

Triangulation: effective verification of food safety and quality management systems and associated organisational culture

by Manning, L.

Copyright, Publisher and Additional Information: This is the author accepted manuscript. The final published version (version of record) is available online via Emerald Publishing.

This version is made available under the CC-BY-ND-NC licence:

<https://creativecommons.org/licenses/by-nc-nd/4.0/>

Please refer to any applicable terms of use of the publisher

DOI: <https://doi.org/10.1108/WHATT-02-2018-0009>



Manning, L. 2018. Triangulation: effective verification of food safety and quality management systems and associated organisational culture. *Worldwide Hospitality and Tourism Themes*.

14 May 2018



Triangulation: effective verification of food safety and quality management systems and associated organisational culture.

Journal:	<i>Worldwide Hospitality and Tourism Themes</i>
Manuscript ID	WHATT-02-2018-0009
Manuscript Type:	Article
Keywords:	Food Service, Audit, Inspection, Checklist, Hospitality

SCHOLARONE™
Manuscripts

and Tourism Themes

Triangulation: effective verification of food safety and quality management systems and associated organisational culture.

Introduction

The Codex Alimentarius Commission (CAC, 2003) defines verification as “the application of methods, procedures, tests and other evaluations, in addition to monitoring to determine compliance”. The British Retail Consortium (BRC) Global Food Standard builds on this in their definition of verification namely: “the application of methods, procedures, tests and other evaluations, in addition to monitoring, to determine whether a control or measure is or has been operating as intended” (BRC, 2015 p. 119). Alternatively, The Food Law Code of Practice (England) March 2017 (p148) defines verification as: “the checking, by examination, and the consideration of objective evidence, whether specified requirements have been fulfilled”. Thus verification can be considered as the use of methods, procedures, tests and checks to provide objective evidence that requirements specified in either quality management system (QMS) or food safety management system (FSMS) standards, or in the FSMS/QMS designed by a particular organisation or an element of the organisation’s FSMS/QMS have been met or organisational activities are operating as planned and how they were designed to function (Luning *et al.*, 2009; Bergh *et al.*, 2016). It is important to note here that in the literature food safety is sometimes seen as an independent food attribute and distinct from quality characteristics, whilst in other literature food safety attributes are seen as being a subset of overall quality attributes for a food material or product. Specified requirements can relate to the product, the process, people or general production environment and can be an element of regulatory compliance i.e. a legal requirement or market compliance, or both. Product verification, such as chemical, physical and microbiological analysis or hygiene testing including surface swabbing for microbiological analysis often involves high analytical costs, and sometimes inappropriate laboratory turnaround times that do not support a just-in-time driven food supply system (Manning, 2016). Process verification through the assessment of documentation, product and process certification and traceability data is less costly than destructive product inspection and testing, but such verification processes rest on the ability to assess valid, authentic, objective and representative evidence (Manning and Soon, 2014).

Verification can be described as first party, where an organisation verifies its own activities; or second party whereby verification is undertaken within a supply chain between two parties where there is a contractual obligation e.g. supplier audits and third party. Third party verification is undertaken by an external organisation when the first party develops their QMS and their FSMS to meet a given system standard and an independent third party organisation undertakes verification activities to confirm the degree of compliance with those standards. Examples of system standards that are used for the basis of judging compliance include the BRC suite of supply chain standards (BRC, 2017), and the ISO suite. Whilst the BRC suite of standards and ISO standards are referenced in this paper, there are a number of third party standards used in food manufacturing and supply. The focus on the BRC suite of standards in this paper is due to their being a connected food safety culture module which can be assessed by third party certification bodies as well as the more formal aspects of the FSMS and QMS (BRC, nd).

The aim of this paper is to critique the existing and emerging alternative approaches being used by regulators and industry to verify the presence and efficacy of FSMS. The paper is structured as follows: firstly there is an introduction to key concepts in the area of

1
2
3 study; secondly there is a review of the strengths and weaknesses of the current use of TPC
4 audits to verify compliance and the interface with regulatory controls and the transition
5 towards risk based regulatory controls where regulated private assurance as an option is
6 gaining greater focus.
7

8 **Auditing as a tool for product and process verification**

9 *Inspection*

10
11 Inspection can be defined as a conformity evaluation by observation and judgement
12 accompanied as appropriate by measurement, testing or gauging (Hinkle, 2006) through
13 product sampling or process assessment of documentation via a checklist approach of
14 accompanying documentation. The Food Law Code of Practice (England) March 2017 (p.
15 143) defines inspection as “the examination of any aspect of feed, food animal health and
16 animal welfare in order to verify that such aspect(s) comply with the legal requirements of
17 feed and food law and animal health and welfare rules.” The practical difference between
18 what is an inspection and what is an audit is nuanced. Indeed, the terms audit and
19 inspection are used interchangeably in the literature with greater differentiation in more
20 historic literature than when compared to contemporary discourse. An inspection is often
21 seen as a “moment in time” checklist based approach (Souness, 2000) where the decisions
22 are binary i.e. complaint or non-compliant with very little emphasis on continuous
23 improvement.
24
25

26 *Systems-based and compliance-based audits*

27
28 BS EN ISO 9001: 2015 defines an audit as a systematic, independent and documented
29 process for obtaining audit evidence (records, statements of fact or other information) and
30 evaluating the evidence objectively to determine the extent to which audit criteria (policies,
31 procedures and requirements) are fulfilled. This required a systematic examination of an
32 auditee’s processes, arrangements and activities to determine whether they conform to
33 standards and procedures, meet audit criteria and if there are any opportunities for
34 improvement (Mallen and Collins, 2003; Blewett and O’Keeffe, 2011). In this context an
35 auditee is an individual, department or organisation being audited. To give benefit to the
36 organisation for the resources utilised in preparing, undertaking and following up audit
37 activities afterwards, auditing should highlight evidence of compliance and best practice as
38 well as report non-compliance and corrective action (Bergh *et al.*, 2016). Compliance can be
39 determined firstly in terms of whether the organisation’s documented management system
40 (FSMS and QMS) meets the criteria and requirements of the third party certification (TPC)
41 standard or alternatively the requirements of legislation and official controls. Thus an audit
42 should give a fully rounded picture of the current status of the organisation and areas of
43 excellence as well as where preventive or corrective action is required. Blewett and O’Keeffe
44 (2011) argue that auditing too can be mechanistic in nature and use binary assessments of
45 whether activities are either completed or not completed, are black or white rather than
46 grey, or are considered simply as good or bad practice. This means the focus of this type of
47 the audit is primarily on compliance.
48
49
50

51 This first approach, which is both mechanistic and binary in terms of whether the
52 organisation’s documented formalised systems have addressed a legislative and/or TPC
53 requirement, or conversely have not is often called a systems audit. Secondly the audit can
54 examine the organisation’s performance and whether it meets both the TPC standard,
55
56
57
58
59
60

official controls and/or the requirements of the FSMS and QMS where these extend beyond the stated criteria within the standard or legislation in terms of a compliance based audit.

