

Food scares: a comprehensive categorisation

Food scares

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Abstract

Purpose – The purpose of this paper is to describe the development of a comprehensive categorisation of food scares.

Design/methodology/approach – Following an initial desktop study, the categorisation was developed collaboratively with industry experts through a workshop and series of semi-structured interviews.

Findings – The new categorisation developed is in Venn diagram format allowing overlapping categories. It is organised around the two major types of contamination (biological, and chemical/physical contaminants) and the two major causes of contamination (wilful deception, and transparency and awareness issues).

Practical implications – The long and complex supply chains characteristic of current food production systems have resulted in a rising number of food scares. There is thus an increased emphasis on developing strategies to reduce both the number of incidents of food scares, and their associated economic, social and environmental impacts. The new categorisation developed in this study enables experts to address categories of food scares. Inclusion of the cause of contamination is particularly important as the method through which contamination occurs is key in devising food scare prevention strategies.

Originality/value – The new categorisation, unlike previous categorisations, enables food scares to fall into multiple categories, as appropriate. Also, again in contrast to previous categorisations, it takes into account not only the physical problem of a food scare but also the mechanism through which it arises.

Keywords Risk reduction, Classification, Food safety, Consumer risk, Contamination

Paper type Research paper

1. Introduction

During recent decades the food supply chain providing urbanised Western consumers has become increasingly industrialised. Where once food was a localised system of household or community relationships, developments in agricultural practices, production, storage, preparation and distribution have transformed the system (Godfray *et al.*, 2010). The food sector has now become a global market with products sourced from all over the world to meet a growing demand for variety and consistency of products, regardless of seasonality. The resultant long and complex supply chains limit traceability and often involve multiple, specialised actors who generally do not have detailed knowledge of each other's processes and procedures (Sivadasan *et al.*, 2006). Thus when a problem arises or is suspected at some

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point in the supply chain, identification of the source is frequently problematic, and the ability of actors to quickly and efficiently address the problem is often limited. Hence the probability that a threat to food safety (whether serious or trivial, real or just suspected) will escalate into a food scare has increased, causing a dramatic increase in the number of food scares reported (Knowles *et al.*, 2007; RASFF, 2014).

Food scares cause economic losses, social disruption and also have environmental implications (Wright *et al.*, 2013) and so companies involved in the food supply chain and associated governmental agencies are striving to reduce both the frequency with which they occur and the severity of the outcomes (Kleindorfer and Saad, 2005; Lloyd *et al.*, 2001). In particular the Horse Meat Scandal of 2013 highlighted the fragility of the food supply chain to food scares in the UK, and has reignited efforts to intervene in the food system (Elliott, 2014).

There are many different types of food scares, with recent examples in the UK including: bovine spongiform encephalopathy (BSE) (Latouche *et al.*, 1999); dioxins (Jacob *et al.*, 2010); *E. coli* (DeLind and Howard, 2008); genetic modification (GM) (Shaw, 2002); Horse Meat Scandal (O'Mahony, 2013); *Listeria* (West, 2008); *Salmonella* (Knowles *et al.*, 2007); and severe acute respiratory syndrome infected meat (Smith, 2006). While each of these may vary in its cause, its timing, the product(s) involved and its geographical spread, there are similarities between certain scares. In developing strategies to reduce food scares, a categorisation which clusters together similar types of food scares is useful.

The aims of the study described in this paper were thus twofold. First, to answer the question: does a comprehensive categorisation of food scares, that is, of use to industry experts in developing strategies to combat food scares, already exist? Then, if the answer is no, to develop a robust, comprehensive categorisation to aid development of strategies to reduce the frequency and severity of food scares.

It is important to define at the outset what is meant by three key terms: food “hazard”, “incident” and “scare”. A food hazard is defined as “A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect” (FAO and WHO Food Standards Programme, 2016). This definition infers that a real agent must be present for a condition to be classified as a food hazard. Complementing this the Food Standards Agency (2014) defines a food incident as “any event where, based on the information available, there are concerns about actual or suspected threats to the safety or integrity of food and/or feed that could require intervention to protect consumers’ interests”. In this wider definition inclusion of the word “suspected” is key. This is because it is vital that all threats should be included when devising strategies to ensure the safety and integrity of the food supply chain, not just those that conform to the narrower definition of a hazard.

