

Food integrity

Globally food integrity, authenticity, traceability and food safety are major consumer concerns and present a challenge for the food industry. To meet these constantly evolving issues that confront governments, individuals and communities, then corporate business, the food supply chain and civil society as well as public sector organisations must work together in order to provide safe, legal, quality, nutritious food to an ever growing human population (Foresight, 2011). This special issue explores the application of the multiple disciplines of food science, food safety and quality, criminology, business theory (including general business disciplines, corporate governance, stakeholder analysis, corporate social responsibility) and wider subjects such as sustainable development, public policy and human attitudes and behaviour that can often be seen to sit in academic isolation.

The Elliott Review (2014) into the integrity and assurance of food supply networks, written in the aftermath of the 2013 horsemeat incident, stressed that food integrity was not only concerned with the nature, substance and quality and safety of food, but also captured other aspects of food production such as “the way it has been sourced, procured, and distributed and being honest about those areas to consumers”. Therefore food integrity as a research area has legal, moral and ethical dimensions. In drawing together this special issue of the *British Food Journal* the aim was to develop a body of literature including technical notes, empirical research articles and conceptual papers that collectively captured the evolving notion of food integrity. The challenge in such an emerging academic field is that much of the evidence sits in non-academic literature and it is only in the synthesis of special issues such as this one that a body of peer-reviewed knowledge can be created.

Once food integrity has been defined as a term of interest in food supply chain management then this brings to the fore, not just consideration of the development of quality management and food safety management systems, but also the wider matter of food integrity management systems and their scope of operation. More recently, in order to create trust and deliver brand integrity to a range of stakeholders, food integrity management systems within the wider food supply chain have developed as a means to first guarantee safety, quality and authenticity; second to ensure reliable labelling of agents of concern such as food allergens; and third to ensure effective management of provenance such as organic or halal status and the veracity of specific food products such as those developed for vegetarians or vegans (Kleboth *et al.*, 2016). Integrity as a characteristic is wider than a more minimalist view of traceability as a purely functional attribute of an information system. Indeed, traceability as a term itself, has been said to encompass wider notions of food integrity and authenticity (Charlebois and Haratifar, 2015) or to allow the certification of geographical origin of products, surveillance and monitoring of the chain, and to facilitate the preservation of food provenance (Pizzuti and Mirabelli, 2015; Manning, 2016). However food integrity extends beyond the ability to simply track and/or trace a product at points within the supply chain. In this special issue, Davidson *et al.* differentiate between supply chain integrity and product integrity and that the notion of integrity can include food defense. Previous work has introduced the concept of food integrity as being made up of four elements: process integrity, product integrity, people integrity and data integrity (Manning, 2016 see Table I).

Mol and Oosterveer (2015) consider there are four types of traceability system: volume based (mass balance); identity preservation based (track and trace), separation based, and certificate based (book and claim) and benefits and limitations can be associated



Table I.

Elements of food integrity

Elements of food integrity	Examples
Product integrity	Adulteration and economically motivated adulteration (EMA), counterfeit product, expiration date, simulation, tampering
Process integrity	Diversion of products outside of intended markets, illegal importation, over-run, theft
People integrity	Characterizations such as the cyber criminals and hacktivist, disgruntled individual, extortionist, extremist, irrational individual, opportunist, professional criminal
Data integrity	Illegal importation, improper, fraudulent, missing or absent health certificates, improper, expired, fraudulent or missing common entry documents or import declarations, mislabelling

Sources: Adapted from Bouzembrak and Marvin (2016); PAS 96 (2014); Spink and Moyer (2011a, b) Manning (2016)

with each type. These approaches focus largely on process integrity and the management of data and information rather than the intrinsic nature of the food product, where concerns in terms of authenticity, substitution or adulteration may arise (see the work of Spink and others). This structural approach to food integrity addresses the four elements of food integrity, but it does not capture as a construct the degree of interrelationship of these four integrity elements, either generally, or in specific instances of malpractice or mislabelling. A holistic approach is needed when developing and implementing food integrity management systems and also when mitigating the types of problems that occur if such systems fail. Ali *et al.* using the example of non-halal ingredients in a certified product in Malaysia in 2014, consider in this special issue that compliance with standards alone cannot be the only mechanism used by the food industry for demonstrating food integrity. The 13 papers in this special issue might seem an eclectic mix, but they afford the reader the opportunity to consider the underlying themes of food integrity including the need for a pluralistic and holistic approach; the need for accountability and transparency; the influence of market dynamics and the role of food science in the verification of product and process integrity.