Performance-based audits

The third type of audit is a performance based audit where the examination is one that considers better or best practice and thus extends beyond simple compliance. Official control audits are an example of performance audits that are used to evaluate governance in terms of cost versus benefits aspects. The three types of verification audit have been compared in Table 1.

Performance based audits derive their meaning from the degree of engagement of all parties in the audit process, and the quality of the relationship between auditor and auditee (Pollit *et al.*, 1999; Weets, 2008; Morin, 2001; 2004; 2008; Lääkkö-Roto and Nevas, 2014). Meaning is a social construct that links people to their environments and as a result influences their perception of a given function or activity e.g. the role of auditing (Rapoport, 1988; Coolen and Ozaki, 2004). Food safety culture as a construct describes the emergent history and traditions of a given organisation that give meaning to the underlying values and beliefs held by members of formal and informal social groupings (Buchann and Huczynski, 2004; Griffith *et al.*, 2010). A deeper analysis of food safety culture is described in paper one of this special themed journal edition (Manning, 2018). Thus performance based audits go further than simple compliance assessment against TPC elements and examine both the formal FSMS and QMS and the informal business practices that are influenced by organisational culture. Performance based auditing extends towards identifying weaknesses in the FSMS or QMS that have not yet given rise to non-compliance but where the auditor recommends that the organisation considers undertaking preventive action before non-conformance potentially arises in the future (see Table 1). These recommendations may or may not be addressed by the organisation but can underpin continuous improvement in management systems and operational performance. This latter approach requires auditors to step away from a mechanistic style of auditing to use a more holistic approach that embraces not only the system and compliance element of auditing, but also considers much wider aspects such as the organisational culture of adopting, implementing and monitoring food safety and quality aspects of products and processes employed.

Third party certification

Certification is the process whereby an accredited certification body provides written assurances, normally in the form of a certificate, that based on a formal assessment, which usually includes an audit, an organisation conforms to the requirements of a given standard (BRC, 2017). A certificate is usually issued with the audit report verifying the result of the audit, including a scoring system grade (if that forms part of the TPC scheme) and stating that the audit has been conducted against particular audit criteria (Blewett and O'Keefe, 2011) as defined in the standard. TPC schemes cover the certification of the management of the production, storage and handling of the products at a discrete point in the supply chain (Manning and Soon, 2014) and can interface in a modular approach to provide whole chain assurance. A certification body is a provider of certification services and is accredited to do so by an authoritative body (BRC, 2017) Accreditation is the process by which an independent authoritative body gives formal recognition of the competence of a certification body to provide certification services against a specified system standard (BRC, 2017).

1
2
3 Whilst the differentiation between an inspection and an audit is not explored in depth
4 here, what is of interest is whether a TPC audit is executed based on a checklist approach
5 alone (akin to inspection) or whether the auditor has the flexibility to also assess criteria
6 that are not defined explicitly in the audit checklist.
7

8 *Checklist-based auditing*

9
10 The checklist approach to auditing, sometimes called *evaluation myopia*, has been
11 described as the rigid application and non-reflective use of a certification standard causing
12 the auditor to overlook the side effects or side impacts that can occur i.e. a blinkered
13 approach to verification (see Martz, 2010). This can result in an auditor only verifying the
14 quality and food safety criteria that are specifically defined in the standard, thus unknown
15 or emerging issues may well go unnoticed and unexamined (Manning, 2013; Manning and
16 Soon, 2014). Flores-Miyamoto *et al.*, (2014) argue that whilst checklist based auditing might
17 be technically correct, myopia can occur if auditors use a checklist to prove they have
18 undertaken the audit appropriately, but there may be no incentive for the auditor to
19 identify wider material weaknesses or deficiencies in the QMS or FSMS. It is argued that
20 there are considerable resources employed in the development and excessive use of
21 manuals, guidebooks, protocols, and checklists for audits often when the contribution of
22 such tools to audit efficiency and effectiveness is unclear (Leeuw, 2011; Lääkkö-Roto and
23 Nevas 2014).
24
25

26 The UK Food Standards Agency (FSA) uses a checklist based approach for their official
27 premises and food audits (FSA, 2017a). Powell *et al.* (2013) state that whilst food service
28 inspection is the cornerstone of local public health, the scores derived can be a poor
29 predictor of foodborne illness. Further they argue whilst TPC audits are a valuable snapshot
30 verification tool and can be a cost-effective way to assure food safety in a supply chain of
31 reducing financial margins where cost-effectiveness is key, food businesses that have
32 approved certified status still continue to be linked with food incidents, product recalls and
33 foodborne illness outbreaks. Manning (2013) built on this concern over the effectiveness of
34 verification by developing a verification risk (VR) model to identify the components of VR
35 that prevent weaknesses or actual non-conformance being identified and addressed during
36 an audit. The degree of VR reflects the products and processes being audited and could
37 arise either from inherent product characteristics (such as clumping, heterogeneity),
38 inherent hazard characteristics (such as low infective dose), inherent weaknesses in the
39 sampling plan for the method of verification or a weak sampling protocol that is being used
40 by the regulator, TPC company, or the organisation itself and/or a lack of resources to
41 undertake effective sampling and surveillance (Manning and Soon, 2013). Flores-Miyamoto
42 *et al.*, (2014) assert that studies into the cost effectiveness and process improvement
43 capabilities of auditing in food production are scarce.
44
45
46

47 *Risk-based auditing*

48
49 Effective auditing has been described as the activities and actions completed to
50 ensure that the maximum number of actual deviations from the expected state of
51 conformity to a specific standard, law or regulation are identified during the audit, whereas
52 efficient auditing is described as where non-conformity is identified with the minimum
53 amount of resources i.e. in efficient auditing approaches there is an element of trade-off
54 between the cost and the benefit derived (Kleboth *et al.*, 2016). Effective auditors must not
55 only be able to assess compliance, but also be able to determine the level of risk in a given
56
57
58
59
60

1
2
3 situation and draw together the information available to determine the effectiveness of the
4 FSMS in that context (Powell *et al.*, 2013).

