Emerging
Food Safety Issues
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Foreword

**safe food, the Food Safety Promotion Board**

**safe food**, the Food Safety Promotion Board is the North-South body responsible for the promotion of food safety on the island of Ireland (IoI). This includes the funding of research to address knowledge gaps in food safety and the promotion of cross-border co-operation in the microbiological surveillance of foodborne diseases. Since its establishment, **safe food** has met this responsibility by commissioning research, and establishing and supporting multi-disciplinary knowledge networks. Currently, there are seven knowledge networks on specific microbiological and chemical food safety topics, and a network addressing food allergy and food intolerance. Each knowledge network provides a forum for information exchange and horizon scanning. **safe food** has co-operated with agencies involved in surveillance on the island of Ireland and has assisted in the development of surveillance capacity through supporting laboratory linkages, enhancing information technology facilities and electronic reporting arrangements for laboratories on the island, as well as reviewing surveillance systems to promote harmonisation.

**Terms of reference and scope**

In recognition of the general function of **safe food** in the promotion of food safety, the **safe food** Scientific Advisory Committee (SAC) asked that a Working Group of SAC members and other co-opted experts be convened, to identify ways of addressing emerging food safety issues (see Appendix 1). The working group, whose members were drawn from regulatory, industry and academic backgrounds, was charged with investigating current activities on the island of Ireland that focus on the identification of emerging food safety issues, and to see if these can be advanced in any way, and always with the ultimate goal of further protecting public health and supporting the Agri-Food industry on the IoI. The Terms of Reference were devised to reflect this objective, bearing in mind the relative absence of previous efforts at investigating emerging food safety issues. The specific objectives were:

1. Identify ways of addressing emerging issues pertaining to the safety of the food chain on the island of Ireland and the factors that influence these.
2. Describe current approaches on the island of Ireland for capturing information on emerging food safety issues and consider the data and networking elements that are important in this regard.
3. Consider possibilities for promoting awareness and acceptance amongst stakeholders, of the importance of addressing emerging food safety issues.
Definition

For the purposes of this report, an emerging Food Safety Issue is defined as a hitherto unknown hazard, or a known hazard subject to new influences, which could present a risk to human health. The definition does not include known food safety hazards with known impacts and established etiologies. The influences that can create or alter the environment in which a hazard can present a distinct risk are referred to as 'drivers of change', and invariably work by facilitating new routes of human exposure.
Abbreviations

ADI  Acceptable Daily Intake
AFBI  Agri-Food and Biosciences Institute
AHAW  European Food Safety Authority Panel on Animal Health and Welfare
ALARA  As low as reasonably achievable
ANS  European Food Safety Authority Panel on Food Additives and Nutrient Sources added
BIOHAZ  European Food Safety Authority Panel on Biological Hazards
BIPs  Border Inspection Posts
BSE  Bovine Spongiform Encephalopathy
CAP  Common Agricultural Policy
CDC  Centre for Disease Control
CDSC  Communicable Disease Surveillance Centre
CEF  European Food Safety Authority Panel on Food Contact Materials, Enzymes
CIDR  Computerised Infectious Disease Reporting
CJD  Creutzfeldt-Jakob Disease
CMO  Chief Medical Officer (for Northern Ireland)
CONTAM  EFSA Panel on Contaminants in the Food Chain
CSO  Central Statistics Office (Republic of Ireland)
CVO  Chief Veterinary Officer (for Northern Ireland)
DACO  Data collection for the identification of emerging risks related to food and feed
DAFM  Department of Agriculture, Food and the Marine (Republic of Ireland)
DARD  Department of Agriculture and Rural Development in Northern Ireland
ECDC  European Centre for Disease Control
EFFoST  European Federation of Food Science and Technology
EFSA  European Food Safety Authority
EHO  Environmental Health Officers
EMA  European Medicines Agency
EMI  DARD QAB Egg Marketing Inspectorate
EMPRES  INFOSAN’s Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases
EMRISK  Emerging Risks Unit of the European Food Safety Authority
ENDIV  European Network for Diagnostics of Imported Viral Diseases
ERA  European Research Area
EREN  Emerging Risks Exchange Network of the European Food Safety Authority
ERN  European Food Safety Authority Emerging Risks Network
ESCO  European Food Safety Authority Scientific Co-operation working group
EU  European Union
EuroTravNet  European Travel Medicine Network
EWRS  Early Warning and Response System
FAO  Food and Agriculture Organisation of the United Nations
FEEDAP  European Food Safety Authority Panel on Additives and Products or Substances used
FIRM  Food Institutional Research Measure
FLEP  Food Law Enforcement Practitioners forum
FP  European Union’s Framework Programmes for Research and Technological
FSA  Food Standards Agency
FSAI  Food Safety Authority of Ireland
GACS  General Advisory Committee on Science of the UK Food Standards Agency
GLEWS  International Food Safety Authorities Network’s Global Early Warning System
GM  Genetically Modified
GMO  European Food Safety Authority Panel on Genetically Modified Organisms
GPHIN  Global Public Health Intelligence Network
GVA  Gross Value Added
HACCP  Hazard Analysis at Critical Control Points
HPA  Health Protection Agency (Northern Ireland)
HPSC  Health Protection Surveillance Centre
HPSC  Health Protection Surveillance Centre (Republic of Ireland)
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1 Introduction

The identification of emerging food safety issues is important for protecting public health, maintaining consumer confidence in the food chain, and preventing negative impacts on the agri-food industry. However, the approaches and methodologies by which this can be achieved are still in the ‘proof-of-concept’ phase of development, as regulators and researchers struggle towards ascertaining what ‘best practice’ actually means in this regard. The process of globalisation makes it increasingly difficult to confine emerging food safety issues, and their potential for evolving into real risks, within specific geographic, societal and organisational boundaries. Therefore, efforts at identifying, and subsequently managing, emerging food safety issues must be done in the context of the modern food environment, which is global, dynamic, complex and interconnected. We live in an environment where “simple cause-and effect relationships are steadily replaced by multi-causal and multi-conditional systems”. This is evident in the diversity and complexity of influences, or ‘drivers-of-change’, that can impact on the food chain, including climate change, technological developments, geo-political changes, economic pressures, etc. Unfortunately, this complexity means that these issues can go undetected until they evolve into actual risks and impact on the food chain and possibly also on human health.

These complexities notwithstanding, there is a realisation within the food safety regime that the prevention of big-impact food safety events will require an ability to identify, evaluate, isolate and manage potential issues and risks. Currently there are no agreed and validated methodologies by which this can be achieved. Perhaps the most noteworthy attempt at redressing this deficit, from an island of Ireland (IoI) perspective, is that being orchestrated by the European Food Safety Authority (EFSA), who have a legislative remit to “undertake action to identify and characterise emerging risks” in the field of food and feed safety. The Emerging Risks Unit (EMRISK) was established within EFSA in 2008 to address this obligation, and this is now the leading agency for identifying emerging food safety risks in Europe. Agencies and authorities in the European Union (EU) member states (MS) contribute both information and expertise to the EMRISK process. The requirements needed to identify actual risks from issues test the resources of individual MS, and can only be adequately met through co-operation at a nexus such as EFSA. That said, the elements needed for emerging issue identification are present at national and regional level and could be exploited through appropriate networking structures. Within the wider EFSA network, the designated national contact points are the Food Safety Authority of Ireland (FSAI) in the Republic of Ireland (ROI) and the Food Standards Agency (FSA) in Northern Ireland (NI).

This report sets out to identify those elements needed for the identification of emerging food safety issues on the IoI. From the outset, it is acknowledged that the Agri-Food industry is the
most probable environment in which emerging food safety issues impact the food chain, and current and historical issues, which have had the most significant impact, are described. A unique aspect of this industry on the IoI is the significant proportion of Small and Medium-sized Enterprises (SMEs). Such businesses are required to control food safety hazards but, as is probably the case in larger industries, they are unlikely at an individual level, to have sufficient skills capacity or resources to monitor for emerging food safety issues. Nonetheless, drivers of change that originate nationally or internationally will impact on the broader industry and these are addressed in the report. The data sources used by food chain stakeholders that are of potential value in capturing information are described, as well as the current networking structures which will be important in achieving this. Finally, a potential structure for addressing emerging food safety issues on an all-island basis is proffered, as well as the elements of a possible remit for the co-ordinating body responsible for orchestrating activities in this regard.

The importance of the Agri-Food industry on the island of Ireland

The three branches of the Agri-Food industry – agriculture, food processing and food distribution – constitute the largest indigenous industry in both jurisdictions on the IoI. In the ROI, the industry gave direct employment to 50,000 people in 2009, as well as providing the primary outlet for the produce of 128,000 family farms. All told, the Agri-Food sector accounted for 7.4 per cent of national employment in 2009, which increased to 10 per cent when employment in inputs, processing and marketing is included. The same year, the sector generated 4.1 per cent of goods and services produced in the economy, i.e. of gross value added (GVA), while accounting for 60 per cent of exports by indigenous firms with a gross annual output of €20 billion. There are upwards of 600 food firms in the Republic, ranging from micro-enterprises to multinational Foreign Direct Investment companies. Over 90 per cent of the food companies in the Republic are SMEs and this reflects the distribution of companies within the sector at EU level.

In 2009, the agriculture, forestry and fishing industry in NI, directly employed 30,000 people (3.9% of total) while the wider food and drink processing industry employed 21,000 people (a further 2.7% of total). The combined Agri-Food industry in NI had a GVA of three per cent for the same year translating into a gross output of £854 million. As in the Republic, the majority of Agri-Food businesses in NI are categorised as SMEs. In 2010, 85 per cent of agricultural output in the Republic was exported in processed form to over 140 markets worldwide and was valued at approximately £8 billion. Dairy products and ingredients is the largest exporting food sector (£2.3bn), followed by beef (£1.5bn), prepared foods (£1.4bn), beverages (£1.2bn) and other relatively smaller, but significant sectors including seafood, pig meat, horticulture, poultry and sheep meat (circa £1.3bn). Ireland is the fifth largest exporter of beef in the world and produces infant formula that feeds one in seven formula-fed babies worldwide. Six of the top twenty global food
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and beverage companies in the world have a presence here.

This was reflected in NI where, in 2009, the food and drink processing sector had a gross turnover of £3.2 billion and external sales (outside NI) of £2 billion. In terms of external sales, the rank order of food sectors was milk and milk products (£570m), beef and sheep meat (£545m), poultry meat (£425m), with significant exports from the drinks, pig meat, bakeries, fruit and vegetables, fish, eggs and animal by-products sectors (circa £640M)\(^4\).

The governments of both jurisdictions have set ambitious targets for growth within the different agri-food sectors by 2020. The drivers for this include the predicted rise in global demand for food, changing food consumption patterns with an emphasis on increased meat consumption, an international commitment to food security and sustainability, the impact of dietary-related diseases such as obesity, changing consumer lifestyle trends and a constant need to ensure competitiveness. The vision for the future development of the Agri-Food industry in ROI is set out in Food Harvest 2020 and focuses on three themes: Act Smart, Think Green, Achieve Growth\(^5\). The obligation for sustainable development will be met through the exploitation of Ireland’s green potential with the already-established grass-based production systems providing the competitive edge. A commitment to enhancing value-added growth will be underscored by research and innovation. These ambitious targets are predicated food safety being an integral element. Food safety cannot be jeopardised in meeting consumer demands for minimally processed foods, or by the introduction of new process technologies and novel materials designed to enhance competitiveness. Research is key to ensuring a robust and reliable food safety regime, not just for addressing any knowledge gaps with regard to ongoing food safety issues, but in developing systems which stakeholders in the food safety regime can use to manage emerging risks\(^6\).

Food production, together with food and drink processing, is the single largest employer in NI’s private sector. A vision for the development of this industry has been proffered by the Industry Advisory Panel, in partnership with the Department of Agriculture and Rural Development in NI (DARD) and Invest NI\(^7\). This vision includes the key performance indicators of (a) the return on capital employed, (b) productivity and (c) the external sales as a percentage of total turnovers, against which performance of the strategy can be measured. The strategy itself has five key themes: (i) market understanding and development, (2) fostering innovation, (3) supply chain management, (4) capability development and (5) energy and waste. The targets mentioned in the strategy have come to pass as the document gave no predictions beyond 2011. Subsequently in quarter one of 2012, the NI Ministers of Agriculture and Rural Development and Enterprise, Trade and Investment appointed an Agri-Food Strategy Board to develop a long-term strategic plan for the Agri-Food sector in NI. The Board issued a ‘call for evidence’ from stakeholders in February 2012, with a view to devising a Strategic Plan for the sector that would be “market-led and action-based”\(^8\).
2 Food safety issues which have impacted, and continue to impact, on the IoI food chain

The safety of our food supply is determined by the presence of microbial hazards, chemical residues, environmental contaminants, physical hazards and infestation, all of which can be detrimental to human health. Microbial foodborne illness generally results from a failure of one or more of the four rules of microbial control, namely cooking, chilling, cleaning and preventing cross-contamination. These behaviours can occur at primary production, processing and end-user stages. Chemical-based food hazards result from improper use of chemicals or through contamination in the environment from both natural and man-made sources. Physical and infestation hazards are usually the result of poor manufacturing practice, although hazards can also be introduced at primary production level. All the aforementioned hazards can present an actual or perceived risk to human health. The risks, as identified, can be pre-existing or novel\textsuperscript{9}. Exposure can give rise to acute or chronic illness, or can contribute to the long-term risk of disease.