The pluralistic and holistic approach

Whitworth *et al.* in this special issue critique the existing categorisation of food scares and argue that food scares can fall into multiple categories and a more pluralistic approach is needed in order to manage food scares effectively and maintain trust in the food supply chain both in terms of the actors themselves and the management systems that are individually or collectively employed. Davidson *et al.* reflect upon their European research and the range of tools that may have a role in verifying food integrity in its wider sense and some of the challenges to implementing detection systems as well as the need for effective product recall systems. Fassam and Dani, in their systematic review of existing literature argue, that “despite there being a need to share data holistically across food chains, the risk of anti-competitive behaviour will stifle such collaboration” and that more research is needed especially to consider the role of the customer in the development of food integrity management systems that operate at supply chain level. The work of Wang *et al.* in their contribution to this special issue proposes that applications such as smart phones may well enable immediate feedback and data flow from consumers. The paper highlights that this approach is important as the conceptualisation of food integrity as a distinct product attribute, and one that is an element of product value, develops further. The role of publishing information on a company’s compliance behaviour was considered by Bavorova *et al.* and the role of disclosure policies in improving transparency and enabling consumers to make better choices. Voluntary and mandatory demands are increasing for transparency and the disclosure of information along added value chains

(Mol, 2015). Transparency as a construct arises from the desire of stakeholders to make informed decisions and the notion that stakeholders make decisions on the basis of that information (Dingwerth and Eichinger, 2010). Mol (2014) describes food systems transparency as the disclosure of information, previously held privately by public and/or private organisations, and states that transparency encompasses intrinsic and extrinsic quality characteristics in order to increase public accountability and consumer trust in food products, production and provisioning. Transparency in the food supply chain is based first on the visibility, for all supply chain stakeholders (public, industry, government, etc.), of the associated production processes and second stakeholders being able to understand or quantify how such processes affect the extrinsic characteristics of the food product (Blokhuis *et al.*, 2003). Disclosure of information to consumers can take two basic forms: first seeking to reduce value chain complexity and the way information is communicated and second introducing labelling and certification systems that communicate in themselves the nature of the supply chain (Mol, 2014). Labelling provides consumers with the opportunity to consider added value in terms of discrete extrinsic considerations when making food choices, in contrast to allowing them to draw more indirect inferences from product characteristics such as country of origin, or provenance (Grunert *et al.*, 2014). Mechanisms must be in place in the supply chain to deliver transparency, since consumers have to believe, and by inference organisations have to demonstrate, that the additional extrinsic product attributes provided justify the often higher prices demanded (Wognum *et al.*, 2011) and see Knoll *et al.* in this special edition. The ability to inform or to disclose information may or may not actually change stakeholder behaviour, but as the ability to exchange real-time information increases it means there is greater potential for the market, and the consumer as a result, to be driven to certain types of reactive behaviour. This ultimately may mean that transparency in supply chain and regulatory governance is a given. Sayadi *et al.* in their paper consider how such activities can be aligned to marketing strategies.

The need for accountability and transparency

As is identified by Wang *et al.* “The concept of food integrity intends to hold the entire food supply chain accountable [...]” and this notion of accountability operates at a system level. The conceptualisation of food integrity has evolved from perspectives of food quality, food safety, authenticity, fraud and wider crime to the morality of individuals as explored by Wang *et al.* and Smith in his paper on integrity at farm level using the case study of sheep rustling as a lens. In this second paper people integrity is seen as needing to be earned and safeguarded highlighting the requirement for trust at organisational and supply chain level. Lecat *et al.* explore the integrity of individuals, and mechanisms to prevent fraudulent behaviour with regard to French wines, as they consider the potential profits to be made through placing counterfeit fine wine on the market. However the value of process verification, or indeed systems such as those described by Mol and Oosterveer (2015), relies on the ability to assess valid and truthful evidence in terms of documentation, records, labelling and evidence of certification (Manning and Soon, 2014). A point echoed in many of the papers in this special issue.

The influence of market dynamics

Smith’s paper and Lecat *et al.*’s paper highlight the impact of the gap between supply and demand in a given market and how this fuels food crime. Entrepreneurial behaviour sits at the root of such food crime and the means to provide a typology of criminals or to implement methods to deter practice are discussed across the papers in this issue. Provenance or unique identification in itself creates the potential for food crime and this theme is explored through papers focussing on integrity in the halal food supply chain (see Soon *et al.*; Ali *et al.*).

Ali *et al.* propose that safeguarding of food integrity should involve all stages and actors within the supply chain and focus on four dimensions, raw material, production, service and information which dovetail to the four elements of food integrity described in Table I.

The role of food science in the verification of product and process integrity

Food science, especially the use of detection methods in the authentication of foods has developed rapidly over time and will continue to do so. The potential for adulteration, substitution, mislabelling, etc. is an issue both in developing and developed countries. Several papers in this special issue have addressed this area of determining product integrity: ghee in India (Antony *et al.*) through the use of IR spectra and fish in Czech Republic (Kyrova) using PCR methodology.

Summary

Thus the themes explored in the papers collected in the special issue include consideration of:

- intrinsic and extrinsic food quality;
- traceability and provenance and supply chain mechanisms to demonstrate food integrity in it legal, moral and ethical dimensions;
- food crime and food fraud; and
- integrity and ethics in those who operate in the food supply chain.

It is hoped that this body of work forms a basis for further research activity in the area of food integrity, because as is demonstrated by the high level of non-compliance in some food sectors this governance is long overdue.

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