5 The characteristics of an excellent audit are that it is quick to apply yet still accurate,
6 is non-invasive i.e. the evidence can be collected with the least possible effort from the
7 auditee, scalable, avoids bias whilst being theoretically grounded, is transparent, and
8 stimulates consensus building (Salama *et al.*, 2009). However, Trotman and Wright (2012)
9 suggest that to prevent identification of non-compliant activities or illicit behaviour, an
10 auditee organisation may develop concealment strategies, especially where the auditee
11 organisation is aware of the analytical procedures and audit processes used by auditors
12 during audits. Because they may second guess the verification activities as part of a
13 concealment strategy it is important for the auditor to use a range of evidence sources to
14 determine the level of risk, degree of compliance and the culture of the organisation that
15 gives context to the FSMS and QMS employed i.e. that triangulation of evidence should be
16 undertaken. This suggests that limiting the amount of objective evidence gathered during an
17 audit to a single source is problematic. Arens *et al.*, (2010: p. 134) described auditor
18 independence as the “mental attitude that is taking unbiased viewpoint in the performance
19 of audit tests during the accumulation and evaluation of evidence, the evaluation of the
20 results, and the issuance of the audit report.” Auditor independence means that auditors
21 have a responsibility to examine a range of objective evidence in order to provide an
22 opinion for that given date or timeframe on whether the evidence assessed reflects the
23 organisation’s activities and the organisation’s degree of compliance with regulatory and/or
24 market standards (Smith and Emerson, 2017). However, barriers to undertaking detailed in-
25 depth auditing exist. Time pressure can affect auditor behaviour and as a result audit quality
26 in terms of both the need to complete an audit of the scope and depth required and also to
27 provide a report of sufficient depth that can inform appropriate action by the auditee
28 organisation. Audits are often called “snapshots” i.e. the resources available in terms of
29 auditor time and expertise will influence the scope and depth of the audit and by
30 implication reliability of the audit process and the audit result (see Powell *et al.*, 2013).

31 In light of these challenges, Albersmeier *et al.*, (2009) considered the trustworthiness of
32 TPC as a quality signal, raising concerns with regard to validity and reliability, and auditor
33 independence and objectiveness based on the use of inspection techniques based on
34 *checklist governance*, i.e. identifying the presence of QMS or quality performance elements
35 and contrasts this model, with the concept of risk-based auditing. The checklist content will
36 also influence the depth and scope of the audit (Powell *et al.*, 2013). Albersmeier *et al.*,
37 (2009) compared the characteristics of inspection based and risk-based audits (see Table 2).

38 From a positive viewpoint, a risk-based auditing programme ensures optimum and cost
39 effective utilisation of verification resources and limited budgets (Van Asseldonk and
40 Velthuis, 2014) especially for micro and small sized organisations where the cost of TPC can
41 be a challenge. Proportional risk-based product and process sampling especially by
42 regulators can be described as stratified sampling based on firstly the levels of risk to
43 consumers and the wider food supply chain, and secondly the concept of earned recognition
44 as a factor of influence when sampling plans, including audit frequency is determined
45 (Manning *et al.*, 2014). Proportional risk-based product sampling is implemented where the
46 sample size and population reflects respective risk level (Thurmond, 2003; Manning *et al.*,
47 2014). The sampling architecture is important to define especially the criteria (strata) which
48 inform the risk assessment, the validity and repeatability of the sampling methodology and
49 the confidence limits when interpreting the results. The most important criteria to address
50
51
52
53
54
55
56
57
58
59
60

when developing a verification sampling framework are to embed risk-based verification systems in a framework so they interact with and activate each other i.e. promote input – output – input processes (see BS EN ISO 9001: 2015); development of verification methodology must be appropriate, sensitive and accurate whilst also being repeatable and reproducible between verification activities. If they are designed to promote early detection of non-compliance whilst minimising false positives, then verification activities must be timely, promote rapid information transfer and the audit report must affect appropriate preventive and corrective action, as required. It is important to ensure system efficiency, and cost-effective surveillance (Briedenbach *et al.*, 2004) as well as net value and return on investment.

Some weaknesses in the use of TPC as a form of FSMS verification have been raised. The process sampling activities used within such TPC audits are constrained by the time available i.e. a snapshot in time, planned frequency of verification activities, volume of data to be assessed, any planned or unplanned sampling bias, and the potential for deviation from the scope of the audit and the quality of the standard against which the audit is being undertaken (Manning, 2013; Powell *et al.*, 2013). The Global Food Safety Initiative (GFSI, nd), a collaborative group of non-governmental food industry actors (CAC, 2017), through their benchmarking activities drive the recognition, consistency and continuous development of TPC schemes and thus play a strong role in the development of industry practices that drive improved audit depth and triangulation of verification activities associated with examining FSMS and the associated food safety culture. The GFSI Technical Working Group on Food Safety will play a pivotal role in this development.

Regulatory approaches to TPC

TPC standards can subsume and/or replicate national legislative requirements or governance arrangements and a trend is emerging within regulatory modernisation programmes to recognise certain aspects of such schemes (CAC, 2017). Thus TPC are being used to drive a more risk-based regulatory approach to food safety governance and delivering food safety objectives. Countries where this approach is being considered include Canada, the Netherlands and the UK (CAC, 2017). Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products which will come into full force by 14 December 2019 states that “competent authorities should perform official controls regularly, on a risk basis and with appropriate frequency... The frequency of official controls should be established by the competent authorities having regard to the need to adjust the control effort to the risk and to the level of compliance expected in the different situations.” In the UK, earned recognition is a regulatory framework for reducing, wherever possible, the frequency and type of official controls on businesses that demonstrate continued legislative compliance (Food Law Code of Practice (England) March 2017), such as regulatory inspection and product sampling. Earned recognition considers the value of TPC as a means to identify food businesses that are of lesser risk and thus require less regulatory interest. Whilst the competent authority is still central to the regulatory process a tighter more risk based approach that rewards good practice with less frequent inspection via the recognition of TPC is increasingly seen as a better form of regulation (Albersmeier *et al.*, 2009). TPC has been described by the Food Law Code of Practice (England) March 2017 (p. 148) as: “Independent verification of business compliance against a predetermined standard which

1
2
3 has been endorsed by the [Food Standards Agency] FSA as being equivalent to /complying
4 with the requirements for food law.” In the UK, the FSA is responsible for ensuring that an
5 effective regulatory regime is in place to verify that food business meet their obligation to
6 ensure food is safe and is what it says it is (FSA, 2017b p. 2). In the emerging regulatory
7 approach “Regulating our future” (ROF) the FSA state: “We will continue to inspect and
8 assure each [TPC] scheme to be confident that its standards, independence and
9 trustworthiness meet our expectations, being clear that this use of regulated private
10 assurance is not self-regulation” (FSA, 2017b, p. 10).
11
12