Seminal food safety events that have impacted the island of Ireland food chain

Since the mid-1980s, food safety has been placed firmly on the political agenda in the wake of a succession of significant food safety incidents, with most developed countries experiencing both economic and public health impacts as a result. These were the impetus for new and updated food safety legislation and infrastructure on the IoI and throughout the EU. Some of the most well-publicised food safety incidents have included *Salmonella* contamination of eggs, Bovine Spongiform Encephalopathy (BSE) infected beef carcasses and the contamination of pork meat with dioxin. All have had implications for human health and the Agri-Food economy, and dented consumer confidence in the food supply chain.

Food safety incidents have frequently led to a temporary or sustained reduction in consumption, which can be damaging for a particular commodity and the associated brand name(s), and have major cost implications for suppliers and retailers alike. The BSE crisis saw beef consumption fall temporarily by 40 per cent, not only in the United Kingdom (UK), but also in countries such as Germany and Italy which, at that time, had no reported cases of BSE\textsuperscript{9}. Six months after the BSE crisis broke, sales of all European beef were still down by 15 per cent\textsuperscript{20}. Some of the seminal
food safety events of the last quarter century that have impacted in both jurisdictions on the IoI are described in Appendix 2.

These events forced governments to re-examine food control structures. The responsibility for food safety regulation and enforcement was shifted from government departments to legislatively independent food safety agencies. These developments were intended to improve the evidence base for food safety management decisions and the flow of independent and verifiable information about food safety to the public\(^1\). In the ROI, the FSAI was established in 1999, while in the UK the FSA was established in 2000. Both the FSAI and the FSA have a legislative remit for food safety on the IoI. EFSA was established in January 2002 as an independent source of scientific advice and communication on risks associated with the food chain. The legislation establishing EFSA also emphasised the responsibility of food businesses to control food safety hazards and ensure the food they produce and market is safe\(^2\).

**Current food safety hazards affecting the island of Ireland food chain**

Adverse food safety events, due to microbial and chemical contamination, are an enormous annual economic burden on the Agri-Food industry, and not just on the IoI. The 2011 estimates of foodborne illness in the United States documented 9.4 million episodes of foodborne illness, 55,961 hospitalisations and 1,351 deaths annually attributable to 31 major pathogens, while a further 38.4 million illness episodes, 71,878 hospitalisations and 1,686 deaths were attributable to unspecified agents\(^3\). Most (58%) illnesses were caused by norovirus, followed by nontyphoidal *Salmonella* spp. (11%), *Clostridium perfringens* (10%), and *Campylobacter* spp. (9%). The leading causes of hospitalisation were nontyphoidal *Salmonella* spp. (35%), norovirus (26%), *Campylobacter* spp. (15%), and *Toxoplasma gondii* (8%). The leading causes of death were nontyphoidal *Salmonella* spp. (28%), *T. gondii* (24%), *Listeria monocytogenes* (19%), and norovirus (11%). The cost to the US economy was estimated at up to $77.7 billion\(^4\). The estimate of the burden and causes of infectious intestinal disease (IID) in the UK population between April 2006 and March 2012 was that approximately 25 per cent of the UK population suffer from an episode of IID in a year – equivalent to 17 million cases annually. About two per cent of the population visit their GP for symptoms of IID each year (approximately 1 million consultations annually). However, for every case of IID reported to national surveillance, there are around 10 GP consultations and 147 cases in the community\(^5\). Roughly half of those who present with IID report being absent from school or work because of their symptoms, and that translates into approximately 11 million days lost in people of working age\(^6\). The most frequently identified causative pathogens were norovirus, sapovirus, *Campylobacter* spp. and rotavirus. In 2007, the total annual economic burden of gastroenteritis from all sources (not just food) was estimated at €102M (£69M) for the ROI and €34M (£23M) for NI\(^7\).
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Adverse food safety events can be immensely costly for specific Agri-Food sectors: following the publication of a link between BSE and the fatal human disease, variant Creutzfeld-Jakob disease (vCJD), all export markets for British beef, which in 1995 were worth an estimated $1.7bn, were suspended\(^5\). Similarly, the Irish dioxin crisis of 2008 primarily impacted the pig meat, and also the beef and dairy sectors in both jurisdictions. The cost to the ROI taxpayer, for the financial assistance facility made available to the industry, was in excess of €100M, to say nothing of the cost to the whole industry of providing contingency supplies for their customers, lost business and the effect of reputational damage\(^7\). A description of the economic significance of the different Agri-Food sectors in the IoI economies, and the associated food safety issues, can be viewed in Appendix 3.

**Foodborne pathogens**

In terms of the potential for exposure of consumers – and therefore for disease – four bacterial species are currently responsible for the majority of cases of foodborne illness on the IoI namely, *Campylobacter*, *Salmonella*, verocytotoxigenic *Escherichia coli* (VTEC) and *Listeria* (see Appendix 5 for a description and exposure history). Table 1 presents the number of cases for 2009 and 2010 in both ROI and NI. These bacteria are important either because they cause a lot of cases of intestinal illness or because they have the potential to cause severe disease, or both. Cases of infection are usually acute but can have long-term complications. It is worth noting that these incidence rates are not corrected for under-ascertainment (the ratio of the total incidence of disease caused by a particular pathogen in the community to the number of cases actually reported to the national surveillance system). Under-ascertainment factors for the four pathogens in Table 1 are not available for the ROI. In the UK, under-ascertainment factors of 9.3, 7.4 and 4.7 were reported for *Campylobacter*, *E. coli* O157-VTEC and *Salmonella*, respectively, and while these factors are not directly transposable to the ROI incidence rates (due to differences in the reporting regime), nonetheless they give an indication of the extent to which incidence rates for pathogen-induced intestinal disease can be under-reported\(^26\).
Table 1: Cases of specific foodborne diseases in the Republic of Ireland and Northern Ireland in 2009 and 2010

<table>
<thead>
<tr>
<th></th>
<th>Republic of Ireland</th>
<th>Northern Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2009</td>
<td>2010</td>
</tr>
<tr>
<td>Campylobacteriosis</td>
<td>1808 (42.6)</td>
<td>1661 (39.2)</td>
</tr>
<tr>
<td>Salmonellosis</td>
<td>332 (7.9)</td>
<td>356 (8.4)</td>
</tr>
<tr>
<td>VTEC serovars</td>
<td>Total</td>
<td>241 (5.7)</td>
</tr>
<tr>
<td></td>
<td>O157</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>O26</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>29</td>
</tr>
<tr>
<td>Listeriosis</td>
<td>10 (0.2)</td>
<td>10 (0.2)</td>
</tr>
</tbody>
</table>

Data sources: Computerised Infectious Disease Reporting (CIDR)/Health Protection Surveillance Centre (HPSC) in ROI and the Communicable Disease Surveillance Centre (CDSC) in NI. Parasites and viruses may also cause foodborne disease. However, while the 2009 crude incidence rate for cryptosporidiosis in ROI was 10.5 per 100,000 population (total number of cases: 445), contaminated drinking water, direct animal contact and person-to-person spread are likely to have played a larger role in transmission. Similarly, while cases of infectious intestinal disease due to hepatitis A and rotavirus were also documented in ROI, these generally resulted from person-to-person contact

Chemical residues and contaminants

Exposure to toxic chemicals through the consumption of contaminated food is a significant public health risk, which is almost invariably associated with the food production environment with very little risk attributable to consumer behaviour. Establishing a direct cause-and-effect link between illness and exposure to chemicals in food can present a challenge for both scientist and public health practitioner alike, especially for low-dose chronic exposures. The risk assessment process primarily relies on toxicology data from animal (high-dose) and structure-activity studies, as well as assessments of human exposure and epidemiological data, although these are usually sparse. If sufficient data is available to indicate a potential for harm, a precautionary approach is taken to the regulation of a chemical. For certain chemicals, the concern is such that an assumption of no safe level of exposure is made and every effort to eliminate or reduce exposure to a minimum is taken. However, if a ‘zero tolerance’ approach is unattainable for logistical reasons, the ALARA (as low as reasonably achievable) principle is invoked. For instance, this is normally applied to levels of radioactive isotopes in food, as it is assumed that the biological effects of radiation follow a linear hypothesis, which asserts that any dose, no matter how small, may inflict some degree of damage to the cells in the body. This underscores the requirement for vigilance and monitoring
programmes for radioactive isotopes in food and other matrices are operated throughout the EU and wider world. In ROI, the Radiological Protection Institute (RPII) is the competent authority charged with the sampling and analysis of different matrices for radioactivity, while in NI this task is carried out by the Environment and Heritage Service’s Industrial Pollution and Radiochemical Inspectorate (IPRI). The results are published annually in the Radioactivity in Food and the Environment (RIFE) reports which represent a comprehensive summary of results from across the UK.

An acceptable level of exposure has been determined for many chemicals. There are essentially two methods of quantifying this exposure limit; the Acceptable Daily Intake (ADI) which pertains to residues of chemicals deliberately used in food production such as additives, pesticides and veterinary medicines, and the Tolerable Daily Intake (TDI) which pertains to chemical contamination of food from the environment. Both are essentially an indication of the amount of a chemical in food or drinking water that is not considered harmful if ingested every day over a lifetime. For agrichemicals used in food production, Maximum Residue Levels (MRLs) are set, which is the maximum amount of a residue allowed in a food as presented to the final consumer. The ADI is one of a number of factors taken into consideration when establishing an MRL, which is invariably lower than the ADI (good agricultural and/or manufacturing practice and technological need are also considered in setting MRLs). The MRL serves both to safeguard human health and to regulate trade in treated food commodities. They are a check that best practice is being adhered to during the production of food. For instance, the insecticide Deltamethrin was fully evaluated as part of the EU authorisation process for pesticide active substances. The toxicological profile of Deltamethrin was sufficient to allow the establishment of an ADI of 0.01 mg/kg bw/day. A range of MRLs have been established for use on different plant crops; that for cultivated mushrooms is 0.05 mg/kg. As part of the national control programme for pesticide residues in food carried out in 2010 by DAFM, an MRL breach was returned for use of Deltamethrin in the production of mushrooms in the Republic of Ireland. This resulted in the issuing of formal warning letters to the growers concerned followed by onsite inspection by DAFM officers who advised on corrective and follow up action. For other chemicals such as food additives, ADIs are established and good manufacturing practice and technological need are also considered: however, the concept of an MRL does not apply in this case.

TDIs have been set for a whole range of environmental contaminants including dioxin and heavy metals. For instance, the consumption of mercury, and its more toxic metabolite methyl mercury, via contaminated food (especially seafood), has been a public health concern ever since the Minamata Bay poisoning event in the 1950s. Even low doses of mercury can cause damage to the nervous system and possibly also the cardiovascular, immune and reproductive systems. Methyl mercury readily passes through both the placenta and the blood-brain barrier, so women of child-bearing age and children are particularly vulnerable to its effects. The EU takes the threat to public health from mercury very seriously. In 2005, it launched a Mercury Strategy which is a
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comprehensive plan to address mercury pollution both in the EU and globally\(^3\). It contains twenty measures to reduce mercury emissions, cut supply and demand and protect against exposure, especially to methyl mercury in fish. A Provisional Tolerable Weekly Intake (PTWI) for mercury of 1.6 µg/kg was established by the Joint Food and Agriculture Organisation of the United Nations (FAO)/World Health Organisation (WHO) Expert Committee on Food Additives (JECFA)\(^4\). In 2004, EFSA reviewed mercury intakes in the European populations and found that high consumers had intake levels close to the PTWI\(^3\). The maximum permitted level of total mercury in fish meat in the EU is 500 µg/kg wet weight for most species, and 1 mg/kg for specific fish species, including tuna\(^2\). Monitoring programmes routinely test fish and other foods for mercury content to determine on-going exposures to mercury and methyl mercury. A 2003 survey in the ROI, which analysed twenty two finfish species landed at ROI ports for trace metals, detected mercury in all species investigated\(^5\). However, the only breach of the established limit was recorded in dogfish meat. Being a species of shark, dogfish are known to accumulate high levels of mercury: however, it is not a commonly-eaten fish species, so the risk to public health is very low.

**Physical contaminants**

Physical contamination can happen when a foreign object unintentionally ends up in a food. Previous food product recalls have resulted from the discovery of such items as hair, glass, animal parts, nail chippings, bones, household objects, dirt, etc. Food businesses – both retail and catering – must exercise appropriate care as part of their hygiene control practices. This involves such measures as the employees wearing personal protective equipment such as hairnets and plastic gloves. There is an obvious food safety threat as the foreign body may cause physical discomfort or even a choking risk to the consumer or may be a source of pathogenic microbes or harmful chemicals. Also, the discovery of a ‘foreign body’ in a food product is detrimental to the key element that underpins a food business’ success, namely the trust and confidence of consumers in the business’ products and brand\(^6\).
3 Drivers of change that can influence the emergence of food safety hazards on the island of Ireland

The interconnectedness and complexity of the food chain makes it increasingly difficult to ascertain and isolate causal factors which give rise to emerging food safety issues. The EMRISK Working Group has acknowledged this difficulty, but has nonetheless identified several ‘drivers-of-change’, which they define as “issues shaping the development of a society, organisation, industry, research area, or technology”\(^5\). These drivers can influence the food environment and impact food safety. They are not confined by geography and, given the integration of the world’s economies, undoubtedly are of significance in an IOL context as well. Table 2 has been adapted from the EMRISK Working Group report. Of course, this list is by no means exhaustive: undoubtedly there are other drivers-of-change that are not identified here, but that could nonetheless impact the food environment. Drivers-of-change have been described in terms of categories such as social, technological, economic, environmental, political, legislative, etc. In the context of this report, political drivers were seen to have legislative consequences. It is evident that there is a certain inter-dependency among the drivers listed in Table 2. For instance, the effects of climate change will impact on the process of globalisation and the global food chain, which in turn will influence human behaviour, policy decisions, migration, etc., giving rise to pressures that will require political and scientific solutions. A single ‘causative’ driver is more likely to be part of a much larger and complex network of different drivers affecting different elements of the food chain.