The term “food scare” is used in contrasting and contradictory ways (Knowles *et al.*, 2007). A commonly used definition of a food scare is a “confirmed outbreak of foodborne illness [that] leads to a marked and relatively sudden fall in consumer demand” (O’Doherty Jensen, 2011). This definition situates a food scare in the market place with the final consumer being key. But it raises questions concerning the legitimacy: while O’Doherty Jensen (2011) state that an outbreak must be confirmed to be a food scare, according to Wu *et al.* (2013) “food scares are an external manifestation of public mental activities”, thus bringing to attention the unconfirmed nature of many food scares. The perceived nature of risk is a dominant theme across the literature (see e.g. Sparks and Shepherd, 1994; Böcker and Hanf, 2000; Lobb *et al.*, 2007): an incident does not need to involve a real outbreak at all, nor be validated by any higher power, before a market-based reaction is seen and a perceived incident becomes a scare.

Another difference in definitions of a food scare is shown by the identification of a “foodborne illness” as a key component of a food scare in the commonly used definition by O’Doherty Jensen (2011). However, the Horse Meat Scandal of 2013 involved the unauthorised presence of horse meat in the beef supply chain across Europe (European Commission, 2016). In the UK this was a moral rather than health issue, as UK culture tends

not to class horse meat as appropriate for human consumption (Troop, 2013). The scandal crystallised a lack of trust in the food supply chain and, arguably, had a dramatic impact, given there were no immediate health implications (Troop, 2013). The definition of a food scare should therefore take account of this type of event.

This paper thus proposes an updated, more robust definition of a food scare, clarifying that while the source of a food incident (real or perceived) lies firmly within the food supply chain itself, it is the response by consumers in their purchasing decisions that elevates a food incident to a food scare. Also, taking account of the recent Horse Meat Scandal, this definition does not specify that a medical risk is a necessary a component of a food scare. Thus the definition is:

A food scare is the response to a food incident (real or perceived) that causes a sudden disruption to the food supply chain and to food consumption patterns.

This is the definition used in the remainder of the paper, which is structured as follows. The next section presents the methodology used in the study, and Section 3 describes results, ending with the new categorisation. Section 4 concludes with a brief discussion of the new categorisation's uses and implications.

2. Research methodology

The aim of this research was to review existing categorisations of food scares and, if none of those found were agreed to be comprehensive and of use to industry experts in tackling food scares, to develop a new categorisation. The research methodology therefore consisted of two main stages: a desktop study, followed by collaborative work with industry experts. These are explained in turn below.

2.1 Desktop study

The first step in the desktop study was to identify existing categorisations of food scares. The keywords "food scare", "types", "typology", "category" and "cause" were used to initially identify the most relevant publications, and this list was augmented by a snowballing approach, through which promising citations in papers already identified were pursued (Jalali and Wohlin, 2012). Snowballing was included as it has been found to be more effective in identifying important evidence than a formal systematic review (Greenhalgh and Peacock, 2005). The review included papers that illustrated different groupings of food scares, even where they did not present explicit categorisations.

The categorisations and groupings identified were then reviewed by the researchers to assess whether any were comprehensive and of use to industry experts in tackling food scares. If no single suitable categorisation was found, those that were considered to offer a suitable basis for a new categorisation were selected. By analysing common themes and disparities in them, an initial list of categories was drawn up to be reviewed by industry experts.

2.2 Collaborative work with industry experts

Collaborative work with stakeholders from across the food supply chain was carried out using an adapted Delphi approach (Linstone and Turoff, 2002). There were two main stages. First a workshop was held in which the initial list of food scare categories from the desktop study was presented. This was followed by a series of expert interviews. These stages are described below.

The stakeholder workshop was held on 25 February 2014 with participants selected to represent primary industry members (farming sector, processors and retailers), trade associations and governing bodies of the UK food industry. Purposive sampling was used for recruitment (Robson, 2002). First participants were recruited through existing contacts and by e-mailing specific key individuals in target organisations, identified through

website searches. This was augmented by a snowballing process through which respondents were asked to recommend other potential participants (Robson, 2002). Workshop activities were designed to obtain individual perspectives surrounding food scares in the food supply chain, followed by group activities to encourage stakeholders to reach agreements concerning key issues surrounding food scares. Participants were divided into groups of maximum eight participants (Davies, 2007). The initial categorisation of food scares developed from the existing literature was presented to participants. The participants discussed the problems of this classification through consideration of where various food scares would sit, and suggested ways in which it could be improved. Based on this the authors drew up a revised, intermediate classification.