13 The FSA are therefore considering within ROF, rather than earned recognition, the use of
14 regulated private assurance (Robinson, 2017). However, Turku et al. (2018) argue that there
15 is a major difference between unannounced regulatory control inspections that are
16 independent, potentially more authentic and focus primarily on the safeguarding of
17 consumer interests whilst TPC is part of a market economy with the associated risk that
18 brings and the potential difference in focus of predominantly announced TPC audits might
19 lead to non-compliance going unrecognised (Martinez *et al.*, 2013; Verbruggen and Havinga,
20 2015). Turku *et al.*, (2018) conclude that due to the longer timescale of a TPC audit versus
21 an official inspection, the content of the different audits/inspections and the competence of
22 the auditors (official audits versus industry audits) that TPC audits had greater impact on
23 business risk management than official control inspections. Unannounced TPC audits within
24 a given timeframe are now being adopted within the requirements of standards such as the
25 BRC Global Standard, but Turku *et al.*, (2018) state that TPC audits cannot be held as a
26 replacement for official food controls and further work needs to be undertaken to consider
27 why discrepancies occur between the audit outcomes/inspection results from the two
28 approaches. Robinson (2017) stated that:
29
30
31

32
33 “whilst there is significant commonality between BRC Global Standards audits and
34 [competent authority] CA inspections, there is a perceived difference in the purpose,
35 assessment focus and approach between them. CAs carry out an inspection, which
36 focuses on assessment of any risk to public health and compliance against relevant
37 legislation, whilst the focus of BRC Global Standards audits is to assess compliance
38 against the requirements of the Standard. Although the Standard has been developed to
39 assist businesses to meet legal requirements, it was the view of the CAs and FSA
40 assessors that this is not the primary focus of the audit assessment. This perceived
41 fundamental difference raised a number of concerns about the Standard being used as
42 the basis for a full replacement of CA interventions by BRC Global Standards audits,
43 however there was general acceptance that the audits could be used to help inform the
44 [risk-based] frequency and/or focus of CA interventions of certificated businesses.”
45 Robinson (2017 p.4)
46
47
48

49 Therefore the transition from the use of TPC audits initially as a compliance verification
50 tool within a wider remit of organisations needing to demonstrate compliance with
51 contractual obligations and due diligence (Elliott Review, 2013) to secondly then TPC being
52 used as a risk-assessment tool for CA inspections within a regulatory risk-based assessment
53 is under consideration in the UK and also the wider EU. This means that the purpose of use
54 of the outputs of TPC is changing and the use of regulated private assurance (FSA, 2017b) as
55 proposed under ROF is of interest not only within food manufacturing, but also for the
56
57
58
59
60

1
2
3 hospitality sector. If the FSA and CAs are going to use the data derived from TPC to
4 determine risk and thus the need for regulatory intervention then there is a suggestion that
5 TPC needs to be more robust in terms of verification activities in order for there to be
6 confidence in such an approach. The Elliott Review stated there was a reluctance to rethink
7 and redesign how auditing is undertaken, and highlighted that:

8
9
10 “The review has found that the quality and completeness of these private audits are
11 variable, and some of their requirements appear futile or unreasonable. The growing
12 number of audits commissioned by retailers is not achieving the intended purpose. The
13 auditing regime has, in some cases, become an industry in itself, because it requires
14 food businesses to pay for their audit. As a result, there is a danger that an audit regime
15 can be used for raising revenue, placing unnecessary costs on food businesses,
16 particularly SMEs.” (Elliott Review, 2013 p. 40).

17
18
19 The Elliott Review (2013) determined that there is a proliferation of first party, second
20 party and third party audit as well as official control inspections that are developed piece
21 meal and with little co-ordination. The duplication uses resources and comes at a cost, and
22 in their current framing the varied requirements whilst being designed to demonstrate due
23 diligence could provide an opportunity for the FSA to implement an earned recognition
24 approach. This requires a given TPC standard or standards to be recognised by the FSA as
25 being compatible with regulatory controls and thus the degree of compliance identified
26 could be used as a proxy for then reducing the requirement for official controls inspection.
27 Powell *et al.*, (2013) assert that TPC audits are only one type of performance indicator and
28 they need to be supplemented with assessment of data from other sources including
29 microbial testing, second-party audits, internal audits, laboratory results and raw product
30 certifications. Different types of verification are now described in more detail.

31 32 33 34 **Types of verification and their validity**

35 Verification includes auditing methods, procedures and tests, product sampling and
36 analysis and is used to determine if the FSMS system including the hazard analysis critical
37 control point (HACCP) system is developed, implemented and is working correctly (CAC,
38 2003). Further the frequency of verification should be sufficient to confirm that the FSMS is
39 working effectively (CAC, 2003). The concerns over the failures in verification, perceived
40 barriers and perceived benefits have been identified in the literature (see Table 3). The
41 perceived benefit is that verification can ensure product and process compliance, but there
42 are barriers in that verification is costly, includes duplication and lacks value.

43
44 Verification of process and product through review and auditing provides the auditor
45 with a range of evidence, or audit observations, which can be both qualitative e.g.
46 interviews, observations and records, or quantitative based on measurement and test
47 (Manning and Soon, 2014) the so-called question – observe - measure (QOM) approach.
48 Triangulation is the obtaining audit evidence from multiple sources using multiple
49 approaches and will increase the likelihood that an auditor acquires sufficient and well-
50 integrated understanding of the organisation, its internal management structure and its
51 performance (Bell *et al.*, 2005). Triangulation allows for comparison between sources of
52 evidence, especially in complex, multi-layered and multi-dimensional situations in order to
53 provide qualified confirmation of audit findings by counterbalancing the strengths and
54 weaknesses of different methodologies and approaches to increase the credibility of audit
55
56
57
58
59
60

1
2
3 findings, improve consistency and aid generalisability (Kopinak, 1999; Bauwens, 2010;
4 Yeasmin and Rahman, 2012; Carugi, 2016; Jespersen and Wallace, 2017). Triangulation is a
5 strategy of acquiring and evaluating complementary evidence that if undertaken effectively
6 can improve auditor judgment, the decision-making processes and the management of
7 detection of risk, and therefore, the overall quality of the audit. (Bell *et al.*, 2005). A multi-
8 method approach to triangulation of verification methods drives both efficient and effective
9 auditing because every method of verification has its limitations (Kleboth *et al.*, 2016). Due
10 to the cost, triangulation between first, second or third party audits and quality assurance or
11 food safety performance metrics such as compliance with microbiological targets is limited
12 in practise.
13