<table>
<thead>
<tr>
<th>Driver</th>
<th>Category</th>
<th>Changes caused</th>
<th>Potential food safety impacts on the IOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Globalisation</td>
<td>Social</td>
<td>The removal of barriers to different</td>
<td>Foodborne hazards could be more difficult to contain and may give rise to global,</td>
</tr>
<tr>
<td></td>
<td>Technological</td>
<td>forms of trans-national interaction</td>
<td>rather than local, risks. The IOL food production industry is global in scope, as</td>
</tr>
<tr>
<td></td>
<td>Economic</td>
<td>which has come to be primarily</td>
<td>both economies are heavily dependent on the Agri-Food export sector. The open</td>
</tr>
</tbody>
</table>

Table 2: Drivers of change and their potential impacts on food safety on the island of Ireland
### Emerging Food Safety Issues

<table>
<thead>
<tr>
<th>Driver</th>
<th>Category</th>
<th>Changes caused</th>
<th>Potential food safety impacts on the IoI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental</td>
<td></td>
<td>associated with economic activity, including the increased movement of commodities and people. Globalisation underpins many other drivers of change as well.</td>
<td>economies on the IoI are susceptible to global hazards and risks, and the impacts of drivers of change elsewhere. Hence, the requirement for a robust food safety and control regime which links into the wider EU system. This was highlighted in 2005, when upwards of 70 retail food products were recalled from the IoI market place due to the presence of the illegal food dye, Sudan Red 1&lt;sup&gt;14&lt;/sup&gt;. This contaminant had entered via contaminated spice used in product manufacture. At the time, it was the largest product recall documented on the IoI.</td>
</tr>
<tr>
<td>Political</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global food chain</td>
<td>Social</td>
<td>Probably a consequence of globalisation. The chain between primary production and end product can be a highly complex multi-step process and can be global in scope.</td>
<td>The global food chain is increasingly complex with international discrepancies in regulatory controls, quality standards and legal frameworks aggravating risks. A typical ‘Hawaiian’ pizza produced on the IoI can consist of ham, cheese, pineapple, processed tomatoes and wheat which can originate in over 20 different countries worldwide&lt;sup&gt;47&lt;/sup&gt;.</td>
</tr>
<tr>
<td></td>
<td>Technological</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Economic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Political</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New science and novel technology</td>
<td>Social</td>
<td>Technological advances could be too rapid for adequate safety evaluations. Indeed the requirement for a safety evaluation may not even be recognised.</td>
<td>On the IoI, consumer demands and economic expedients force industry to develop and implement science-based technological solutions to food production. However, very often the process of safety evaluation cannot keep pace with these developments and may aggravate the implementation of new technological solutions. The application of nanotechnology to food industry processes has been stalled for this reason: not only are safety evaluations inadequate or non-existent, but the methods for carrying out risk assessments are currently under discussion&lt;sup&gt;48&lt;/sup&gt;.</td>
</tr>
<tr>
<td></td>
<td>Technological</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Economic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driver</td>
<td>Category</td>
<td>Changes caused</td>
<td>Potential food safety impacts on the IoI</td>
</tr>
<tr>
<td>-------------------------</td>
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<td>--------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Human behaviour and character</td>
<td>Social</td>
<td>Global events, such as financial crises or increases in food/feed/production prices, could foster a lowering of safety standards. Global media coverage of food safety crises will influence consumers' behaviour, with ramifications for the food production and regulatory regimes. Worldwide, a drive for excellence, care, attention-to-detail and rising standards is challenged by the effects of fraud, dishonesty, carelessness and apathy.</td>
<td>The open economies of the IoI render these vulnerable to the impacts of adverse human behaviours at home and elsewhere. The IoI food industry strives for greater excellence, care, attention-to-detail and standards to check any inherent weaknesses in the system, which may be the result of carelessness or apathy or even fraud or dishonesty. However, this is not helped by a current shortage of qualified food scientists/technologists who have the capacity to identify and manage risks. Also, fiscal pressures adversely affect the food safety regime with negative impacts on regulation and aggravation of food safety risks. The 2008 dioxin incident involved the replacement of vegetable oil for the purpose of drying food with diesel oil that had been illegally contaminated with transformer oil containing dioxins.</td>
</tr>
<tr>
<td>Demographic trends</td>
<td>Social</td>
<td>Shifting population demographics are expected to have a significant influence on food safety risks. This might include an ageing population, an increasing number of immunocompromised persons as people live longer with chronic diseases and changing patterns of immigration with the associated cultural changes in diet and food</td>
<td>The population on the IoI is aging, albeit not to the same extent as in other Western societies, resulting in an increasing proportion of the population that are more susceptible to the effects of food hazards. Population flux can aggravate the risks associated with the global food chain to which the people and economies on the IoI are vulnerable. In 2010, 14 per cent of the population in NI were aged 65 or over. This figure is projected to rise to 23 per cent by 2035. About 12 per cent of the population in ROI were aged 65 and over in 2011. Under certain assumptions, population projections suggest that the old dependency ratio (population aged 65 and over as a proportion of the 15-64 age group) may increase from 16 per cent in 2006 to 23 per cent in 2026 and to 32 per cent by 2041.</td>
</tr>
<tr>
<td>Driver</td>
<td>Category</td>
<td>Changes caused</td>
<td>Potential food safety impacts on the IoI</td>
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<td>--------------------------------------------------</td>
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<td>-------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Common Agricultural Policy (Common Agricultural</td>
<td>Economic</td>
<td>This will result in increased global competition with consequences for the</td>
<td>CAP reforms will impact directly on the food production systems on the IoI. The ramifications for food</td>
</tr>
<tr>
<td>Policy (CAP)) reform-after 2013</td>
<td>Environmental</td>
<td>sustainable production of food, food quality standards, biodiversity</td>
<td>safety are difficult to predict in a globalised economy. That said, it has been suggested that, in ROI</td>
</tr>
<tr>
<td></td>
<td>Political</td>
<td>and animal welfare among other concerns.</td>
<td>at least, the CAP reforms, and in particular the decoupling of payments, will lead to an overall</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>decline in the number of breeding animals and a resultant decrease in beef, sheep and pig meat</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>production. This does not correlate with the ambitions for increased agricultural production by</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>sector until 2020.</td>
</tr>
<tr>
<td>Enhanced analytical skills capacity</td>
<td>Social</td>
<td>Developments in analytical science/tools, in combination with zero-tolerance</td>
<td>The concepts of hazard and risk, and how the results of analytical investigations are</td>
</tr>
<tr>
<td></td>
<td>Technological</td>
<td>and/or zero-risk as a standard, are not pragmatic and are the likely result</td>
<td>communicated to different stakeholders including consumers, can have negative impacts on different</td>
</tr>
<tr>
<td></td>
<td>Economic</td>
<td>of the precautionary principal being applied in the absence of an adequate</td>
<td>Agri-Food industries. Accurate interpretation and communication are essential to guard against any</td>
</tr>
<tr>
<td></td>
<td>Environmental</td>
<td>toxicological database. Misinterpretation could lead to a loss of consumer</td>
<td>misunderstanding. Researchers at the Ashtown Food Research Centre in Dublin have developed an ultra-</td>
</tr>
<tr>
<td></td>
<td>Political</td>
<td>confidence and trust.</td>
<td>sensitive method for the detection of anti-helminthic residues in milk which has influenced the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>establishment of MRLs for a number of compounds.</td>
</tr>
<tr>
<td>Climate change</td>
<td>Economic</td>
<td>Results in climatic and physical environmental changes which impact on the</td>
<td>No food production system can escape the effects of climate change which are, by definition, global.</td>
</tr>
<tr>
<td></td>
<td>Environmental</td>
<td>biology of different species</td>
<td>The impacts of climate change on human behaviour and evolution will undoubtedly have consequences for</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>food safety. Prediction models</td>
</tr>
</tbody>
</table>
**Emerging Food Safety Issues**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Category</th>
<th>Changes caused</th>
<th>Potential food safety impacts on the IoI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Environmental Changes</td>
<td>Economic Environmental</td>
<td>Loss of biodiversity, deforestation, diminishing clean water resources, desertification, etc.</td>
<td>The international scope of the IoI Agri-Food industry and the inter-connectedness of the global food production chain mean that environmental impacts on food safety in one part of the world will filter through the chain and impact to some degree elsewhere as well, including the IoI. These impacts could be positive or negative.</td>
</tr>
<tr>
<td>Evolution</td>
<td>Social</td>
<td>Natural and man-made evolutionary pressures, for instance through the use/misuse of antimicrobial chemicals, can foster traits that can be difficult to control and quite potent.</td>
<td>The consequences of artificial selection due to inappropriate use of antimicrobial chemicals is an on-going problem for both public health and Agri-Food industry on the IoI.</td>
</tr>
<tr>
<td></td>
<td>Technological Economic Environmental</td>
<td>including microbial, animal and plant hazards that may present as new/altered food safety risks.</td>
<td>for ROI for the period 2021-2060 indicate a mean monthly temperature increase between 1.25 and 1.5°C, while precipitation is projected to decrease by approximately 10 per cent in June, with December values showing increases ranging between 10 per cent in the south-east and 25 per cent in the north-west. Key findings from the UK Climate Change Predictions estimate that by 2050, NI will have an increase in mean winter temperature of approximately 1.7 °C, an increase in mean summer temperature of approximately 2.2°C and changes in mean precipitation of approximately -13 per cent and +9 per cent in summer and winter, respectively.</td>
</tr>
</tbody>
</table>
Drivers of change associated with known or potential food safety issues on the island of Ireland

Driver: Evolution

Issue: Antimicrobial resistance

Antibiotics are natural substances secreted by bacteria and fungi to kill other bacteria that are competing for limited nutrients. The antibiotics used to treat people today are typically synthetic derivatives of these natural products. Some bacteria have become resistant to antibiotics through changes in their DNA, e.g. mutation or the acquisition of genetic material. Food is a perfect micro-environment for bacterial growth and for the continuing transfer of antibiotic resistance genes between food-related pathogens. The emergence of antibiotic resistant zoonotic bacteria that can be transmitted to humans through the food chain, may be a consequence of the widespread use of antibiotics in food animal production systems and human medicine. Increased incidence of treatment failure and severity of disease, as a result of infection with antibiotic resistant bacteria, has a negative impact on public health. Antimicrobial resistance, caused by the use/misuse of antimicrobial chemicals in food production, is a classic example of an evolutionary driver of change. It has been recognised in recent decades by authorities such as the Centre for Disease Control (CDC) in the US and European Centre for Disease Control (ECDC) in Europe^{56-57}.

It is difficult to determine the present extent to which food is involved in the spread of antimicrobial resistance. However, according to the EFSA Panel of Biological Hazards, foodborne pathogens and commensal flora are displaying an increasingly diverse level of antimicrobial resistance^{59}. It is known that antimicrobial resistant bacteria can spread to humans via contaminated foods (e.g. Salmonella). Thus, the same principles apply to both the prevention and control of the spread of pathogenic bacteria and the spread of antimicrobial-resistant bacteria. However, as this phenomenon is a particular public health risk, other measures may be required, e.g., limiting the use of antimicrobials at the pre-harvest phase of food production.

There are two main emerging issues in food-related antimicrobial resistance; the first is the increasing resistance to fluorquinolones in enterobacterial pathogens such as Salmonella Typhi, Typhimurium and Enteritidis, with reduced sensitivity to ciprofloxacin coupled with high-level resistance to nalidixic acid; the second is the rapid and recent emergence of resistance to third and fourth generation cephalosporins. Both are of public health concern. The genes coding for these enzymes may be located on highly transferable plasmids and are found in bacteria causing infections in hospitals, but also in infections acquired in the community. The transmission source of human exposure to fluoroquinolone resistance via food appears to be poultry, whereas pork and beef, as well as poultry, are important for cephalosporin resistance. It is these food production systems that require particular attention to prevent the spread of resistance from these sources. Therefore, as a matter of priority, specific measures need to be put in place to
counter the developing antimicrobial resistance found in a variety of bacterial isolates from food and from animals in primary production. The EFSA panel recommend that a full risk assessment of antimicrobial resistance for specific food-bacterium combinations should be undertaken using harmonised modified methodologies at both MS and EU level⁵⁸.

