14. Please state what level of qualification (if any) you have completed for food safety and hygiene training? Options: Level 2, Level 3, Level 4, Other (please state) 15. Please state the year you last completed food safety and hygiene training from outside of your food business. Options: 2023, 2022, 2021, 2020, Prior to 2020 16. In-house refreshment training on hygiene and food safety is performed.

Themes	Indicators	Owner/ manager	Operative
Pressure at Work	▪ Volume of activities ▪ Pressure from the Manager ▪ Pressure over Deadlines ▪ Dimensioning of professionals	17. My volume of tasks does not interfere with my ability to follow food safety rules and procedures. 18. I have enough time to follow my company's orientations on food safety, even in times of great demand. 19. I manage to follow the food safety norms and procedures because I set clear priorities and deadlines for employee's activities. 20. The number of professionals in my company is adequate for handling food safety activities.	17. My volume of tasks does not interfere with my ability to follow food safety rules and procedures. 18. I have enough time to follow my manager's orientations and directions on food safety, even in times of great demand. 19. I manage to follow the food safety norms and procedures because my manager sets clear priorities and deadlines for my activities. 20. The number of professionals in my company is adequate for handling food safety activities.
Risk Perception	▪ Behavior ▪ Haste and Selfconfidence	21. In my company, we take no risks, no matter how small, that might affect food safety.	21. In my company, we take no risks, no matter how small, that might affect food safety.

Themes	Indicators	Owner/ manager	Operative
	▪ Negligence and improvisation ▪ Lack of insistence	22. My staff in the company do not perform their tasks in a hurry to avoid risks with food safety. 23. My staff in the company are not negligent in their activities to avoid risks with food safety. 24. My staff in the company do not improvise in their activities to avoid risks of food safety.	22. My colleagues within my company do not perform their tasks in a hurry to avoid risks with food safety. 23. My colleagues in the company are not negligent in their activities to avoid risks with food safety. 24. My colleagues in the company do not improvise in their activities to avoid risks of food safety.
Management System	▪ Role of management systems ▪ Metrics ▪ Metrics ▪ Feedback	25. In my company, we have objectives, goals that help us to improve conformity and reduce food safety risks. 26. The food safety goals and objectives reinforce desired behaviour in my company and motivate all my staff. 27. The food safety indicators help to identify new or safer ways of carrying	25. In my company, we have objectives, goals that help us to improve conformity and reduce food safety risks. 26. The food safety measures reinforce desired behaviour in my company and motivate all my colleagues. 27. The food safety measures and matrices help to identify new or safer ways of

Themes	Indicators	Owner/ manager	Operative
		out a particular task in the production of food. 28. I receive feedback from our own systems and procedures and staff when I do not seek to align my behaviour with the food safety indicators.	carrying out a particular task in the production of food. 28. I receive feedback from my immediate superior when I do not seek to align my behaviour with the food safety measures and matrices.
Leadership	• Vision • Vision • Model • Trust	29. I have a clear vision regarding the importance of food safety practices. 30. I inspire staff regarding the importance of food safety practices. 31. I provide good examples of the behaviour expected to ensure food safety. 32. I view food safety as a non-negotiable value.	29. The company leadership has a clear vision regarding the importance of food safety practices. 30. The company leadership inspires me regarding the importance of food safety practices. 31. The company leadership provides good examples of the behaviour expected to ensure food safety. 32. The company leadership views food safety as a non-negotiable value.

Themes	Indicators	Owner/ manager	Operative
Teamwork	• Collaboration • Collaboration • Proactivity • Trust and mutual respect	33. My staff are always helpful and support me to guarantee food safety. 34. My staff encourage cooperative behaviour for successful food safety. 35. When unsafe behaviour needs to be adjusted, my staff in the company guide each other based on the food safety norms and procedures. 36. I trust and respect my staff and know that they make a maximum effort to ensure food safety in the company.	33. My colleagues in my company are always helpful and support me to guarantee food safety. 34. My colleagues in my company encourage cooperative behaviour for successful food safety. 35. When unsafe behaviour needs to be adjusted, my colleagues in the company guide me based on the food safety norms and procedures. 36. I trust and respect my colleagues and know that they make a maximum effort to ensure food safety in the company.

Themes	Indicators	Owner/ manager	Operative
Responsibility	• Role of the Owner • Discipline • Discipline • Shared responsibility	37. My staff take personal responsibility and care over food safety and promote a vision of responsibility to each when choosing safer practices. 38. I comply with all my responsibilities related to food safety. 39. I promote a vision of responsibility for every staff in my company when choosing safer practices. 40. I constantly emphasise that food safety is interdependent, i.e., all my colleagues have shared responsibilities to guarantee safe products.	37. My colleagues take personal responsibility and care over food safety and promote a vision of responsibility to each when choosing safer practices. 38. My manager complies with all their responsibilities related to food safety. 39. My manager promotes a vision of responsibility for every colleague in my company when choosing safer practices. 40. My manager constantly emphasizes that food safety is interdependent, i.e., all my colleagues have shared responsibilities to guarantee safe products.

Themes	Indicators	Owner/ manager	Operative
Commitment	• Proud • Importance • Practice • Practice	41. Employees are proud to practice food safety with excellence. 42. Doubts regarding food safety risk could mean halting production and taking corrective actions. 43. Employees believe that food safety is important and follow food safety practices consistently in their activities. 44. Employees understand the reasons for having to follow food safety practices consistently. 45. I intend to work within this food business for the foreseeable future.	41. Employees are proud to practice food safety with excellence. 42. Doubts regarding food safety risk could mean halting production and taking corrective actions. 43. Employees believe that food safety is important and follow food safety practices consistently in their activities. 44. Employees understand the reasons for having to follow food safety practices consistently. 45. I intend to work within this food business for the foreseeable future.
FS messaging		46. On food safety and hygiene training courses these elements are important to me.	46. On food safety and hygiene training courses these elements are important to me.

Themes	Indicators	Owner/ manager	Operative
		- Personal interaction with trainer during face-to-face meetings - Training specified for your food business - Training can be completed in own time - Training can be completed quickly - Training can be completed online - None of these	- Personal interaction with trainer during face-to-face meetings - Training specified for your food business - Training can be completed in own time - Training can be completed quickly - Training can be completed online - None of these