14 Bergh *et al.*, (2016) differentiate between the use of interviews, questionnaires, surveys
15 and scoring systems, but state that ensuring validity and reliability is important. Stadlmüller
16 *et al.*, (2017) considered triangulation between hygiene inspection undertaken by trained
17 regulatory inspectors during unannounced audits using a survey based hygiene scoring
18 system, along with food sampling and environmental samples such as swab samples, surface
19 samples, floor drain samples and slicer dust. In high-risk organisations, the results
20 demonstrate a correlation between deficiencies in operational hygiene (as indicated by the
21 developed hygiene inspection score) and food rejections or recommendations for food
22 business operators demonstrating hygiene inspection score data together with other data
23 from national control authorities can be used to determine a risk rating for a given
24 organisation. Luning *et al.*, (2011) distinguish between diagnostic tools that determine the
25 level of performance of a FSMS; selection tools that are designed to help a selection process
26 and determining the most appropriate analysis and detection system and improvement
27 tools that are designed to drive improvement with the FSMS (Manning, 2018). These tools
28 go beyond compliance based auditing to ensuring performance-based auditing (see Table 1).
29 Research studies that have sought to adopt a triangulation approach include Albersmeier *et al.*,
30 (2009); and Sampers *et al.*, (2010). Henriques *et al.*, (2014) suggest document review, a
31 checklist based audit combined with microbiological testing (surface swabs and product
32 testing). The use of audits with laboratory tests incl. DNA analysis and isotope ratio-based
33 fingerprint analysis has also been suggested (Fauzi and Mas'ud, 2009; van der Spiegel *et al.*,
34 2012) but again these methodologies are expensive and may not translate to routine
35 verification in industry. FSMS diagnostic tools include the FSMS diagnostic instrument
36 (FSMS-DI) (Luning *et al.*, 2008; 2009) and a microbiological assessment scheme (MAS)
37 (Jacxsens *et al.*, 2009). Boeck *et al.* (2016) combined the use of FSMS-DI; MAS and a food
38 safety climate self-assessment tool described in De Boeck *et al.*, (2015).
39

40 With particular emphasis on food service, Griffith *et al.*, (2017) considered triangulation
41 to assess both food safety management and food safety culture using semi-structured
42 interviews rather than a self-assessment questionnaire and where possible the responses
43 were verified using objective evidence such as documents, records and observations.
44 Griffith (2014) consider triangulation to be better than a traditional TPC audit, which may
45 only assess the visible outer layer of FSMS and shallow elements of food safety culture.
46

47 From the financial literature, Trotman and Wright (2012) consider the triangulation of
48 audit evidence in fraud risk assessment in terms of evidence from both systems and
49 compliance audits, but there may be some audit objectives where triangulation is neither
50 required, necessary nor practical. However it is essential to have sufficient objective
51 evidence to prove validity and authenticity if triangulation is not used (Bell *et al.*, 2005).
52 Kleboth *et al.*, (2016) assert that triangulation will avoid the existence of blind spots during
53
54
55
56
57
58
59
60

1
2
3 an auditing process in the food supply chain especially with regard to emerging trends or
4 drivers that can influence risk. Therefore triangulation can provide consistent,
5 complementary or alternatively contradictory evidence, reinforcing and amplifying the
6 results of a traditional audit (Bell *et al.*, 2005), but there are barriers such as cost which
7 impact on its implementation in practice.

8 The British Retail Consortium (BRC) Global Standards, in an industry approach to
9 assessing food safety culture, have adopted a low cost version of the Culture Excellence
10 Survey in their voluntary Food Safety Culture Module that can be added to the core BRC
11 audit (BRC, nd). This additional module that assesses people, process, purpose and
12 proactivity includes both a self-administered questionnaire completed by a prescribed
13 number of employees and also a third-party assessment questionnaire completed by the
14 auditor so that cross-checking, or triangulation, can occur. This voluntary module supports
15 the information gathered during third party audits, alongside additional auditor
16 observations of factors that impact on food safety culture. Further details of the Culture
17 Excellence survey can be found in papers three and four of this special themed journal
18 edition (Taylor & Rostron, 2018; Taylor & Budworth, 2018).

22 Conclusion

23 The aim of this paper is to critique the existing and emerging alternative approaches
24 being used by regulators and industry to verify the presence and efficacy of FSMS. This has
25 been considered from both the perspective of market approaches to ensure food safety
26 objectives are met at all stages of the food supply chain via adoption of TPC and also the use
27 of TPC to develop more risk-based regulatory controls as this more hybrid approach would
28 reduce the regulatory burden on CAs and food business organisations alike. Combined with
29 the developed Primary Authority scheme in the UK this could allow rationalisation of the
30 official inspections and the wider TPC landscape (Elliott Review, 2013; FSA, 2017b). However
31 this form of co-regulation whilst having resource efficiency benefits also raises concerns
32 over the depth of audit employed and the quality of the audit undertaken with particular
33 focus on the types of verification and their efficacy. The efficiency and effectiveness of
34 verification has been explored not only in considering FSMS compliance with regulatory
35 requirements and market standards but also consideration of food safety culture and its
36 influence on compliant behaviour and reducing risk. The use of triangulation within
37 verification activities has been highlighted and critiqued and much research work is being
38 undertaken.

39 TPC using systems-based and compliance-based audits alone will not deliver effective
40 verification of the FSMS and continuous improvement of the organisation's products and
41 processes over time. Performance-based approaches that consider risk factors and the
42 cultural context of how formal systems are implemented, monitored and internally verified
43 are required and some examples of these methodological approaches are given in the
44 paper. Triangulation needs to be undertaken during the FSMS verification process which at
45 its simplest is a Question, Observe, Measure (QOM) triad of objective evidence collection
46 and at its more complex involves TPC compliance audits and performance assessment using
47 data analysis methodology and product, process and environmental testing.

48 Triangulation is essential to ensure effective verification and as TPC standards and
49 regulatory official control evolve, the use of multiple sources of evidence of performance is
50 essential. Effective verification of FSMS and QMS and the associated organisational culture
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

is essential to ensuring that the food produced is safe and consistently of the quality required by customers and consumers.