The second stage of consultation was undertaken in order to refine the intermediate categorisation. This phase consisted of semi-structured interviews held with individual stakeholders between March and June 2014. Each expert interview consisted of an in-depth discussion between an individual stakeholder with the researchers. Notes were taken as more than one researcher was present at each interview, and interviews were not recorded. The stakeholders were selected in order to obtain a representative sample of key stages of the UK food supply chain: farming, processing, retailers and overarching organisations (such as insurers, FSA and levy boards). Interviewees were recruited using the same method as described above for the workshop. Only people who had not attended the previous workshop (and therefore came with fresh perspective and knowledge of UK supply chains) were selected. This was important in order to ensure the categorisation could be understood as a stand-alone categorisation.

The interviews were structured around themes of the participants' understanding of the food supply chain and food scares. The most up to date version of the categorisation was presented at each interview and possible amendments discussed through examination of how various food scares would fall in the categorisation. Each interview was followed by a process of refinement to the categories to capture the expert knowledge, while ensuring that the amendments were conceptually sound and could be supported by existing industry, academic or governmental data. When no further amendments were suggested during several consecutive expert consultations it was deemed that "saturation" had been reached and that the categorisation was representative and usable (Guest *et al.*, 2006).

2.3 Limitations

An important limitation to this study is the selection of participants, and their limited number. As with most research, the researchers were dependent on the goodwill and availability of respondents (Bell, 2005), and a greater number of participants would have strengthened the study. Another limitation is that the study was concluded when saturation was reached. Had a different sample been chosen, or had the participants been interviewed in a different order, saturation may have occurred sooner or later, and there is also a possibility that a different outcome would have been reached (Guest *et al.*, 2006). A further limitation of the study is that interviews and workshops both have their strengths and weaknesses. Compared to interviews, workshops draw on a greater knowledge base, involve exchanges of views, and can eliminate personal biases (Robson, 2002). The main drawback of workshops is that, even with strong facilitation, a group may be dominated by one or two strong characters, while this is not a danger in interviews. Finally, the classification has not yet been tested in practice, and it is recommended that this is done in further work to ensure that the final categorisation is fit for purpose.

3. Results and discussion

The results of the desktop study and collaborative work are presented in Sections 3.1 and 3.2, respectively.

3.1 Findings of the review of existing categories of food scares

Over 60 papers were identified in the keyword search and in total over 85 papers were reviewed in the desktop study. A single, robust, comprehensive categorisation of food scares suitable for use in aiding the development of strategies to reduce their frequency and severity was not found. Six studies were, however, found to present different categorisations of food scares that were considered to be relevant to this project and a useful basis for the development of a new categorisation. An overview of the categories defined in each of these studies is presented in Table I.

By teasing out the common themes and disparities presented by these publications, the categories identified in Table I were synthesised into five types as described in the following subsections, and summarised in Section 3.1.7 and Table II.

3.1.1 Microbiological. In the studies selected, Knowles *et al.* (2007), Sanders (1999) and Yeung and Morris (2001) specifically identify “microbiological” as a category. In contrast, Brewer *et al.* (1994) and then later Brewer and Prestat (2002) situate “microbiological” within the wider categorisation of “spoilage”, which incorporates concerns for food safety due to

Paper	Types
Brewer <i>et al.</i> (1994) and Brewer and Prestat (2002)	Chemical Health Spoilage Regulatory Deceptive Information issues (or ideal types in 1994)
Frewer <i>et al.</i> (1994)	Technical Bacteriological Chemical Life-style
Knowles <i>et al.</i> (2007)	Microbiological Contaminant Animal disease
Sanders (1999)	Naturally occurring toxicants Microbiological Food production
Yeung and Morris (2001)	Industrial processing Microbiological Chemical Technological

Table I.
Previous categorisations of food scares

Category	Definition	Paper
Information	Provision of information to consumers concerning the ingredients and processes which are used in production of a food item	Brewer <i>et al.</i> (1994) and Brewer and Prestat (2002)
Deception	Fraudulent substitution, addition or subtraction of ingredients to food items	Brewer <i>et al.</i> (1994) and Brewer and Prestat (2002)
Technology	Technological interventions such as GM and irradiation	Frewer <i>et al.</i> (1994) and Yeung and Morris (2001)
Contaminant	Contamination of food items with anything that is not naturally found in the food item	Knowles <i>et al.</i> (2007)
Microbiology	Contamination of food items by microorganisms found in the air, food, water, soil, animals and human body	Knowles <i>et al.</i> (2007), Yeung and Morris (2001), Sanders (1999) and Frewer <i>et al.</i> (1994)