**Driver: Evolution**

**Issue: Bacterial gene transfer and stress-induced characteristics**

To adapt to, and survive, the stresses of changing environmental conditions, bacteria have global response systems that result in changes in gene expression and cellular metabolism. These environmental stresses induce response pathways which can extensively overlap. These stresses include DNA damage, temperature shift, nutritional deprivation and exposure to antibiotics. All of these global stress responses include functions that can increase genetic variability. Bacteria also have the ability to transfer virulence determinants inducing pathogenic or hyper virulent variants, as was observed in the *E. coli* O104:H4 outbreak in 2011⁶⁹. Again, this is a further example of an evolutionary driver of change, that can be natural or anthropogenic in origin, but that has ramifications for food safety.

A relevant case study came to light in 2009, when a report on a food poisoning outbreak in France identified a genetically distinct, non-motile variant of *Salmonella* Typhimurium. Eight people became ill after consuming homemade tiramisu prepared with raw eggs⁷⁰. The variant was recovered from all patients, the tiramisu itself and the dust and faeces from the suspected laying farm. The recovered isolate was characterised and found to be a clone of the multi-drug resistant *S. enterica* serovar Typhimurium DT104 known to cause human disease. This non-motile variant, which had been circulating in laying hens, had escaped the European poultry flock regulations, as it was initially not considered to be a Typhimurium. As a result of Commission Regulation (EU) 517/2011, French legislation has included notification of non-motile variants of *S. enterica* serovar Typhimurium after January 2010 to protect public health⁷¹. The likelihood of a known risk (multi-drug resistant *S. enterica* serovar Typhimurium DT104) evolving into a new form had not been anticipated.

**Driver: Climate change**

**Issue: Potential effects on biotoxins**

Marine biotoxins are a significant and expanding food hazard throughout the world and have been associated with mass killings of marine life and illness and mortality in humans⁷². Ciguatera fish poisoning is an example of a marine biotoxin-induced illness that was once confined to local indigenous communities in tropical regions, but which has now ‘gone global’ thanks to the international trade in fish products and mass tourism. The lol is not immune to this risk, as certain susceptible fish species are imported, while others are regular visitors to Irish coastal waters. In
addition, tourists from the lol vacation each year in areas of the world where the toxin is prevalent. Ciguatera fish poisoning is caused by the ingestion of fish containing the toxins of the marine dinoflagellate plankton, *Gambierdiscus toxicus*. The symptoms of ciguatera fish poisoning include nausea, vomiting, pain and also muscle weakness and disturbances of the nervous system. The dinoflagellate is frequently found in damaged coral reef systems in the Pacific, Caribbean and Indian Ocean. Cases of ciguatera fish poisoning have increased in Europe, largely due to foreign travel by Europeans to tropical countries where the disease is endemic. However, outbreaks on the Canary Islands between 2004 and 2009 involved the consumption of locally-caught fish which were contaminated with Ciguatoxin. Furthermore, *Gambierdiscus toxicus* has been detected in the Eastern Atlantic, while the actual toxin has been identified in samples of fish from the Mediterranean Sea (2007) and Madeira (2010). There is a possibility that the apparent expansion of the dinoflagellate’s range is a consequence of climate change. As is currently the case with other marine phycotoxins, the presence of this emerging issue in European waters could have ramifications for both the European shellfish and pelagic fish industries. The increase in cases of intoxication in European tourists was attributed to increased global travel, and did not give rise to concerns as to the potential for the disease to spread naturally, despite Ciguatera fish poisoning being the most common type of marine biotoxin food poisoning worldwide, with an estimated 10–50,000 people succumbing to the toxin annually.

The expansion of marine biotoxins is mirrored on land by the expansion of mycotoxins. These are toxic chemicals produced by fungi and moulds that impact on a variety of food crops, especially cereals. The environmental conditions conducive to their production have been studied and the impact of climate change on fungal growth and distribution is currently under investigation. The forecast temperature and precipitation consequences of climate change on the lol will affect the production of both traditional and new crop varieties, and this will in turn impact on the variety and extent of the mycotoxin contamination risk. The implications for human and animal health due to exposure to mycotoxins have been studied. Mycotoxicoses results in decreased productivity in food producing animals, while mycotoxin exposure is associated with different disease states in humans. The importance of proactively identifying the potential health and economic impacts of mycotoxins influenced by climate change has been emphasised. EFSA’s EMRISK Unit has identified changing patterns in aflatoxin contamination in cereals such as wheat, maize and rice, due to climate change as a potential emerging food safety hazard. The risk scenarios generated suggest a greater risk of aflatoxin contamination of maize in the southern EU countries but a low risk in northern EU countries. They predict a very low aflatoxin contamination risk for wheat and rice in the EU as a whole. The report did not deal with other mycotoxins.
Driver: Human behaviour and character

Issue: The Irish pork dioxin crisis of 2008

The root cause of many food safety events is essentially either economic expediencies or human behaviour or both. A lot of the information which is needed to identify potential issues and risks may already exist, but is missed, ignored or downplayed due to what are termed ‘cognitive impediments’ which are, in essence, a form of human error. These give a false sense of security, either at the individual or organisational level, resulting in warning signals being overlooked, discounted or even ignored. This can lead to “predictable surprises” which, in hindsight, were somewhat obvious. In addition, fiscal pressures can act as incentives for fraud, carelessness, or the taking of short cuts at any stage in the food production chain. The Irish pork dioxin crisis of 2008 is an example of how these cognitive impediments and fiscal pressures conspired to impact on the food production chain. Transformer oil was identified as the source in this case and also during the 1999 dioxin crisis in Belgium. The EU identified weaknesses in feed and food safety regulation on foot of the Belgian crisis and, while there were subsequent advances in scientific risk assessments, legislation and other controls, considerable discretion remained on the part of MS in managing food crises themselves. This encouraged systemic weaknesses which became evident in the Irish crisis of 2008. The report of The Inter-Agency Review Group on the Dioxin Contamination Incident in Ireland in December 2008 highlighted deficits in the food business’ feed safety management system and in the inspection control regime, and concluded “there needs to be more effective collaboration and co-ordination between the official authorities involved in registration/licensing and inspection of premises”.

Driver: Enhanced analytical skills capacity

Issue: Ethyl carbonate and acrylamide

Advances in analytical science have seen a lowering of the detection and quantitation limits for a multitude of chemical compounds in food, as well as the development of screening techniques which can test for multiple chemical compounds simultaneously. This has not given rise to new issues and potential risks per se, but has simply highlighted their presence which may have hitherto been concealed by shortcomings in analytical capability. Ethyl carbamate is genotoxic and carcinogenic in animals and is regarded as a probable carcinogen in humans. Since the 1980s, its presence in a range of distilled and fermented foods has been confirmed including wine, beer, whiskey, yogurt and bread. This prompted the Canadian Health Protection Board to set a guideline limit of 0.15 ng/l for ethyl carbamate in distilled drinks, while the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment in the UK concluded in its 1992 review, that ethyl carbamate levels in food and drink should be reduced to the lowest technologically achievable. This was reiterated in 2005 by the JECFA, which highlighted the low margin-of-exposure for ethyl carbamate in the diet (i.e. the difference between the amount ingested and the levels at which toxicity occurs was too small). The likelihood is that ethyl
Emerging Food Safety Issues

carbamate has always been present in distilled and fermented foods. However, a combination of increased analytical capacity and an expansion of the toxicological database have highlighted the compound as a potential food safety risk to human health.

Similarly, the toxic effects of acrylamide have been known for some time. Experimental studies with acrylamide in animals have resulted in a classification for neurotoxicity, genotoxicity and as a probable human carcinogen. In 2002, the Swedish National Food Administration and researchers from Stockholm University announced that they had detected significant levels of acrylamide in carbohydrate-rich foods that had been prepared/cooked by frying, grilling, baking or toasting. JECFA investigated dietary exposure levels of acrylamide and, in 2005, announced that these gave rise to concerns for human health and called for continued efforts to reduce acrylamide in food. This is a further example of a hazard that probably had always been present wherever carbohydrate-rich foods had been prepared by these processes, but which had remained undetected and unsuspected until the Swedish analyses of 2002. Literally overnight, these rudimentary and ubiquitous cooking techniques became a food safety issue which, upon an analysis of the exposure, was rapidly upgraded to a full blown food safety risk.

Driver: New science and novel technology

Issue: Genetically Modified technology and Nanotechnology

The application of scientific and technological advances to food production and manufacturing can be a major source of public (and therefore regulatory and industrial) angst. For instance, the pasteurisation of milk caused major public concern when introduced in the USA in the 1920s. An incomplete safety assessment of a new technology (or the perception of same) can give rise to a suspicion of ‘unknown’ adverse health effects. Genetically Modified or ‘GM’ technology is the most obvious example of this, and the battery of safety assessments which have been carried out, have never shown a link between exposure and ill-health in consumers. Nonetheless, the debate over the development and implementation of GM technology to food production continues in Europe. Proponents cite benefits such as responding to increased food production demands, alleviating the effects of climate change, a reduced dependency on pesticides, enhanced crop and animal traits, and the absence of adverse health effects in humans or animals. Opponents cite moral and ethical considerations including concerns over the potential impacts on human health, the environment and the economy. The principal potential health concerns, apart from any potential for direct toxicity, are allergenicity and gene transfer. Although no allergic effects have been found in GM foods currently on the market, and the probability of gene transfer has been shown to be low, this has done little to assuage consumer concerns, at least in Europe. The ROI (but not the UK) was one of a number of countries which bucked the trend, with a slight majority of those questioned supporting GM. A lack of consumer information on the issue may be contributory to the negative image of GM technology. Regulators are aware of the potential for a ‘repeat performance’ in terms of consumer perceptions of nanotechnology and
Emerging Food Safety Issues

have advocated engagement with consumers at an early stage\textsuperscript{87,88}.

Nanotechnology is the engineering of functional systems at the molecular level and refers to the use of very small particles (nanoparticles) that are less than 100 nm in size (there are 25.5 million nanometers in 1 inch)\textsuperscript{88}. Current and potential applications of nanotechnology in the food industry include nanocomposites in food containers to minimise carbon dioxide leakage out of carbonated beverages, or reduce oxygen inflow, moisture outflow, or the growth of bacteria in order to keep food fresher and safer for longer. Nanosensors built into plastic packaging can highlight food spoilage, while nanosensors, to detect Salmonella, pesticides and other contaminants before packaging and distribution, are being developed\textsuperscript{89}. However, the implementation of these applications can only be accomplished if the safety of the resulting food products can be assured\textsuperscript{90}. The paradox is that the safety evaluation is trailing behind the developments in technology. This was acknowledged in the report on the Relevance for Food Safety of Applications of Nanotechnology in the Food and Feed Industries which was published by the FSAI in 2008\textsuperscript{91}. An EFSA report in 2009 corroborated this finding and recommended the development of analytical methods to detect nanomaterials in food, feed and biological tissue samples, as well as determining exposures to nanomaterials\textsuperscript{92}. EFSA has established a Scientific Network for Risk Assessment of Nanotechnologies in Food and Feed to ensure an efficient and robust risk assessment of any current or proposed application to food production\textsuperscript{93}. 

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4 Drivers of Data sources of potential importance in emerging issue identification

EFSA has specified data collection as a fundamental step in the emerging risk identification process. The EMRISK unit has established a working group to address the whole issue of data collection (DACO) and the group reported their findings in 201194. The group adopted the potential data sources identified in the report of the 15th meeting of the EFSA Scientific Colloquium on Emerging Risks. These sources captured both top-down and bottom-up approaches to issue identification. They can be loosely sub-divided into national or international data sources:

**International sources of data**

- EU agencies
- National and international scientific committees (including EFSA itself) and research coordinators
- Media data and information

**National sources of data**

- National official agencies
- Consumer pattern data
- Scientific research
- Trade data and market research
- Stakeholder data and information including industry, primary production, non-governmental organisations and consumers.

Many of the data sources identified as being useful for this purpose are similar to those that would be utilised in the routine risk assessment of known food safety hazards. They are multidisciplinary and originate from within and outside the food and feed chain, thereby facilitating a holistic approach to the identification of emerging issues. They give rise to hard data (measurements, observations, trends, etc.) that act as indicators which can signal the emergence of a new or changed hazard and possible risk. The DACO WG also adopted the eleven priority indicators that had already been defined by the EFSA Scientific Cooperation (ESCO) working group. These are:-
Emerging Food Safety Issues

1. New research data indicating toxic properties of substances possibly occurring in food or feed
2. Unexpected detection in food or feed of a potentially toxic/radioactive chemical
3. Emergence of new zoonotic and other foodborne pathogens
4. Emergence of a new or exotic biological agent that is pathogenic to animals
5. Emergence of increased resistance to antimicrobials and plant protection products
6. Emergence of a new or exotic biological agent that is pathogenic to plants/food/feed crops
7. Increased virulence of known pathogens (including plant pathogens)
8. Unexpected evidence of increased exposure of specified human (sub)populations to particular hazardous chemical/biological/radioactive contaminants and other agents in the food/feed chain
9. Unexpected evidence of increased exposure of specified animal (sub)populations to particular hazardous chemical/biological/radioactive contaminants and other agents through food
10. Unexpected increased susceptibility of (sub)populations to known contaminants and other hazardous substances not regulated in the food/feed chain
11. Dietary changes or imbalances caused by modification of food consumption habits.

Using these indicators, 188 potential sources of data were identified and assessed for relevance, validity and credibility as well as timeliness, accessibility, clarity and comparability\footnote{95,96,97}. The importance of expert judgment and the provision of IT solutions for managing substantial volumes of data were emphasised.