Worldwide Hospitality and Tourism Themes

References

- Albersmeier, F., Schulze, H., Jahn, G., and Spiller, A. (2009), "The reliability of third-party certification in the food chain: From checklists to risk-oriented auditing," *Food Control*, Vol. 20, No. 10, , pp. 927-935.
- Arens, A. A., Best, P., Shailer, G., Fidler, B., Elder, R. J., and Beasley, M. S. (2010), *Auditing Assurance Services in Australia: An Integrated Approach*. 8th edition. Pearson Australia, NSW 2086.
- Baş, M., Yüksel, M. and Çavuşoğlu, T., (2007), "Difficulties and barriers for the implementing of HACCP and food safety systems in food businesses in Turkey." *Food Control*, Vol. 18 No. 2, pp. 124-130.
- Bauwens, A. (2010), "The use of method triangulation in probation research." *European Journal of Probation*, Vol. 2 No. 2, pp. 39–52.
- Bell, T. B., Peecher, M. E., and Solomon, I. (2005), *The 21st century public company audit: Conceptual elements of KPMG's global audit methodology*. KPMG LLP.
- Bergh, L.I.V., Hinna, S., Leka, S. and Zwetsloot, G.I., (2016), "Developing and testing an internal audit tool of the psychosocial work environment in the oil and gas industry." *Safety science*, Vol. 88, pp.232-241.
- Blewett, V. and O'Keefe, V., (2011), "Weighing the pig never made it heavier: Auditing OHS, social auditing as verification of process in Australia." *Safety science*, Vol. 49 No. 7, pp. 1014-1021.
- BRC (nd), "What is food safety excellence?" Available from: <https://www.brcglobalstandards.com/brc-global-standards/food-safety/additional-modules/food-safety-culture-module/> (accessed on 24/11/17)
- BRC (2017), BRC Global Standards, Available at: <https://www.brcglobalstandards.com> (Accessed on 5th November 2017)
- BRC (2015), *British Retail Consortium Global Standard Food Safety*. Issue 7. BRC, London.
- Breidenbach, E., Sievi, M., Weber, U., Heiz, H. and Stärk, K.D.C., (2004), Fundamental principles for risk-based planning of random sampling to trace hazard in imported meat. In *Proceedings 5th World Congress Foodborne Infections and Intoxications, 7–11 June 2004, Berlin*.
- BS EN ISO 9001: 2015 (2015) Quality management systems: requirements. TSO London ISBN 9780580918162.
- Buchann, D. and Huczynski, A. (2004), *Organizational Behaviour: An Introductory Text*, 5th Ed., Pearson Education Limited, Madrid.
- CAC (Codex Alimentarius Commission) (2017), *Joint FAO/WHO Food Standards Programme. Codex Committee on Food Import and Export Inspection and Certification Systems*. Twenty-Third Session. Discussion Paper on Regulatory Approaches to Third Party Certification in Food safety. February 2017 CX/FICS 17/23/8
- CAC (Codex Alimentarius Commission) (2003), *Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its application, Codex Alimentarius Commission Food Hygiene Basic Texts* (Revision 4). Available at: <http://www.codexalimentarius.org>
- Carugi, C. (2016), "Experiences with systematic triangulation at the global environment facility", *Evaluation and Program Planning*, Vol. 55 No. 1, pp. 55–66. <http://dx.doi.org/10.1016/j.evalprogplan.2015.12.001>.
- Coolen, H., and Ozaki, R., (2004). "Culture, Lifestyle and the Meaning of a Dwelling", in *International Conference on Adequate and Affordable Housing for All: Research, Policy and Practice* (pp. 24-27).

- 1
2
3 De Boeck, E., Jacxsens, L., Bollaerts, M., Uyttendaele, M. and Vlerick, P., (2016), "Interplay
4 between food safety climate, food safety management system and microbiological hygiene
5 in farm butcheries and affiliated butcher shops", *Food Control*, Vol. 65, pp. 78-91.
- 6 De Boeck, E., Jacxsens, L., Bollaerts, M., and Vlerick, P., (2015). "Food safety climate in food
7 processing organisations. Development and validation of a self-assessment tool". *Trends in*
8 *Food Science and Technology*, Vol. 46, pp. 242-251.
- 9
10 Elliott Review (2013), Elliott Review into the Integrity and Assurance of Food Supply
11 Networks – Final Report: A National Food Crime Prevention Framework (July 2014) HM
12 Government. London.
- 13 Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017
14 on official controls and other official activities performed to ensure the application of food
15 and feed law, rules on animal health and welfare, plant health and plant protection products
16 Available at: <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32017R0625>
- 17 Fauzi, A. M., and Mas'ud, Z. A. (2009), *Instrumentation techniques for potential application*
18 *in halal products authentication*. Paper presented at the 3rd IMT-GT international
19 symposium on halal science and management, 21st-22nd December 2009, Kuala Lumpur,
20 Malaysia.
- 21
22 Flores-Miyamoto, A., Reij, M.W. and Velthuis, A.G.J., (2014), "Do farm audits improve milk
23 quality?". *Journal of Dairy Science*, Vol. 97 No. 1, pp.1-9.
- 24 Food Law Code of Practice (England) March 2017, Available at:
25 <https://www.food.gov.uk/enforcement/codes-of-practice/food-law-code-of-practice>
26 (Accessed on 5th November 2017)
- 27
28 FSA (Food Standards Agency) (2017a), Audit documents, Available from:
29 <https://www.food.gov.uk/enforcement/auditandmonitoring/auditdoc> (accessed 10/11/17)
- 30
31 FSA (Food Standards Agency) (2017b) Regulating our future. Available from:
32 <https://www.food.gov.uk/sites/default/files/rof-paper-july2017.pdf> (accessed 10/11/17)
- 33 Griffith, C.J., Griffith, C.J., Jackson, L.M., Jackson, L.M., Lues, R. and Lues, R., (2017), "The
34 food safety culture in a large South African food service complex: Perspectives on a case
35 study", *British Food Journal*, Vol. 199 No. 4, pp.729-743.
- 36 Griffith, C. (2014), *Developing and Maintaining a Positive Food Safety Culture*. 1st Edition.
37 Highfield Publications.
- 38 Griffith, C.J., Livesey K.M., and Clayton, D.A., (2010), "Food safety culture: the evolution of
39 an emerging risk factor?" *British Food Journal*, Vol. 112 No. 4, pp. 426–438
- 40 GFSI (Global Food Safety Initiative) (nd) Available at: [http://www.mygfsi.com/about-](http://www.mygfsi.com/about-us/about-gfsi/what-is-gfsi.html)
41 [us/about-gfsi/what-is-gfsi.html](http://www.mygfsi.com/about-us/about-gfsi/what-is-gfsi.html) (accessed 24/11/17)
- 42
43 Henriques, A.R., da Gama, L.T. and Fraqueza, M.J., (2014), "Assessing Listeria
44 monocytogenes presence in Portuguese ready-to-eat meat processing industries based on
45 hygienic and safety audit.", *Food Research International*, Vol. 63, pp.81-88.
- 46 Hinkle, S., (2006), *Take a quality ride: the realities of implementing a quality management*
47 *system*. iUniverse.
- 48
49 Jacxsens, L., Kussaga, J., Luning, P.A., Van der Spiegel, M., Devlieghere, F., Uyttendaele,
50 M., (2009), "A microbial assessment scheme to support microbial performance
51 measurements of food safety management systems", *International Journal of Food*
52 *Microbiology*, Vol. 134, pp. 113–125.
- 53
54 Jespersen, L. and Wallace, C.A., (2017), "Triangulation and the importance of establishing
55 valid methods for food safety culture evaluation", *Food Research International*, Vol. 100,
56 pp.244-253.
- 57
58
59
60