Table II.
The five categories of food scares synthesised from previous categorisations

improper food preparation, storage and sanitation issues. Grouping “microbiological” issues such as *E. coli* and *Salmonella* alongside food management implies that human error plays a role in the emergence of these types of food scare.

Frewer *et al.* (1994) also deviate from the “microbiological” categorisation, using a “bacteriological” category to account for hazards such as *Listeria* and *Salmonella*. This categorisation focusses greater attention on bacterial organisms over organisms in general, suggesting this is a specific area of importance for food scares. However, such a distinction fails to account for scares that are not microorganism based, such as mycology, parasitology and prions. Frewer *et al.* (1994) do not explicitly identify where these microorganisms would fall within their categorisation, suggesting their categorisation is not exhaustive.

Related to this distinction is Knowles *et al.*'s (2007) identification of “animal disease” as a specific type. This is in contrast to other categorisations where prions and other “animal disease” are captured within the microbiological category. While prions are not living cells they can legitimately be included within a “microbiological” classification because they can only be viewed with a microscope, and they have the ability to replicate themselves. Knowles *et al.* (2007) include foot-and-mouth disease and Avian Influenza in this category. Although neither of these diseases pose a known risk to human health, the perceived uncertainty surrounding the affect upon human health is sufficient to impact upon consumers’ purchasing behaviour (Brewer and Prestat, 2002; Mazzocchi *et al.*, 2008) and thus they warrant inclusion in any comprehensive typology.

3.1.2 Contaminant. In addition to “microbiological” and “animal disease” Knowles *et al.* (2007) identify a “contaminant” type which includes unauthorised use of antibiotics, hormones and pesticides in the production of food. Numerous scares involving such contaminants have occurred. Unsurprisingly, contaminants which cause food poisoning are seen to concern consumers more than others (Miles *et al.*, 2004).

While Brewer *et al.* (1994), Brewer and Prestat (2002), Frewer *et al.* (1994) and Yeung and Morris (2001) utilise the term “chemical” in their classification, these incorporate the same origins of food scares as “contaminant”, for example, antibiotics, hormones and pesticides. Sanders (1999), however, uses a more refined classification of “naturally occurring toxicants”. These toxins, which include, for example, alkaloids, legume toxins, cyanogenic glycosides are ubiquitous in plants; they pose a greater risk to people in developing countries due to lack of suitable food or the processes to effectively turn the food into a safe form.

3.1.3 Technological. Alongside many benefits, technological advances in food production systems represent challenges for human health and the potential for food scares. Frewer *et al.* (1994) and Yeung and Morris (2001) specify “technological” and “technical” classifications, respectively. These categories include GM and irradiation, which are both innovative technological processes that have been viewed with suspicion by consumers and governments alike, due to the unknown nature of the processes and potential outcomes.

3.1.4 Deception. Deception is defined by the Collins English Dictionary (2016) as “the act of deceiving or the state of being deceived” or “something that deceives”. Examples in the “deceptive” category defined by Brewer *et al.* (1994) and Brewer and Prestat (2002) relate to misinforming the consumer about unhealthy weight reduction diets, and naturally occurring toxins which are harmless below certain quantities. Perhaps surprisingly, they also included misinformation concerning allergenic food ingredients: the authors do not comment why, but inclusion here infers that they assume mislabelling of allergenic ingredients to be generally due to deception rather than, for example, due to human or technological error.

3.1.5 Information. Brewer and Prestat (2002) specify an “information” category which refers to the (lack of) access to information such as mandatory health labelling, with their example referring to detailed information that should be available for consumers at a store,

market or restaurant. In an earlier, similar study, Brewer *et al.* (1994) did not have an “information” category but instead identified an “ideal situations” category (referring to food safety practices in an ideal situation) which included mandatory health labelling.