On the IoI, it is highly unlikely that where data is being captured, it is used for the identification of emerging food safety issues. Nonetheless, we can describe the current structures for capturing data and the sources of data which can be generated nationally or internationally. A classification or quality assessment of these data sources is beyond the scope of this report.

International sources of data

EU agency data

ECDC

The founding legislation of the European Centre for Disease Prevention and Control (ECDC) specifies the organisation's mandate regarding risk identification and risk assessment: (a) identify, assess and communicate current and emerging threats to human health from communicable diseases, and (b) establishing a framework for collecting, collating and analysing information and relevant data\footnote{99}. The mandate also requires the ECDC to ‘assist the Commission by operating the early warning and response system’. The goal is to speed up detection of potential health threats as well as facilitating timely responses. The ECDC has instigated a process by which emerging communicable disease risks can be identified. The
Epidemic Intelligence Information System (EPIS) will allow risk assessment bodies to exchange information regarding current or emerging public health treats with a potential impact in the EU. In this regard, the work load among the various national public health institutes with regard to surveillance and control activities can be better co-ordinated and shared. The importance attached to the range and number of network stakeholders or “sources of epidemic intelligence information”, is evident and a comprehensive list of these is available on the ECDC website\(^9\). These include laboratory experts of the European Network for Diagnostics of Imported Viral Diseases (ENDIV) and from clinical experts in tropical and travel medicine of the European Travel Medicine Network (EuroTravNet)\(^100,101\).

The ‘Epidemic Intelligence’ process is designed to detect, verify, analyse, assess and investigate public health events that may represent a risk. To assist in the monitoring of emerging communicable disease risks, the ECDC has developed a ‘Threat Tracking Tool’ which enables verified events with a known or possible impact on public health to be tracked\(^102\). The epidemic intelligence team is responsible for the communicable disease threat reports which are published weekly. In addition, the ECDC has published Annual Threat Reports since 2009, as part of its Early Warning and Response System (EWRS). These reports describe emerging threats that were either directly reported to ECDC through MS notifications on EWRS, or found through active screening of various sources, including national epidemiological bulletins, international networks Programme for Monitoring Emerging Diseases (ProMED), Global Public Health Intelligence Network (GPHIN) and the media\(^103\). These summarise information gathered through epidemic intelligence by ECDC regarding communicable disease threats of concern to the EU. They also provide updates on the global situation and changes in the epidemiology of communicable diseases with potential to affect Europe and include diseases under elimination. The national contact organisation for the ROI within the ‘Epidemic Intelligence’ process is the HPSC, while in the UK (and therefore NI) this role is taken by the Health Protection Agency.

**Rapid Alert System for Food and Feed**

The Rapid Alert System for Food and Feed (RASFF) was established in 2002 to provide national authorities, with responsibility for food and feed safety, with a mechanism to exchange information about measures taken in response to the detection of food or feed safety risks\(^104\). This networking tool facilitates the rapid and co-ordinated response to a health threat caused by food or feed. The effectiveness of the RASFF lies in its simplicity with specific contact points in the MS, the Commission, EFSA and the European Economic Area, and the use of clearly defined templates for the exchange of information. Information generated by a MS is rapidly transmitted, via the Commission, to the other MS. The national contact point for ROI is the FSAI, while the FSA fulfils this role in the UK (and NI via the devolved administrations). While there is no stated element of horizon scanning – RASFF is by its very nature reactive –
the accumulation of hazard event data identifies the RASFF database as an important data source for trend analysis and other information for substantiating any suspicions with regard to potential emerging food safety issues. The database has been investigated for its utility in this regard; however, it was recommended that RASFF data has potential value only when combined with other data including risk assessments, surveillance trends, hazard information and management measures, to provide a holistic approach to the identification of emerging food safety issues. The RASFF database is used by EMRISK to identify potential emerging food safety issues.

International / National scientific committees

EFSA Scientific units and panels

The function of the EFSA scientific units and panels is to provide independent scientific advice on specific food safety hazards and an assessment of the risks posed by them. In the area of risk assessment and scientific assistance, there are panels concerning Animal Health and Welfare (AHAW) Panel, Biological Hazards (BIOHAZ Panel), Contaminants (CONTAM Panel) and Plant Health (PLH Panel), as well as units for Biological Monitoring (which analyses and reports data of zoonoses, antimicrobial resistance, microbiological contaminants and foodborne outbreaks), Dietary and Chemical Monitoring (which deals with the collection, collation and analysis of data on food consumption and chemical occurrence in food and feed for exposure assessments at European level) and Scientific Assessment Support (which provides technical support in the field of statistics, modelling, data management and risk assessment). There are five panels concerning the scientific evaluation of regulated products from the perspective of Feed (Panel on Additives and Products or Substances used in Animal Feed (FEEDAP)), Nutrition (Panel on Dietetic Products, Nutrition and Allergies (NDA)), Food Ingredients and Packaging (Panel on Food Additives and Nutrient Sources added to Food (ANS)), Panel on Food Contact Materials, Enzymes, Flavourings and Processing Aids (CEF), GMOs (Panel on Genetically Modified Organisms (GMO)) and Pesticides (Panel on Plant Protection Products and their Residues (PPR)).

In addition, there are three science strategy and co-ordination units concerned with Advisory Fora and Scientific Co-operation (strengthening scientific co-operation and networking between EFSA and EU MS/pre-accession countries), Emerging Risks (responsible for establishing procedures to monitor, collect and analyse information and data in order to identify emerging risks) and the EFSA Scientific Committee (responsible for supporting the scientific panels in the preparation of scientific advice in the area of new and harmonised approaches for risk assessment of food and feed and also strategic advice to EFSA’s Executive Director).

EFSA has also established a series of networks composed of MS experts, whose role is to exchange information with EFSA and strengthen links between EFSA and MS risk assessment
functions. Examples of relevant networks are the Emerging Risks Network (ERN) and Microbiological Risk Assessment Network (MRAN).

Zoonoses Committees on the Iol

There are a number of agencies, government departments, and both governmental and non-governmental groups who together provide monitoring and surveillance capacity on the island of Ireland. These will be outlined in the subsequent Chapters. In both jurisdictions, zoonoses committees have been established on the island of Ireland since the 2002 report106. These committees comprise multidisciplinary teams of Public Health, Veterinary Public Health, Environmental Health and laboratory professionals, and provide a forum for interdisciplinary discussion. In NI, a Regional Zoonoses Group has been established and is chaired by the Chief Medical Officer (CMO) for NI. In addition, in the UK an overarching UK Zoonoses Group exists107. As of 2009, this group has merged with the Surveillance Group on Diseases and Infections of Animals to form the UK Zoonoses Animal Disease and Infection Group. This new group will meet twice a year and will be chaired by the CMO and co-chaired by a Chief Veterinary Officer (CVO) on an alternating basis.

Zoonoses Committees operate at both regional and national level in ROI. Regional zoonoses committees in ROI share information, foster collaborations, produce joint protocols and engage in horizon scanning at a local level. The ROI National Zoonoses Committee provides a mechanism for information exchange on zoonotic disease among key stakeholders. It also provides an important national forum for the Regional Zoonoses Committees.

Media data and information

In general, media – be it visual media, radio or the different facets of social media – does not generate data but instead exploits other data sources. Investigative journalism has the potential to highlight hitherto unacknowledged threats or problems concerning food safety, and may also be a source of collated or summarised data. There are a number of systems which monitor the media for signals or indications of safety threats in food and feed. MedISys is part of the European Media Monitor and is dedicated to the collection of media reports on medical and health-related topics including food safety issues108. Similarly, ProMED-mail - the Programme for Monitoring Emerging Diseases which is part of the International Society for Infectious Diseases – uses a variety of sources for information including the media109. In a recent study, these media monitoring systems were compared with RASFF for their capability to detect the presence hazards in food and feed. The authors concluded that MedISys was a promising early warning system for food and feedborne hazards, but that further customisation was necessary to improve the sensitivity110.
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National sources of data

National official agencies

Surveillance of microbial foodborne illness on IOI

Surveillance data is key to identifying emerging microbial foodborne disease issues, either through the investigation of individual outbreaks, through monitoring trends in outbreak data, or through recognition of changes in the expected distribution of sporadic disease incidences. A recent example of the predictive power of surveillance data is the association between foodborne illness and the consumption of raw beetroot in Finland in 2010, which resulted in *Pseudomonas fluorescens* being flagged as a potential emerging pathogenic agent

In IOI, surveillance of all infectious disease outbreaks (including those suspected as foodborne) is carried out by the Health Protection Surveillance Centre (HPSC) in ROI and the Health Protection Service of the Public Health Agency (PHA) in NI. The information collected on outbreaks includes the pathogen implicated (if known), the burden of illness caused, the source and transmission route for infection, and the factors which contributed to occurrence of the outbreak. In addition, in both jurisdictions, there are systems for reporting on sporadic disease incidences for a range of infectious diseases potentially transmitted by food. For selected diseases (especially those with high outbreak potential), additional epidemiological and typing data are collated for sporadic as well as outbreak cases. In both jurisdictions, information on foodborne disease is generated from one or more of the following sources:

1. Statutory notifications from medical practitioners (NI and ROI);
2. Statutory notifications from laboratory directors (ROI);
3. Voluntary reporting by laboratories (NI);
4. Reference laboratory reporting (NI and ROI);
5. Reported outbreaks of foodborne disease (voluntary (NI), statutory (ROI));
6. Enhanced surveillance systems for specific diseases, e.g. Verocytotoxigenic *Escherichia coli* (VTEC) in ROI and VTEC O157 in NI.

In ROI, an enhanced surveillance system for VTEC O157 was established in 1999, and for all VTEC cases in 2004. Each case identified is investigated thoroughly, contacts are screened as appropriate, potential links between cases are investigated, and a comprehensive standard dataset of information is collected and collated nationally by HPSC via the national electronic web-based information system, CIDR. When cases of VTEC O157 are identified in NI, a similar thorough investigation is undertaken and information is collated locally. This information has been collated at NI level since 2005, using a VTEC O157 specific questionnaire. There is also enhanced surveillance for listeriosis since 2001, for cryptosporidiosis since 2010, and for salmonellosis since 2011 in ROI. In both jurisdictions, if a medical practitioner becomes aware of, or suspects that, an attending patient is suffering from a notifiable infectious
intestinal disease, the practitioner is legally required to notify the relevant medical officer. The information is submitted to either the PHA or the Health Service Executive (HSE). In the PHA, individual notification details are linked with laboratory reports at a central level. In ROI, clinical and laboratory data are linked at Department of Health and Children level and made available electronically via CIDR. Laboratory directors, medical scientists in clinical laboratories, public health doctors, surveillance scientists and other relevant staff in public health departments have secure, regulated access to CIDR for the management of surveillance and control of infectious diseases.

In NI, clinical laboratories provide information on laboratory isolation/detections of microorganisms of public health significance to the PHA for local public health action and for regional surveillance. This is done on a voluntary basis. Using software developed and used by the Health Protection Agency (HPA), clinical laboratories electronically forward reportable organisms to the PHA. This information is then sent to the HPA Centre for Infections in London for incorporation into the UK national database. In ROI, the clinical laboratory director is legally required to report all notifiable pathogens to regional departments of Public Health, and this is linked to clinical epidemiological data on CIDR and is available for analysis on a local and national level. The use of electronic reporting in NI and ROI allows production of data in a standard format for each jurisdiction. Such information can be used to provide similar outputs and allows the comparison of NI and ROI data.

Personnel involved in foodborne disease investigation and management are routinely informed of changes in microbial foodborne disease trends and emerging issues through (a) the scientific literature including Eurosurveillance, (b) publications and communications from national and international public health agencies including Public Health departments and (c) disease digests such as Promed mail and the HPA UK Emerging Infections Summary196,197,198. The HPSC publishes data on foodborne illness via an Annual Infectious Disease Report, Weekly Infectious Disease and Acute Infectious Gastroenteritis reports, Weekly Outbreak Reports and quarterly reports on the Surveillance of Infectious Intestinal Disease (IID) and Zoonotic and Vectorborne Disease199,200,201,202,203. In NI, disease surveillance data is published, among other routes, in ‘Transmit’, a monthly infectious disease report204.

Formal evaluation at European level of trends in foodborne outbreak aetiology, locations where outbreaks occur and the factors which contribute to their occurrence, is undertaken jointly by ECDC and EFSA. The EFSA annual reports are based on foodborne outbreak surveillance data reported by HPSC (ROI), the HPA (NI) and other national public health agencies throughout the EU. The advantage of this larger dataset is that trends can be more readily assessed205. A schematic of the surveillance network involved in the identification, risk assessment and risk management of pathogens of human and animal health concern can be viewed in Appendix 4. While this particular example pertains to the whole of the UK
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including NI, the surveillance network in the ROI.

Consumer pattern data

Food consumption data

The Irish Universities Nutrition Alliance (IUNA), which consists of four third-level partners from University College Cork, University of Ulster, Trinity College Dublin and University College Dublin, has conducted a number of studies on food consumption on the Iol. These include the National Teens’ Food Survey (ROI), the National Children’s Food Survey (ROI), The North-South Ireland Food Consumption Survey (ROI and NI) and the National Adult Nutrition Survey (ROI). In addition, the ROI National Adult Surveys of Lifestyles, Attitudes and Nutrition (‘SLÁN’) in 1998, 2002 and 2007 provide further consumption pattern information. In the UK, the National Diet and Nutrition Surveys (NDNS) include a rolling survey of the food consumption, nutrient intakes and nutritional status of adults throughout the UK. The data is not broken down geographically so information specific to NI is unavailable. Instead, the Northern Ireland Health and Social Well-being Survey (NIHSWS) has been conducted on three occasions to date – 1997, 2001 and 2005.

