Appendix 9: What works to prevent food fraud - chain of custody, mass balance analysis, and guardianship

The International, Social, Environmental, Accreditation and Labelling (ISEAL) Alliance are a non-profit organisation that codify best practice standards for sustainable practice for over 35 standards. They are an example of institutional guardians who have a role in ensuring that fraud relating to the claims on food products does not occur. One focus for the ISEAL Alliance is to promote strong guardianship practices for their members. Among those practices is the chain of custody system.

The **chain of custody (CoC) system** is: 'the list of all organisations (supply chain) that take ownership or control of a product during production, processing, shipping and retail (physically and/or administratively)' (ISEAL Alliance, 2016). The CoC system can either be prescribed by regulation, market standards, or developed as part of a supplier assurance programme by an individual organisation. A CoC system can be a key element of a FFPS underpinning the FFPPs at FBO or supply chain level. Box 1 includes the elements of a CoC system.

Elements of a Chain of Custody System (adapted from the ISEAL Alliance, 2016) can include:

- Identification of the origin and identity if claims are made of the components of a final product through mass balance assessment.
- Mass balance assessment demonstrates the volume sold (production output) matches or does not exceed the volume expected to be produced from the materials procured.
- Developing a secure, immutable record of the custodial sequence of all components of a final product from supplier through to consumer (this includes not only ingredients, but also packaging, processing aids etc.)
- Developing communication between members of the supply chain so information can be shared.
- Developing procurement assessment protocols so that all business entities have a unique identity which can be verified, including the undertaking of due diligence checks.
- Verification of the chain of custody, for example, through material testing, auditing, checking of certification and other methods as appropriate.

ISEAL differentiate between mass balance analysis verification at batch level, site level, and supply chain level depending on the granularity of the reconciliation undertaken. Interviewees in this study cited activities such as stock checks, reconciliation between invoice and actual deliveries, and checking products purchased with a specific identity for example, organic ingredients versus product sold with the same stated identity (organic product made from the ingredients) as examples of mass balance analysis verification. From the fashion sector, Better Cotton CoC and ISEAL member, is one such example of 'what works' in terms of developing greater supply chain transparency .

Independent mass balance analysis is already a pre-requisite utilised during the verification processes in multiple food supply third party certification schemes such as organic food certification, and the BRC Global Standard. Mass balance analysis, especially digital real-time mass balance analysis increases transparency through transaction data including the types and quantities of products sourced, from where and for what purpose. Public or state verification of such data would give insights into potential anomalies in the CoC for a food product. Regulators and FBOs can increase the level of deterrence for fraudsters, as a prevention measure, by increasing the effort required by perpetrators to commit food fraud by introducing additional requirements to improve supply chain transparency, for example, the adoption of mass balance analysis using both financial and production data. One example of this approach is the Innovate funded The Digital Sandwich project which is seeking to use blockchain-based technology.

Where claims are being made about a product the potential for detection is also a potential deterrence strategy. One quote from the interviews which captures this was:

"… like the Sicilian lemon, you know, if you're a manufacturer and you're strapped for cash. It's that easy. Well, no one's going to really taste the difference. No one's going to notice. It's got the right label on it. It's got the right packaging. … Is it going to taste that different? It's not like you're buying it as lemon. You're probably putting it on a cake or within a seasoning. It's 0.05% not 5% of the product. Are you going to notice the difference?"

Deterrence is also a key theme that has emerged from the literature and the interviews as an essential element of a FFPS at national, but more particularly at FBO levels. We believe that guardians, and in particular guardianship, is a crucial component of deterrence. Guardians monitor and protect food, consumers, FBOs, supply chains, and nations against illegal activity (Cohen and Felson, 1979). Guardianship requires the collaboration of multiple actors to create an inter-organisational guardianship network, however regulators and enforcement bodies have a specific role in the overarching regulatory protection applied where FBOs are unable to protect themselves or have insufficient information or empowerment to make decisions on their own behalf (Kowalska and Manning, 2022). The range of guardians that the interviewees mentioned in the interviews have been collated in the codebook (Appendix 7).

There is evidence that effective guardianship (regulations, enforcement, and surveillance systems) by regulators, FBOs and food supply chains reduces the likelihood of food fraud incidents occurring (Qian et al., 2020; Kowalska and Manning, 2022). More activities should be undertaken to improve guardianship networks especially to support micro and small FBOs. The sense of powerlessness of micro and small businesses in addressing food fraud, in embedding capable guardianship, was a theme that emerged from the interviews. Concerns were raised too in the interviews in terms of the capacity and capability of guardians within existing systems in the UK and one prevention strategy for the large organisations was to only do business with organisations who could demonstrate their capable guardianship.

Capable guardianship has been considered in Australia with regard to financial fraud (Lindley et., 2012) and is a key requirement within national, supply chain level and FBO level FFPPs. Capable guardians not identified by the interviewees, but still important in terms of national and industry level FFPPs are security guards, staff working at ports and border inspection points. Within the banking sector and with computer systems technology has also formed a guardianship role. Perpetrators will be less likely to commit fraud if there is an increased level of countermeasures or hurdles implemented through capable guardianship and this will act as a deterrent. A Venezuelan study. concluded that auditing as a sole verification activity did not guarantee or improve fraud prevention. Instead FFPPs needed to address:

- Improving the effectiveness of components and procedures of internal control with an anti-fraud basis.

- Clearly defining behaviour that is acceptable and unacceptable (for internal and external parties).
- Integrating all levels of management within the FFPP and food fraud strategies
- Segregation of duties to prevent fraud.
- Periodical reporting on fraud suspicion or fraud practice.

These elements were all echoed in the interviews in our study and exemplar quotes are included in Appendix 5. Some research has suggested that food fraud detection technologies are a form of capable guardian as its presence reduces opportunity and FBO vulnerability and acts as a deterrent because some types of food fraud can be detected (Ellis et al., 2016). Ellis et al. (2016) argue that “future sensor/detection platforms and technologies, along with future predictive computational methods could together take on the capable guardian role, and assist in significantly reducing the areas of vulnerability to fraud within food supply chains.” We would echo that statement.