3.1.6 *Other.* Brewer *et al.* (1994) and then later Brewer and Prestat (2002) identify “health” as a category. This relates to the effect of contemporary food trends on the human body, the greatest being cholesterol and fat. Complementing this, Frewer *et al.* (1994) include a “life-style” categorisation, which includes inappropriate dietary choices. While such issues cause widespread societal problems they do not fall within the definition of a food scare used in this paper (see Section 1), as they do not cause sudden shocks to the food system but are more pervasive and emergent. These are thus not included in the categorisation developed in this paper.

Sanders (1999) specifies “food production” and “industrial processes” to represent the exposure of food to agricultural and environmental chemicals, GM, food additives, and preservatives and toxins from packaging. In this study these were categorised within the more specific categorisations of “technology”, “information” and “contaminant”.

3.1.7 *Summary of desk study.* From the existing literature five categories of food scares emerge, as summarised in Table II. This categorisation takes into consideration historically significant types of food scares such as “deception”, “contaminant” and “microbiology”, while also taking into consideration modern day advancements in technology, and the increasing role of information in food supply chains. This categorisation was used as the starting point for the development of a new categorisation of food scares, as described in the next section.

3.2 *The collaborative development of a new category of food scares*

When the initial categorisation synthesised from the literature review (as shown in Table II) was presented at the workshop, the nine participants discussed its linear, simplistic nature. Participants agreed that some food scares can be classified within more than one of the categories, and they pointed out that such cases could not be appropriately or adequately placed within the categorisation presented. This was specifically thought to be the situation for the categories of “deception”, “contamination” and “information” as these can occur at different stages of the supply chain. As such, participants stressed that the categorisation of food scares cannot be independent categories – cross-categorisation must be allowed for. In other words, while it is possible that some food scares can be appropriately categorised within one category (e.g. *E. coli* categorised as microbiological), others are more appropriately classified under more than one category (e.g. the Horse Meat Scandal falls under both information and deception). With this feedback in mind, the authors refined the categorisation. This revised, intermediate categorisation, shown in Figure 1, represents the inherent complexity expressed by the workshop participants using a Venn diagram format. The categories are based on those identified from the desktop study as shown in Table II, with some changes to category names: for example, the “technology” category was replaced by “industrial processing” as this was felt by the participants to be broader[1].

In this categorisation, “information” refers to provision of information to consumers concerning the ingredients and processes which are used in production of a food item. “Industrial processing” refers to the use of technology that can result in either unsafe food items or food items perceived by the public to be harmful. The category of “microbiological” covers contamination of food items by microorganisms found in the air, food, water, soil, animals and human body, while the “contaminant” category covers the contamination of food items with anything that is not naturally found in the food item. This can be biological, chemical or physical. Finally, the “deception” category covers fraudulent substitution, addition or subtraction of ingredients to food items.

As described in Section 3 the intermediate classification shown in Figure 1, and its subsequent evolution, was presented at a series of expert interviews. While the workshop participants had focussed on the overlapping nature of food scare categories, the