Research data

Food safety research on the Iol

Research into food safety, addressing microbial and chemical contamination at all stages of the food chain, is conducted by the universities and research institutes across the Iol. In NI, the main centres carrying out research in this area include the Institute of Agri-Food and Land Use at Queens’ University Belfast and the School of Biomedical Sciences at the University of Ulster. The Agri-Food and Biosciences Institute conducts research into agriculture, food, fisheries, horticulture and the environment for DARD, as well as for other public and commercial bodies.

In ROI, the Colleges of the National University of Ireland, including University College Dublin’s Institute of Food and Health and Centre for Food Safety, as well the Institutes of Technology, generate significant amounts of research data pertaining to food safety and the security and sustainability of the food chain. In addition, Teagasc, the Agriculture and Food Development Authority, provides research services to the Agri-Food industry, while the Marine Institute is responsible for marine research, technology development and innovation. One of the main funding bodies for fundamental and basic non-commissioned food research at third level in ROI is the Department of Agriculture, Food and the Marine (National University of Ireland) via its Food Institutional Research Measure (FIRM). The goal of FIRM is to augment the bank of knowledge and expertise within the research community, which the food industry can exploit for the purposes of innovation and development. This enhanced
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research capacity has also permitted researchers to participate in transnational research programmes, such as those funded under the European Union’s Framework Programmes for Research and Technological Development (FP) and the all-island Food for Health Research Initiative, which is jointly administered by the Department of Agriculture, Food and the Marine (DAFM) and the Health Research Board(19).

*safefood* undertakes a wide ranging programme of research and since its establishment, the organisation has commissioned over one hundred research projects covering various scientific disciplines including microbiological and chemical risks and hazards, studies of dietary patterns, food intakes and attitudes among various population cohorts, food poverty and food allergy and intolerance issues. *safefood*’s research obligations are an integral part of its primary function, which is to promote the realisation that food safety throughout the food chain is a shared responsibility. In this regard, the research programmes are targeted at the whole food chain on the Iol and strive to encourage, wherever possible, all-island working relationships and enhanced partnerships between research institutions.

The data generated by these research groups is reported in peer-reviewed publications, research reports and conference proceedings, and outputs of economic importance can be communicated to relevant industries. Funding bodies frequently list completed and on-going research projects on their websites, for example, the DAFM website in ROI. However, reports on completed projects may not be readily accessible. Peer-reviewed publications may be found through searches of databases such as PubMed, Science Direct, Google Scholar, Athens, etc.

**Futures research**

Futures research uses various techniques to predict, and thereby prepare for, future events. It is an evolving discipline which is by nature interdisciplinary, combining developments in science and technology, society, economy, politics, legislation, etc. As a result, there is considerable variation in the terminology and approaches used between different organisations and disciplines. The most commonly employed techniques include horizon scanning, trend research, visioning, scenario building and back-casting. Futures research is encompassed within foresight activities, which combines stakeholder networking with a capacity for prediction, the goal being the influencing of policy and strategy. Horizon scanning is focussed on the early detection of potentially important changes through a systematic examination of possible threats and opportunities. Novel and unexpected issues are investigated as well as persistent problems and trends. It therefore is reliant on trend impact analysis, which is simply forecasting based on the future extrapolation of historical data. Together, these techniques can generate signals, trends and scenarios as well as wild cards. It is not known to what extent the various governmental and academic stakeholders in
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the IOI food chain engage in futures research activity.

**Trade data and market research**

**All-island trade statistics**

InterTrade Ireland was established under the British-Irish Agreement of 1999, to co-ordinate work on trade and business development on an all-island basis with a particular focus on SMEs. This is achieved through “co-operative business, policy and research programmes, partnerships and networks.” InterTrade Ireland collates and publishes trade statistics on cross-border sectorial and total trade, tourism flows, transport flows, student flows and economic indicators. These are available in interactive format on the website. In addition to trade data, InterTrade Ireland publishes a series of all-island sectorial market intelligence reports on niche and emergent sectors, with the aim of facilitating the development of business strategies. An all-island Business Monitor Survey of business sentiment is published quarterly.

**Bord Bia data**

Bord Bia publishes a number of marketing reports on a wide range of topics including specific food commodities, consumer consumption and attitudes, nutrition, price and value, and retail trends. The latter reports detailed overall trends in retail sales and other aspects, such as supply chain logistics and the impact of technology on shopping habits. They do not provide consumer consumption data. In addition, Bord Bia publishes a number of industry commentary reports on such topics as the export performance of Irish food products including specific commodities such as Meat and Livestock.

**Agricultural production and trade data**

In NI, DARD publishes statistics on agriculture, food, animal health, fisheries and forestry. This includes the Northern Ireland Food and Drinks Processing Sector reports which deal with economic aspects of the food and drinks processing sector in NI. They also carry out Expenditure and Food Surveys, as part of a UK-wide endeavour, to ascertain household food consumption and expenditure. These surveys also capture data on food consumed outside the home. The data is processed centrally by the Department for Environment, Food and Rural Affairs.

In ROI, the Central Statistics Office (CSO) publishes official statistics on agricultural production and associated trade (including fisheries and aquaculture) that are generated by government departments and state organisations. In addition, DAFM publishes a Compendium of Agricultural Statistics, which cover different aspects of the agricultural economy. As well as
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DAFM data, the compendium is compiled using statistics from the CSO, EC DG Agriculture, Eurostat, Teagasc, the Central Bank of Ireland and the Department of Finance. DAFM also publish statistics on bovine brucellosis and tuberculosis. Farm level economic statistics are published by Teagasc in their National Farm Survey. The Sea Fisheries Protection Authority publishes statistics on fish landings and quotas. Import and export trade data for overall agricultural outputs and food commodities classified according to Standard International Trade Classification are made available through the CSO.

Retail data

Consumer data on food and drink consumption and shopping habits based on retail checkout statistics is not readily available. A number of organisations provide general trade data for Ireland and the UK. In the UK, the BRC, sponsored by KPMG, publishes the Retail Sales Monitor. Sales across a range of 12 product categories (including food and drink) are collated weekly, and this data is used to generate growth rates for each week and month. Food and drink data is submitted by the Institute of Grocery Distribution via their Market Track scheme, covering the entire grocery sector. The official statistics for ROI and NI also provide annual value and volume indices for retail sales and Food Beverages and Tobacco is one of the categories investigated.

Stakeholder data

Food industry data

The food industry as a whole possesses considerable amounts of data on the safety and quality of a wide variety of products. They are obliged to do so in accordance with a raft of food safety and hygiene legislation. Under Regulation (EC) No. 2073/2005, food business operators are required to validate or verify the correct functioning of their food safety hazard control plans, based on Hazard Analysis at Critical Control Points or ‘HACCP’, by analysing trends in the test results, and by taking appropriate actions to prevent microbiological risks when they observe a trend towards unsatisfactory results. These, and other data, have been gathered routinely over time by individual companies as part of their own internal monitoring systems. Depending on the business, laboratory analyses may either be carried out in-house or by contracting out on a confidential basis to commercial private and accredited laboratories. It would be expected that these monitoring and surveillance activities relate to the particular conditions in-house in a manufacturing plant. The data may be obtained through the use of individualised sampling plans and different sampling methodologies, and consequently may not readily lend itself to inter-laboratory comparison. However, laboratory method accreditation and the application of IT solutions and various statistical tools have the potential to overcome these limitations and permit data compilation and interrogation.
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From the perspective of an individual food business, data sharing could provide a better context for sampling and surveillance. However, the possibility of sharing data would be predicated on the necessary assurances concerning commercial confidentiality and intellectual property being given. In May of 2011, the FSA initiated a consultation on a proposed framework it intends to use when co-funding scientific research with industry or other interest groups, and also to enable the use of external scientific data not in the peer-reviewed literature. The FSA already utilises external data from a number of sources, including industry, in formulating policy and carrying out impact assessments. In its consultation, the FSA proposes to adopt the framework produced by the General Advisory Committee on Science for the utilisation of industry data (Annex C to the consultation). Within this framework, it was recommended the FSA should clarify the representativeness and validity of industry-generated data, and should carry out an independent review of all such primary data, especially before the outcomes of any secondary research (systematic reviews and meta-analyses) could be accepted. These FSA proposals address two primary concerns relating to the use of industry data. Firstly, unease that there could be biases in the way in which data has been collected by industry and secondly, commercial concerns leading to a withholding of information that industry might consider critical to its commercial interests or policy objectives. To assuage these fears, the framework advocates assurances that commercial confidentiality and intellectual property rights would be respected, and encourages co-funding opportunities with industry partners to the benefit of both parties.

Consumer data

The agencies involved in food safety on the IoT operate consumer advice helplines including *safefood*, FSAI, FSANI, local government agencies, etc. Helpline queries are categorised and recorded, and while the databases are not routinely scanned for signals or trends that may indicate emerging threats to the safety of food, potentially they could be exploited, albeit at a rudimentary level, for this purpose.
5 Networking elements for identifying emerging food safety issues

EFSA has highlighted the establishment of networks for information exchange as the third and final step in the emerging risk identification process. These networks should encompass as wide a range of experts and stakeholders as possible. Experts might not necessarily be drawn from the scientific community alone, but may include consumers, consumer organisations, non-governmental organisations and industry representatives as well. In recognition of this, the EU Commission has established an open electronic network for Scientific Information and Expertise for Policy Support in Europe (SINAPSE), where individuals or organisations can post warnings and discuss issues. The UN has also emphasised the central importance of networking in understanding food chain vulnerabilities and the timely identification of emerging risks. Indeed, the antithesis of effective networking – system fragmentation – has clearly been shown to be a driver for emerging issues and risks: for instance the Report of the Inter-Agency Review Group on the Dioxin Contamination Incident in Ireland in December 2008 concluded that “more effective collaboration and co-ordination between the official authorities involved in registration/licensing and inspection of premises” was needed if similar events were to be avoided. A similar inadequate collaboration between official agencies was highlighted in the Report of the Sudan I Review Panel in 2007.

The EFSA networking structure for information exchange

The broader the range of expertise available to a network concerned with the identification of emerging food safety issues, the greater the likelihood that data and other information critical to the process will be identified, assessed and used. At the level of actual emerging risk identification, this necessitates the incorporation of appropriate partners, and other networks, at international, regional and national level. The working group of the EFSA Scientific Colloquium of 2010, identified a number of agencies who probably should be involved in a European-wide network for addressing emerging risks in the food/feed chain. These include the wide range of EFSA stakeholder groups, including the Scientific Panels, the Advisory Forum Working Group on Communications and the recently formed Emerging Risks Exchange Network (EREN). The FSA and FSA are the national contact points for EFSA, and participate in the EFSA Scientific Panels along with other IoI government and academic experts. EFSA networks with the FSAI, FSA and other agencies through EREN and consults stakeholders in the field of emerging risk identification through its Stakeholder Consultative Group on Emerging Risks. The EFSA working group also
emphasised the importance of an international dimension to the identification of emerging risks and recommended inclusion of the ECDC, the European Medicines Agency (EMA), FAO, WHO, consumers’ groups and non-governmental organisations (NGOs). Government departments and bodies, as well as academic institutions, on the island actively network with these and other international agencies. Within the confines of the island, the national contact authorities are, through their legislative remits, part of a national food safety regime which is, in essence, a professional network.

### Regulation and enforcement networks on the island of Ireland

#### Republic of Ireland

In ROI, responsibility for enforcement of food legislation is managed through service contracts between the FSAI and the competent authorities (Appendix 6 gives a breakdown of where responsibility for food control activities on the island lies). DAFM laboratories undertake work under service contract with FSAI, which includes reporting of official control testing. Similar arrangements are also in place with the laboratories of the Health Services Executive (HSE) and the Marine Institute that also provide data on surveillance to FSAI. Official food sampling is performed in order to meet EU obligations on official controls. These samples are tested in official laboratories for official food control purposes. These in turn co-operate with National Reference Laboratories which specialise in a number of parameters specified in EU Law, and are mirrored by European Reference Laboratories. That said, the vast majority of food safety surveillance sampling is carried out by food businesses throughout the supply and manufacturing chain which they are obliged to do under the provisions of the general food law.

The roles played by official laboratories are critical to the identification and monitoring of food safety hazards and to provide operational support in emergency incidents and outbreaks. The statutory role of laboratories is to test food for compliance with a range of diverse legislative controls put in place to protect consumer health and interests. In ROI, there are seven Official Food Microbiology Laboratories (OFMLs) and three Public Analyst laboratories (PALS) within the HSE. The Marine Institute conducts official testing on seafood for chemical and microbiological parameters, and within DAFM there are seven official laboratories conducting a mixture of microbiological and chemical testing. A number of laboratories within the DAFM Backweston Campus have been designated National Reference Laboratories for food, feed and animal health for parameters including *Salmonella*, *Campylobacter*, *E. coli*, Listeria and Staphylococci, antimicrobial resistance, parasites and transmissible spongiform encephalopathies (TSEs). There is one laboratory that provides official control services to the Local Authority Veterinary Service.