- 1
2
3 Keener, K. P. E. (2007), Verification programs: safe food guidelines for small meat and
4 poultry processors. <http://www.extension.purdue.edu/extmedia/FS/FS-24-W.pdf>
5 Kleboth, J.A., Luning, P.A. and Fogliano, V., (2016), "Risk-based integrity audits in the food
6 chain—a framework for complex systems", *Trends in Food Science & Technology*, Vol. 56,
7 pp.167-174.
8 Kopinak, J. K. (1999), "The use of triangulation in a study of refugee well-being.", *Quality and*
9 *Quantity*, Vol. 33 No. 2, pp. 169–183.
10 Lääkkö-Roto, T. and Nevas, M., (2014), "Auditing local official food control: perceptions of
11 auditors and auditees", *Food Control*, Vol. 37, pp.135-140.
12 Leeuw, F. L. (2011), "On the effects, lack of effects and perverse effects of performance
13 audit", in J. Lonsdale, P. Wilkins, & T. Ling (Eds.), *Performance auditing* (pp. 231-247).
14 Luning, P. A., Jacxsens, L., Rovira, J., Osés, S. M., Uyttendaele, M., and Marcelis, W. J. (2011),
15 "A concurrent diagnosis of microbiological food safety output and food safety management
16 system performance: cases from meat processing industries". *Food Control*, Vol. 22, pp. 555-
17 565.
18 Luning, P.A., Marcelis, W.J., Rovira, J., Van der Spiegel, M., Uyttendaele, M., and Jacxsens, L.,
19 (2009), "Systematic assessment of core assurance activities in company specific food safety
20 management systems", *Trends in Food Science & Technology*, Vol. 20, pp. 300–312.
21 Luning, P.A., Bango, L., Kussaga, J., Rovira, J. and Marcelis, W.J., (2008), "Comprehensive
22 analysis and differentiated assessment of food safety control systems: a diagnostic
23 instrument", *Trends in Food Science & Technology*, Vol. 19 No. 10, pp.522-534.
24 Mallen, D., and Collins, C., (2003), *The Audit Skills Handbook; A Basic Introduction to*
25 *Planning and Performing Business Management System Audits*. Consensus
26 Books (Standards Australia International Ltd), Sydney
27 Manning, L. (2018), "The value of food safety culture to the hospitality industry", *Worldwide*
28 *Hospitality and Tourism Themes*, Vol. 10 No. 2.
29 Manning L. (2016), "Food Fraud, policy and food chain", *Current Opinions in Food Science*,
30 Vol. 10, pp. 16-21
31 Manning, L., Wright, M and McKellar, D (2014), Development of risk-based sampling
32 guidance for enforcement officers, Details available at:
33 <http://www.food.gov.uk/science/research/research/choiceandstandardsresearch/fs222001>
34 (Project duration 2013-2014) details not published by FSA to date.
35 Manning, L and Soon, J.M, (2014), "Developing systems to control food adulteration", *Food*
36 *Policy*, Vol. 49 No. 1, pp. 23-32
37 Manning, L., and Soon, J.M., (2013), "Mechanisms for assessing food safety risk", *British*
38 *Food Journal*, Vol. 115 No. 3, pp. 460-484
39 Manning, L., (2013), "Development of a food safety verification risk model", *British Food*
40 *Journal*, Vol. 115 No. 4, pp. 575-589
41 Martinez, M. G., Verbruggen, P., and Fearne, A. (2013), "Risk-based approaches to food
42 safety regulation: What role for co-regulation"? *Journal of Risk Research*, Vol. 16 pp. 1101-
43 1121.
44 Martins, E. A., and Germano, P. M. L. (2008), "Microbiological indicators for the assessment
45 of performance in the hazard analysis and critical control points (HACCP) system in meat
46 lasagne production", *Food Control*, Vol. 19 No. 8, pp. 764-771.
47 Martz, W., (2010), "Validating an evaluation checklist using a mixed method design", *Eval.*
48 *Program Plann.* Vol. 33 No. 3, pp. 215–222.
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 Morin, D. (2008), "Auditors general's universe revisited. An exploratory study of the
4 influence they exert on public administration through their value for money audits",
5 *Managerial Auditing Journal*, Vol. 23 No. 7, pp. 697-720.
- 6 Morin, D. (2004), "Measuring the impact of value-for-money audits: a model for surveying
7 audited managers", *Canadian Public Administration*, Vol. 47 No. 2, pp. 141-164.
- 8 Morin, D. (2001), "Influence of value for money audit on public administrations: looking
9 beyond appearances", *Financial Accountability and Management*, Vol. 17 No. 2, pp. 99-117.
- 10 Nguyen, T., Wilcock, A., and Aung, M. (2004), "Food safety and quality systems in Canada:
11 an exploratory study", *International Journal of Quality & Reliability Management*, Vol. 21
12 No. 6, pp. 655-671.
- 13 Panisello, P. J., and Quantick, P. C. (2001), "Technical barriers to hazard analysis critical
14 control point (HACCP)", *Food Control*, Vol. 12 No. 3, pp. 165-173.
- 15 Pollit, C., Girre, X., Lonsdale, J., Mul, R., Summa, H., and Waerness, M. (1999), *Performance
16 or compliance?: Performance audit and public management in five countries*, New York,
17 Oxford University Press.
- 18 Powell, D.A., Erdozain, S., Dodd, C., Costa, R., Morley, K. and Chapman, B.J., (2013), "Audits
19 and inspections are never enough: a critique to enhance food safety." *Food Control*, Vol. 30
20 No. 2, pp. 686-691.
- 21 Rapoport, A., (1988), "Levels of meaning in the built environment", in: F. Poyatos (ed.),
22 *Cross-cultural perspectives in nonverbal communication*, C.J. Hogrefe, Toronto, 317-336.
- 23 Robinson, Y. (2017), Summary Report of the Pilot Project on the Potential for Recognition of
24 the BRC Global Standard for Food Safety (September 2017) Available at:
25 <https://www.food.gov.uk/sites/default/files/fsa-brc-report-oct17.pdf> (accessed on
26 10/11/17)
- 27 Salama, K.F., Luzzatto, D., Sianesi, A. and Towill, D.R., (2009), "The value of auditing supply
28 chains", *International Journal of Production Economics*, Vol. 119 No. 1, pp.34-45.
- 29 Sampers, I., Jacxsens, L. Luning, P. A. Marcelis W. J. Dumoulin, A and Uyttendaele. M. (2010),
30 "Performance of food safety management systems in poultry meat preparation processing
31 plants in relation to *Campylobacter* spp. contamination", *Journal of Food Protection*, Vol. 73,
32 pp. 1447-1457.
- 33 Smith, K.J. and Emerson, D.J., (2017). "An analysis of the relation between resilience and
34 reduced audit quality within the role stress paradigm", *Advances in Accounting*, Vol. 37,
35 pp.1-14.
- 36 Souness, R., (2000), "HACCP in Australian food control," *Food Control*, Vol. 11 No. 5, pp.353-
37 357.
- 38 Stadlmüller, L., Matt, M., Stüger, H.P., Komericki-Strimitzer, T., Jebousek, K., Luttenfeldner,
39 M. and Fuchs, K., (2017), "An operational hygiene inspection scoring system for Austrian
40 high-risk companies producing food of animal origin", *Food Control*, Vol. 77, pp.121-130.
- 41 Swanson, K. M. J., and Anderson, J. E. (2000), "Industry perspectives on the use of microbial
42 data for hazard analysis and critical control point validation and verification", *Journal of
43 Food Protection*, Vol. 63 No. 6, pp. 815-818.
- 44 Taylor, J. Z. and Budworth, L. (2018), "Food safety culture: patterns and trends from a
45 quantitative analysis of the Culture Excellence assessment program", *Worldwide Hospitality
46 and Tourism Themes*, Vol. 10 No. 2.
- 47 Taylor, J.Z. and Rostron, K. (2018), "The development of a safety and quality culture
48 assessment tool from a longitudinal, mixed method research journey", *Worldwide Hospitality
49 and Tourism Themes*, Vol. 10 No. 2.
- 50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 Taylor, E. (2001), "HACCP in small companies: benefit or burden?", *Food Control*, Vol. 12 No.
4 4, pp. 217-222.
- 5 Thurmond, M.C. (2003), "Conceptual foundations for infectious disease surveillance",
6 *Journal of Veterinary Diagnostic Investigation*, Vol. 15, pp. 501-514
- 7 Tompkin, R. B. (1994), "HACCP in the meat and poultry industry", *Food Control*, Vol. 5 No. 3,
8 pp. 153-161.
- 9
10 Trotman, K.T. and Wright, W.F., (2012), "Triangulation of audit evidence in fraud risk
11 assessments", *Accounting, Organizations and Society*, Vol. 37 No. 1, pp.41-53.
- 12 Turku, M., Lepistö, O. and Lundén, J., (2018), "Differences between official inspections and
13 third party audits of food establishments", *Food Control*, Vol. 85, pp.459-465.
- 14 Van Asseldonk, M.A.P.M. and Velthuis, A.G.J., (2014), "Risk-based audit selection of dairy
15 farms", *Journal of dairy science*, Vol. 97 No. 2, pp.592-597.
- 16 Van der Spiegel, M., Van der Fels-Klerx, H.J., Sterrenburg, P., Van Ruth, S.M., Scholtens-
17 Toma, I.M.J. and Kok, E.J., (2012), "Halal assurance in food supply chains: Verification of
18 halal certificates using audits and laboratory analysis", *Trends in Food Science and*
19 *Technology*, Vol. 27 No. 2, pp.109-119.
- 20 Verbruggen, P., and Havinga, T. (2015), "Food safety meta-controls in The Netherlands."
21 *European Journal of Risk Regulation*, Vol. 6, pp. 512-524.
- 22 Weets, K. (2008), How effective are performance audits? A multiple case study within the
23 local audit office in Rotterdam. In Paper for the 5th International conference on accounting,
24 auditing & management in public sector reforms. Amsterdam, 3-5 September.
- 25 Yeasmin, S., & Rahman, K. F. (2012), "'Triangulation' research method as the tool of social
26 science research", *BUP Journal*, Vol. 1 No. 1, pp. 154-163.
- 27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Paper 2 Tables