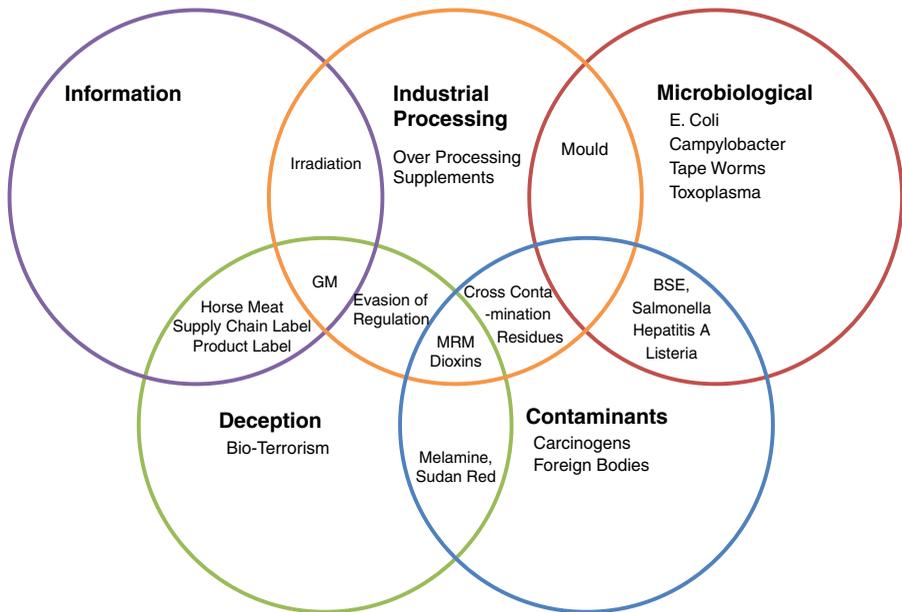


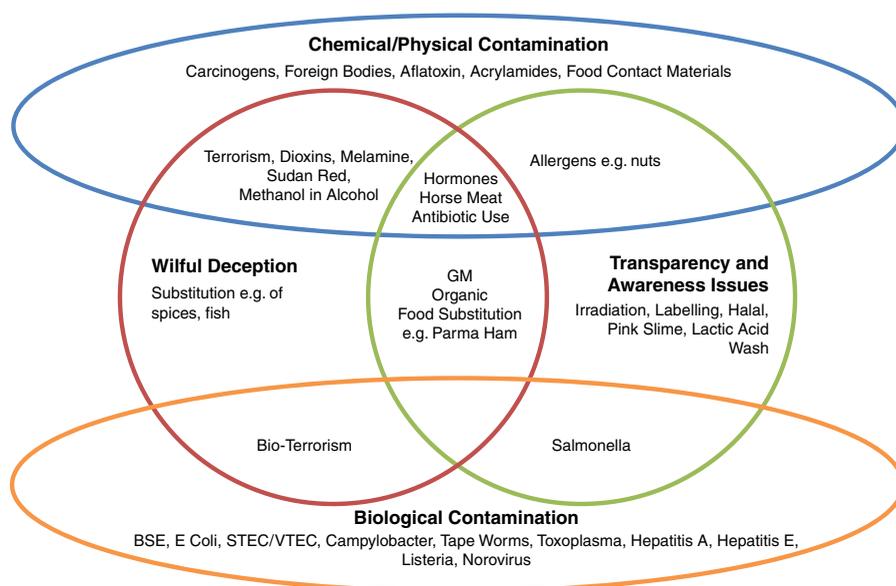
Figure 1.
Intermediate
re-categorisation of
food scares

Notes: Bold lettering denotes a category, and non-bold provides examples

interviewees accepted the resulting Venn diagram format but questioned its layout and the categories themselves. During this process it emerged that rather than the five uniform lobes of the Venn diagram shown in Figure 1, a distinction should be made between lobes that represent the cause of a food scare, and those that represent its manifestation (real or imagined). Successive amendments were made until, after five interviews had taken place, the categorisation was thought to be fit for use and saturation judged to have been reached. The final categorisation is shown in Figure 2.

In contrast to Figure 1, this categorisation is organised around two types of contamination (“biological contamination” and “chemical/physical contamination”), and it highlights that the causes of contamination can be implemented in two different ways (“wilful deception” and/or “transparency and awareness issues”). Inclusion of the cause of contamination is particularly important as the method through which contamination occurs is key in determining the way in which the risk and management of a food scare is handled, and for devising food scare prevention strategies. Food scares that are not the result of “wilful deception” or “transparency and awareness issues” are placed in the appropriate lobe (“biological contamination” or “chemical/physical contamination”) such that they do not overlap with the “wilful deception” or “transparency and awareness issues” lobes. For example, a microbiological outbreak due to a system or process failure would be placed at the very bottom of the “biological contamination” lobe alongside, for example, *Listeria*. The two types of contamination are as follows:

Biological contamination. This category includes all scares relating to microorganisms found in the air, food, water, soil, crops and animals. It thus includes, for example, *E. coli*, *Salmonella* and BSE. From the previous studies this category assimilates the “microbiology” category of Knowles *et al.* (2007), Sanders (1999) and Yeung and Morris (2001), “animal disease” of Knowles *et al.* (2007), “spoilage” as defined by Brewer *et al.* (1994) and Brewer and Prestat (2002) and “bacteriological” of Frewer *et al.* (1994).