The FSAI co-ordinates the national surveillance programmes as part of official controls for ROI,
and runs a number of microbiological surveillance studies each year in conjunction with the HSE. A broad summary of all routine regional and local food control sampling is included in the FSAI annual reports. Data on all official controls activities are transmitted to the European Commission, and data on zoonotic agents are transmitted to EFSA as well as being compiled by FSAI into a national zoonosis report for Ireland.

**Northern Ireland**

In NI, day to day responsibility for official control functions is divided between central and local Government, namely, the FSA, DARD and Local Authorities. In all District Councils in NI, Environmental Health Officers (EHO) regularly inspect food premises, with the frequency of inspection based upon a risk rating scheme contained in the Code of Practice to assess the risk the business poses. Food sampling programmes are co-ordinated across NI by the NI Food Liaison Group (NIFLG) and frequently link with regional or national sampling surveys. Information concerning these sampling initiatives is discussed by the NIFLG, reported to the appropriate co-ordinators and reports are then prepared to advise the EHOs in NI of the overall findings. Chemical sample analysis is performed by a private laboratory, while microbial analysis is carried out at an OFML. Data from all sampling activities are captured and disseminated using the Food Surveillance System (the national database for food sampling data in local authorities, Port Health authorities and Public Analyst laboratories in the UK). Food control activities are undertaken by officers of DARD Quality Assurance Branch (QAB) and DARD Veterinary Service - Veterinary health plans at primary production level. The majority of laboratory analyses to support these activities are performed by the Agri-Food and Biosciences Institute (AFBI) laboratory. Analytical data are supplied to the FSA from AFBI via a Laboratory Information Management System on a monthly basis, with immediate notification, if required. With the exception of DARD feed sample results, this data is currently not inputted to the Food Surveillance System.

In addition to the official inspection of food and feed premises, there are multiple voluntary inspection and compliance and assurance schemes that many food business operators sign up to. For instance, the NI Food Chain Certification attracts the bulk of the red meat industry throughput. Additionally, the retailers will require BRC audits of all their suppliers and this in turn can be reinforced by the retailers own audit.

**International Food Safety Authorities Network (INFOSAN)**

INFOSAN is a voluntary global network of food safety agencies managed by WHO and FAO that exchanges information between members on food safety events with international implications. INFOSAN shares information on important food safety related issues of global interest, promotes partnership and collaboration between countries and between networks, including the provision of
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assistance to help countries strengthen their capacity to manage food safety risks\(^{56}\). This is accomplished through sharing of information of disease events, epidemiological analyses and risk assessments. INFOSAN Emergency National Focal Points are responsible for informing INFOSAN of relevant events and of ensuring that their country is aware of alerts sent through INFOSAN to allow appropriate action to occur. INFOSAN is used to disseminate information generated through the FAO Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases or ‘EMPRES’ programme, which takes a holistic approach to horizon-scanning for identifying and interpreting low-key signals and indicators of food safety hazards, while on a practical level assistance, in the form of consultation and scientific advice, is given to member states to proactively manage emerging food safety issues. In addition, INFOSAN assists the Global Early Warning System for Major Animal Diseases (including Zoonoses) (GLEWS) to foster efficient early warning and forecasting of zoonotic disease trends through functional surveillance systems\(^{57}\). There are currently 177 member countries in INFOSAN. The INFOSAN focal points in ROI and the UK are the FSAI and FSA, respectively.

Facilitating industry participation in the identification of emerging issues

It is not common practice for industry to publicise or share information which it deems to be commercially sensitive and that could denigrate specific product types or product brands. However, it is now generally recognised that this pool of data is an invaluable but as yet untapped resource that, if properly managed and quality assessed, could contribute enormously to food safety risk assessments including the identification and assessment of potential emerging issues and risks. The inaccessibility of this data to the food safety regime is recognised as a significant disadvantage for the risk assessment process. Following the Irish Dioxin crisis of 2008, the Inter-agency review group recommended the establishment of a Food and Feed Safety Advisory Forum that would facilitate the sharing of information on emerging risks, and would involve both industry and regulators\(^{57}\). Similarly, the Report of the Sudan I Review Panel in 2007, suggested the FSA should take a more active role with stakeholders (including industry) to intelligence gathering and horizon scanning as well as proactively sharing this information with the food industry\(^{59}\). Both reviews recommended that industry should share information, including that which may be generated prior to and during incidents, with the regulatory authorities and other food businesses. So, to be effective in preventing incidents from occurring, and in determining emerging issues and risks, the flow of information must be binary between the food industry and official agencies. Trade associations may also have a role to play in this.

The FSA is currently investigating approaches for accessing and utilising food industry data. In 2010, the FSA issued a request for advice on the circumstances in which it could use non-peer reviewed data generated from different sources including industry\(^{58}\). In this context, the FSA was aware of the benefits of having access to industry data that, once properly evaluated, could be used
for “monitoring trends and horizon scanning for new sources of risk”. The General Advisory Committee on Science (GACS) recommendations which followed in 2011 included a number of suggestions for fomenting greater general interaction between the FSA and industry, which could have a positive impact on data sharing\(^{149}\). The GACS framework took into account the FSA’s needs and reputation, and provided five guiding principles for sharing data and also for possible research funding collaborations. These principles were concerned with:

a) The robustness of the evidence
b) The FSA’s reputation and independence
c) The most efficient use of resources
d) Issues surrounding commercial confidentiality and intellectual property
e) Distributing the costs of any collaboration amongst those who benefit, whether public or private.

The consultation outcomes were considered by the GACS and the FSA’s Board. Among the GACS recommendations was an agreement in advance with the owner of external data as to what level of confidentiality would be maintained and how this would be achieved in practice\(^{159}\).

**The QUB-IAFLU risk register and alert system for the feed industry**

These issues have been addressed on one level at the Institute of Agri-Food and Land Use (IAFLU) in Queen’s University Belfast, where a Risk Register for the feed industry has been established. It was recognised from the outset that commercial sensitivities would be a barrier to official agencies accessing industry-generated data which may otherwise be used to identify emerging food safety issues and risks. However, it was also recognised that a lack of openness to data sharing may not be in a food business’s best interests, especially if the business is confronted with the same issues and risks as its counterparts within a particular sector. This gives rise to duplication of costs and effort with obvious economic impacts on all the businesses affected.

Using the concept of ‘Fortress’ Ireland’, IAFLU, in association with InvestNI, has established itself as a ‘neutral space’ for the sharing of risk information by these businesses\(^{160}\). The key deliverable is the Risk Register, which documents risks associated with commodity type and source. The Risk Register provides a mechanism by which businesses, in this case those involved in animal feed production, can share analytical data amongst themselves in a structure that assures confidentiality, protects Intellectual Property (IP), and has the clear advantage of cost sharing among all participating animal feed businesses. Two key elements for success are recognition by the industry of (a) the actual risks and (b) the risk drivers, such as food safety incidents, retail pressures, etc. Participating businesses contribute risk data without rescinding ownership of the data: in short, they ‘own’ the register. The regulatory agencies do not have access to the register but nonetheless contribute testing and rapid alert data. The minable information is generic and supports a form of ‘rapid alert’ system exclusively for the members. It
 Emerging Food Safety Issues

can also be used to co-ordinate and streamline the testing currently done by individual companies, so the burden of hazard analysis can be shared amongst the participants. Other benefits include the provision of a context against which positive research results can be interpreted, the verification of standards and claims (e.g. GMO-free), and the augmentation of supplier assurance systems. The register is an attractive proposition for similar industries as the advantages of participation will be self-evident. However, it is as yet unclear how SMEs with limited resources and expertise can contribute to this process.

Phase II of the project utilises the analytical capacity of the institute and it is in this phase that the ‘horizon scanning’ element is being developed. Fingerprinting technology is applied whereby a spectral analysis of the different feed constituents is taken, and this gives a baseline against which any deviations of the spectra can be detected. This is the first clue that something is abnormal and is an indicator for further investigation. The presence of pathogens, poor growing conditions (increasing susceptibility to pathogens), damage during processing and storage, etc. can all be inferred from these analyses. ‘Unknowns’ may indicate new/un-documented hazards and potential issues and risks.

Research and knowledge-exchange networks

Professional networks

Professional networks provide fora for the dissemination of information and views on emerging issues and risks in specific fields of professional expertise. They are similar in ethos to representative associations, insofar as they are vocationally focussed. However, unlike representative associations, they are not limited to specific professions, but are usually open to a broad range of stakeholders from diverse backgrounds and with particular thematic interests. There are many professional networks operating at both national and international level on the IoI that may be relevant in the context of emerging risks in food and feed. For example, the Food Law Enforcement Practitioners (FLEP) forum was established to facilitate the exchange of information between professionals involved in food control. Similarly, the Institute of Food Science and Technology, which operates in both jurisdictions provides a forum for food scientists and operates under the umbrella of the European Federation of Food Science and Technology (EFFoST) and the International Union of Food Science and Technology (IUFoST). On the IoI, similar organisations exist in other Agri-Food disciplines, including those of agricultural science such as the Northern Ireland Institute of Agricultural Science (NIIAS).

Research networks

Research networks are generally focussed on specific research topics or themes and attract a more restricted membership in comparison to professional networks, although not necessarily limited
to researchers *per se*. As such, they tend to be temporary structures designed to facilitate the co-
ordination and execution of research, as well as the implementation of any outcomes within
strictly defined timelines and budgetary limits. A discussion of past and current food-safety
research networks which involved/involve IoI researchers is beyond the scope of this report.
However, it is worth noting that one of the more significant funding programmes which
encourages the formation of transnational research networks are the Framework Programmes for
Research and Technological Development (FP) created by the European Union, in order to support
and encourage research in the European Research Area (ERA) which includes the IoI. The
programme supports research across all scientific and technological areas including research into
food safety. The current programme (FP7) runs from 2007–2013, while FP8 is scheduled to begin
in 2014. DAFM is the national contact point for the Food, Agriculture and Fisheries, and
Biotechnology research theme, whose aim is to build a European Knowledge Based Bio-Economy.
Activity 2 under this theme – ‘Fork to Farm’ - includes a ‘food quality and safety’ element138.

**safefood Knowledge Networks**

The **safefood** Knowledge Networks are something of a hybrid, having the broad membership and
thematic scope of a professional network while retaining links to research as well. They were set
up in 2011 with the aim of providing an environment which is both dynamic and rewarding, and
conducive to the exchange of food safety information to the benefit of the members.
Membership is drawn from all disciplines involved in knowledge creation and application and
policy development to support and enhance food safety. There are currently four Knowledge
Networks concerning food pathogens: Verocytotoxigenic *Escherichia coli* (VTEC), *Campylobacter*,
Listeria and *Salmonella*: two networks concerning chemical compounds: Botoxins and Chemical
Residues: and a network concerning Food Allergy and Food Intolerance. All networks feature a
unique online professional networking platform (Ning) to facilitate information exchange
electronically between the members. A key deliverable is the organisation of a themed annual
meeting at which the network facilitator is obliged contractually to hold an open discussion
session focussed on horizon scanning (including possible signals leading to the identification of
emerging food safety issues). This foresight activity has been specified in the protocol for
operation of the networks46. The real strength of the Networks is that, in addition to a well-
established North-South dimension, they also have East-West connections and can, though the
connectedness of the network facilitators, tap into similar networks across Europe, the United
States and the wider world. They thus empower food safety professionals to effectively exchange
world class information and expertise in a timely manner. This has obvious advantages for the
Agri-Food industry on the island of Ireland as a whole, as companies in the networks receive new
information, share ideas and solutions, develop new relationships with their peers in other
countries, and tap into a wide range of business opportunities that may arise from being part of
an inter-network arrangement.
6 Addressing emerging food safety issues on the island of Ireland

A potential collaborative structure for addressing emerging food safety issues

A structured surveillance and regulatory regime exists on the IoI, whose function is to detect, identify and arrest food safety hazards before they impact on human/animal health and productivity or mitigate the impacts of any hazards that may not be arrested in time. Despite these precautions, the IoI is no stranger to adverse food safety events: from BSE and *E. coli* O157 in the 1990s, to Sudan Red and dioxin in the first decade of this millennium, the IoI Agri-Food industry has experienced the ramifications of several ‘direct hits’ by food safety hazards. These experiences not only provided the necessary impetus for further developments in food safety policy, but also gave strength to the idea that prevention would require a more proactive approach to the identification and management of current and emerging food safety risks, and this would necessitate the participation of a diversity of stakeholders with differing expertise.