Table 1. Types of verification audit

Compliance auditing		Performance –based audit
Systems-based audit	Compliance-based audit	
An audit that examines whether the organisation's documented, formal management system complies legislation and/or with the criteria in a TPC standard, or first or second party standard or customer specifications.	An audit examines whether the practices observed and identified in records and questioning of staff meet both the standard against which the audit is being performed and the requirements in the formal management system. This approach can be binary (against a checklist or equivalent) or holistic and consider multiple sources of evidence to reach a conclusion on the level of compliance.	An audit that considers business performance against best practice and extends beyond binary compliance audits. This will include considerations such as cost vs. benefit, and business risk. Performance audits extend beyond compliance to consider meaning. Performance based audits address both the visible and the invisible food safety culture.
The scope of the audit can include food safety, quality, and/or environmental aspects as defined at the opening meeting by the criteria in the standard itself or where the audit scope may be extended to include other audit criteria.	The scope of the audit can include food safety, quality, and/or environmental aspects as defined at the opening meeting by the criteria in the standard itself or where the scope may be extended. Depending on the development of the audit approach, observations may be included within the audit report which are weaknesses identified by the auditor, but have not yet given rise to non-conformance.	The scope of the audit can include food safety, quality, and/or environmental aspects as defined at the opening meeting by the criteria in the standard itself or where the scope may be extended. All observations are included within the audit report with regard to compliance or non-compliance and also weaknesses in the system or practice that have not yet given rise to non-conformance, but could if controls are lacking or could fail.
If business improvement and food safety culture are not explicitly identified in the TPC standard or scope of the audit it will not be verified.	If business improvement and food safety culture are not explicitly identified in the TPC standard or scope of the audit it will not be verified.	Business improvement and assessment of food safety culture is embedded within the scope of the audit and will be verified.

Table 2: Compliance inspection versus risk-based auditing (adapted from Albersmeier et al., 2009)

Compliance inspection (Checklist governance)	Risk-based auditing
Consistency driven by checklist of criteria to inspect.	Rather than checklist driven there is concentration on specific risk areas.
Stepwise review of the list of requirements and level of compliance and allocation of resources.	Stepwise improvement of the efficiency and effectiveness of the audits undertaken.

Consistent expenditure and time given to each audit and auditee.	Reduction of expenditure and time by use of selection process for audit programme.
Consistent time intervals between audits.	Risk-based audit intervals.
Consistent training for all inspectors.	Training of auditors for special risk areas.
No bias towards who is inspected and how often.	Adopt of concepts such as co-regulation, hybridized food safety governance and earned recognition.
Inspection and product sampling based on weighted formula with some unannounced audits to triangulate.	Randomly chosen audits without announcements plus additional risk-oriented sampling.

Table 3. Failures, perceived barriers and perceived benefits to verification (adapted from Van der Spiegel *et al.*, 2012; Kleboth *et al.*, 2016)

Failures in verification	Source
Inappropriately performed	Keener (2007)
Lack of technical resources	Panisello and Quantick (2001)
Lack of record keeping	Baş <i>et al.</i> , (2007)
Perceived barriers to verification	
Costly	Panisello and Quantick, (2001); Nguyen <i>et al.</i> , (2004)
Duplication	Taylor (2001)
Lack of value	Kleboth <i>et al.</i> , (2016)
Perceived benefits to verification	
Ensures system compliance	Tompkin (1994); Swanson and Anderson, (2000); Martins and Germano (2008)