Notes: Bold lettering denotes a category, and non-bold provides examples

Figure 2.
A comprehensive categorisation of food scares, as developed by industry experts

Chemical/physical contamination. Unlike “biological contamination” this categorisation refers to forms of contamination that are not living microorganisms and that should not be present in the supply chain or final product. Food scares within this type include: material goods (such as razor blades[2]), cross-contaminated food matter that occurs through cross-contamination or other means (such as unintended meat, as in the Horse Meat Scandal), chemicals, antibiotics and hormones. This definition is an extension and amalgamation of the “chemical” categorisations by Brewer *et al.* (1994), Brewer and Prestat (2002), Frewer *et al.* (1994), and Yeung and Morris (2001) and includes Sanders’ (1999) “industrial processing” category. The “contaminant” category of Knowles *et al.’s* (2007) and Sanders’ (1999) “food production”, “naturally occurring toxicants” and “industrial processing” categories are classified as appropriate according to the precise nature of the contaminant.

The two contamination categories do not overlap, as a scare cannot be both “biological” and “chemical/physical”. However, both of these categories may be caused by “wilful deception” or “transparency and awareness issues”. For example, bio-terrorism is an example of “biological contamination” caused by “wilful deception”, and the Horse Meat Scandal is an example of “chemical/physical contamination” caused by “wilful deception”.

The explicit inclusion of “wilful deception” enables us to distinguish food scares which have resulted from intentional contamination, such as the Horse Meat Scandal, and contrast it with unintentional contamination, where contamination can occur accidentally or without prior knowledge or understanding of the hazard. “Wilful deception” refers to an agent consciously meddling with the supply chain and relates to Brewer and Prestat’s (2002) “deceptive” category. Deception may have many motivations, such as an agent’s financial gain or maliciously damaging the reputation of the brand. This is not to suggest that this is a new form of food scare: as noted in Section 1, cases of this type date back at least to the times of King John I of England when bread was adulterated with alternative food and non-food stuffs. However, as food production becomes increasingly economically driven, short cuts to save money are increasing (Spink and Moyer, 2011).

The category “transparency and awareness issues” builds on Brewer and Prestat’s (2002) “information issues” but encapsulates more than the provision of information: it takes into account the availability of information, the coherence and legitimacy of information, as well as the discourses surrounding the scare. For example, industry generally regards irradiation as safe, but some consumers deem it risky, and hence it has potential to underlie a food scare. Research has indicated that a short explanation about the process and benefits of irradiation can change consumers’ opinions and negative attitudes (Roberts, 2014), and thus consumers’ understanding and their access to information can be key in both the cause and intensity of a food scare.

Some types of food scares, such those arising due to issues with irradiation, are classified under “transparency and awareness issues” alone. Thus, not being classified as “chemical/physical contamination” or “biological contamination”, irradiation is placed between these two lobes in Figure 2. Brewer *et al.* (1994) and Brewer and Prestat’s (2002) categories “health” and “regulatory”, Frewer *et al.*’s (1994) “technical” category and Yeung and Morris’ (2001) “technological” category are part of the “transparency and awareness issues” category.

4. Conclusion

A useful starting point for the development of effective and efficient strategies to combat food scares is a categorisation of types of food scares. This study found, however, that a single comprehensive, robust and usable categorisation did not previously exist, and therefore a new categorisation was developed to fill this gap.

The new categorisation, shown in Figure 2, builds on previous categorisations published in the literature (Brewer *et al.*, 1994; Brewer and Prestat 2002; Frewer *et al.*, 1994; Knowles *et al.*, 2007; Sanders 1999; Yeung and Morris 2001). It was developed through a series of expert consultations with stakeholders associated with the UK food supply chain and we recommend that in future work the categorisation is tested in practice, to ensure that it is fit for purpose.

Unlike previous categorisations, the new categorisation enables a food scare to be categorised according to both to its physical manifestation (“chemical/physical contamination” or “biological contamination”) and, where appropriate, the mechanism(s) through which it arises (“wilful deception” and/or “transparency and awareness issues”). By highlighting where and how the nature of different types of food scares overlap, this categorisation will enable risk management teams to address categories of food scares in a systematic way. It will be of use in developing strategies to reduce both the number of incidents of food scares, and the associated economic, social and environmental impacts.

Notes

1. In addition, the category “microbiology” in Table I was renamed “microbiological” as this is more useful in talking about a food scare (a “microbiological food scare” is better English than “a microbiology food scare”).
2. In 1989, jars of baby food were contaminated with razor blades, pins, caustic soda and slivers of glass. This led to the “baby food panic” which saw parents boycotting the two largest baby food producers. However, only one injury occurred and parents were asked to return products from known contaminated sources. This led one producer to change their packaging to include a plastic covering (Lohr, 1989).

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