Efforts are currently underway to ascertain the best approaches to emerging food safety risk identification. Most notably the EMRISK unit of EFSA has developed a structured approach which includes a pan-European network of expertise that can be exploited for this purpose. Within this structure, the importance of national and regional professional networks for the provision of information that can be fed into the EFSA process, is emphasised. On the IoI, the regulatory regimes for food safety essentially comprise networks of professionals representing a diversity of expertise and professions. Complementing these are a host of professional (‘vocational’) networks in which inter-disciplinary linkages and associations are fomented to encourage a more joined-up approach to tackling food safety issues and promote the cross-fertilisation of ideas. Most notable among these associations are the safefood Knowledge Networks, whose focus broadly covers what are currently the more important food safety issues and which operate on an integrated all-island basis. The Knowledge Networks bring together elements involved in the surveillance of foodborne illness, regulation and enforcement, academia, industry and consumers and, through these, links to other national and international scientific networks as well as the different European and international agencies concerned with food safety. All of the Networks have a contractual obligation to include an horizon scanning element to the network deliverables.
A potential role for *safefood*

The Emerging Food Safety Issues Working Group have agreed that *safefood* is in a unique position to act as the ‘neutral broker’ that could provide the focus for the collaborative effort necessary to address potential food safety impacts on the IoI food chain. *safefood*, as the all-island Food Safety Promotion Board, has a specific legislative remit which does not include a regulatory and enforcement element, but rather an obligation to promote an awareness and acceptance across the food chain that the responsibility for the provision of safe and healthy food is ubiquitous among stakeholders. As such, the organisation is well placed to co-ordinate the formation of a Core Body of industrial, research and enforcement experts on an IoI basis, and oversee the development of agreed business rules. It is envisaged that this Body would convene at set intervals, or whenever required to do so, by the co-ordinator or at the behest of any member. Since the establishment of a Core Body to address emerging food safety issues would be without precedent on the IoI, the Working Group considered it prudent to regard this development as a pilot project in the first instance.

Composition of the core body

The Emerging Food Safety Issues Working Group emphasised the importance of the composition of the Core Body (see Figure 1). This should reflect the principal stakeholders on the IoI with responsibility for the management of emerging food safety hazards including regulators, industry and primary producers. The members should have:-

- experience in the risk management of food hazards,
- experience in risk assessment,
- a track record in strategic networking,
- be familiar with, or have direct experience of, EU processes,
- some experience with futures research (ideally).

The members should also be in a position to devote the necessary resources, particularly time, to the Core Body. They must be able to work confidentially and have the capability to manage any conflict of interest that may arise.

The Working Group highlighted the possibility of exploring the participation of international experts with experience in this area, as this could contribute to the development of a programme of activities for the Core Body. Further expertise could be co-opted according to need and the Working Group highlighted the utility of establishing a database of personal profiles and expertise that could be accessed to assist the Core Body in their work. It was acknowledged that expert opinion on a diversity of issues is already available on the IoI and could possibly be exploited for this purpose.
A potential remit for the core body

The Working Group considered a potential remit for the Core Body and agreed on the following essential elements:

- To bring about agreement among relevant stakeholders of the importance of proactive identification and management of emerging food safety hazards, emphasising the added value for participants.
- To define and implement rules of business taking into account the diversity of participants and any commercial, IP or other factors that must be accommodated in order to foment trust within the Core Body structure.
- To identify emerging food safety hazards that may impact on the IoI food and feed chain and public health. This might also include reviews of the events that lead to, and the mechanisms by which, known food safety hazards can potentially impact other areas of the food chain.
- To construct a database of relevant and diverse expertise and persons who can be co-opted to augment the Core Body in dealing with emerging food safety issues.
- To collate and evaluate data pertaining to emerging food safety issues that may impact on the IoI food chain and public health.
- To highlight the work and objectives of the Core Body among relevant stakeholders including the food industry.
- To convey relevant information via the national contact points in ROI and NI to the EFSA EMRISK group as, and when, required.
- To act as a forum for discussing signals that has been highlighted by EFSA.
- To identify and liaise with IoI agencies and institutions who engage in futures research or horizon scanning pertaining to food safety hazards.

It is not possible to define a more proscriptive remit for the Core Body within the scope of this report. It was decided that, given the novelty of such a Body in the food safety environment of the IoI, the remit should be subject to pilot and on-going review.
Fig 1: Schematic of the recommended structure for addressing emerging food safety issues on an all-island basis

Fig 1: A database of IoI and international expertise would be an invaluable resource for the Core Body to carry out its remit. These could be co-opted on a case-by-case basis to assist the Body in ranking or weighting of critical factors that are indicative of emerging hazards and therefore essential to the forming of an expert opinion. Research outcomes are part of this evaluation process which may also highlight further research opportunities that could be communicated to relevant stakeholders. It is envisaged the Core Body will contain regulatory elements through which important information can be communicated to, and received from, the larger EFSA emerging risk identification process.

Promoting emerging food safety issues amongst stakeholders

The Core Body proposed by the Emerging Food Safety Issues Working Group will have an obligation to promote itself and its objectives among relevant stakeholders on the IoI. This will be necessary from the outset, as the battery of expertise required to proactively identifying emerging food safety issues will depend on how well awareness of these issues is promoted amongst stakeholders. The Core Body structure lends itself readily to a holistic approach to emerging issue identification, as issues may emanate from both inside and outside the food
production chain. The pool of expertise available to the Core Body can be used to identify areas of concern in either a specific food sector, or an actual food commodity and its associated production chain. It can also be used for expert judgment on what data exists (and is useable), any associated uncertainties and possibly data gaps that should be addressed. This same expert judgment can be harnessed to rank or apply a weighting to critical factors that influence the emergence of food safety hazards and which are most likely to be affected by the driver-of-change under investigation.

**Research requirements to facilitate emerging issue identification**

As well as highlighting knowledge gaps that could benefit from focused research, expert judgment on the critical factors that can indicate emerging food safety hazards is also dependent on the availability of research data. Following an evaluation of EU FP projects as appropriate data sources, the DACO WG recommended that an emerging hazard identification element should be built into future project structures, and, furthermore, that such a protocol could be applied to “national or regional funded research projects” as well. IoT food safety projects currently funded through national or international programmes do not include such a protocol.

Research collaborations among stakeholders are beneficial in terms of cost sharing, data access and lack of duplication. The QUB Risk register is a working model by which this can be achieved between different businesses within an Agri-Food sector. The Emerging Food Safety Issues Working Group concluded that this model had considerable merit as a mechanism by which (1) a more structured and co-operative approach to risk management of food hazards could be fomented within Agri-Food sectorial industries and (2) the application of analytical techniques to the identification of emerging food safety hazards could be implemented. It was acknowledged that the esoteric structure of the Register provided an attractive forum for the sharing of industry-generated data, as there was a clear value-added element for participants combined with guarantees of data ownership, IP, membership, confidentiality, etc. However, this esotericism may mitigate against the same level of participation and interaction within an overarching forum, such as the proposed Core Body, as the diversity of stakeholders within the Body structure could erode the aforementioned guarantees, and therefore be an impediment to data sharing and utilisation. Nonetheless, structures like the Risk Register have a part to play in the mitigation of food safety risks within the food industry, as well as the identification and management of emerging food safety hazards. Perhaps the latter information could be communicated within a wider structure, albeit in generic form.

Mutually beneficial collaborations, such as the co-funding of research, may encourage the sharing of data. In ROI, the Food for Health Ireland initiative represents collaboration between publicly funded research organisations and the Irish food industry, to execute a dairy industry-led
Emerging Food Safety Issues

research agenda concentrating on functional food products to improve health and wellbeing. This is funded by Enterprise Ireland and the Dairy industry and promotes a symbiosis between this industry and research expertise at third level. Similarly, the ‘AgriSearch’ programme in NI encourages direct participation (funding) by specific Agri-Food sectors in production oriented research, geared specifically for that sector. It is carried out by the NI Agricultural Research and Development Council and involves the beef, dairy and sheep sectors. Monies gathered from these sectors are used to commission research, with a view to application of the outcomes to promote further developments and improvements in running costs, performance, innovation and welfare in these farming sectors. In 2011, the GACS report to the FSA recommended research funding collaborations where feasible, and once the usual assurances of commercial confidentiality and intellectual property rights would be respected. This approach would incentivise stakeholders (in this case the food industry) to be more agreeable to sharing its data, as the benefits of doing so would be self-evident.
7 Appendices

APPENDIX 1

Working group members

Prof. Charles Daly (Chair): Vice Chairperson safefood Advisory Committee and Emeritus Professor of Food Science and Technology, University College Cork.

Dr. Wayne Anderson: Director of Food Science and Standards Division, Food Safety Authority of Ireland.

Mr. Barny Heywood: Group Chief Environmental Health Officer for Western Group Environmental Health, Northern Ireland.

Dr. Robert Huey: Deputy Chief Veterinary Officer at the Department of Agriculture and Rural Development, Northern Ireland.

Prof. Maureen Edmondson: Chair of the Advisory Board of the Northern Ireland Centre for Food and Nutrition at Ulster University.

Prof. Christopher Elliott: Director or the Institute for Global Food Security, Queen’s University Belfast.

Dr. Patricia Garvey: Surveillance Scientist, HSE-Health Protection Surveillance Centre, Dublin.

Mr. Campbell Tweedie: Vice Chairperson safefood Advisory Board and President of the Northern Ireland Meat Exporters’ Association.

Dr. Hans Marvin: Senior Scientist at RIKILT, Netherlands Institute of Food Safety.

Dr. James McIntosh: Toxicologist with safefood

Dr. Linda Gordon: Technical Executive safefood

Dr. Brenda Murphy: Technical Executive safefood
APPENDIX 2

Seminal food safety incidents on the IoI

Chronology of the seminal food safety incidents that have affected the food chain on the IoI in the last twenty five years. (‘Seminal’ is defined here as a food safety incident which was instrumental in causing policy and/or legislative change.)

Table 3: Seminal food safety incidents affecting the food chain on the island of Ireland in the last twenty five years

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<tr>
<td>1988</td>
<td>Salmonella Enteritidis</td>
<td>In the late 1980s, there was a dramatic increase in the number of human cases of <em>S. Enteritidis</em> reported in the UK and many countries in Western Europe. In 1988, a number of UK food poisoning incidents were reported from food consumed at public gatherings, as well as the House of Lords, each of which were attributed to the consumption of eggs and cheese. This led the junior health minister to make a statement that “most of the egg production of this country, sadly, is now infected with <em>Salmonella</em>”, which aroused much public anxiety and political concern.</td>
<td>The impact on industry resulted in the slaughter of more than a million hens, mostly involving small producers, sales of eggs fell by 60 per cent overnight and many egg producers went out of business with no impact on the <em>Salmonella</em> poisoning. This caused particular anger in NI, where egg production is a significant part of the economy. Following a lawsuit by twelve UK egg producers, Edwina Currie MP resigned and the Ministry of Agriculture, Fisheries and Food (MAFF) set aside £20 million to compensate egg producers.</td>
<td>The introduction of improved hygiene and storage practices, together with the vaccination of laying flocks against <em>Salmonella</em>, has since resulted in a reduction in the incidence of <em>Salmonella</em> in eggs in the UK. The control of <em>Salmonella</em> is governed by Regulation (EC) 216/2003 with the implementation of Regulation (EC) 646/2007 for the specific reduction of <em>S. Enteritidis</em> and <em>S. enterica</em> serovar Typhimurium in broilers. In 2004, safefood commissioned a three-year project that investigated the prevalence of <em>Salmonella</em> in eggs on the IoI, and compared the two approaches to <em>Salmonella</em> control in operation in the</td>
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## Emerging Food Safety Issues

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<td>1989</td>
<td><em>Listeria monocytogenes</em></td>
<td>Human Listeriosis is one of the most serious foodborne bacterial infections and although it accounted for less than 0.1 per cent of all foodborne illness in 2004, it accounted for approximately 17 per cent of deaths related to foodborne illness. Between 1987 and 1989, the number of deaths in the UK from Listeriosis rose dramatically. A survey of imported pâtés to the UK showed that it frequently contained <em>Listeria monocytogenes</em>.</td>
<td>Following health government warnings on pâté consumption and the suspension of product importation from affected manufacturers, the number of deaths resulting from Listeriosis declined.</td>
<td>As a result of the increase in cases of Listeriosis in the over-60s, the UK’s Environment Minister has proposed a shake-up of the food labelling dating system.</td>
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In NI (as in the rest of the UK), a vaccination regime is adopted, whilst in the ROI, controls based on routine monitoring for *Salmonella* and subsequent culling of infected flocks are applied. A 2004 *safefood* study found that both methods are equally effective in controlling *Salmonella*, and that eggs produced on the IoI are almost totally free from *Salmonella* (prevalence of 0.04%) and therefore not a potential source of human infection.
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<td>1989</td>
<td>Bovine Spongiform Encephalopathy (BSE)</td>
<td>More recently the FSA has reported a marked increase in cases of Listeriosis, predominantly in the over-60s age group in the UK since 2007, as elderly people are more likely to expose themselves to the bacteria by eating food that has passed its ‘use-by’ date.</td>
<td>In March 1996, an expert committee of scientists announced that a human variant of Creutzfeldt-Jakob Disease (CJD) could be linked to BSE in cattle. The association of the human variant of CJD with consumption of BSE-contaminated meat prompted a European-wide loss of confidence in British beef. The number of deaths from variant CJD peaked in 2000 at 28 deaths. This also affected the consumption of beef in other European countries. Cases of BSE peaked in the UK in 1992.</td>
<td>Following the introduction of a combination of controls and regulations, the numbers of BSE infected cattle on the island dropped from its peak of approximately 500 cases in the mid-1990s to 37 in 2007. The emergence of BSE, and its link to variant CJD, has been singularly responsible for profound changes to how food is produced and regulated in the modern farming era. BSE is commonly regarded as the food safety incident that initiated both the reform of EU food safety legislation (Regulation (EC) 999/2001-amended under Regulation (EC) 220/2009) and the establishment of many new regulatory</td>
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<td>1996</td>
<td><em>E. coli</em> O157:H7</td>
<td><em>E. coli</em> O157:H7 presents a highly significant threat to public health (especially individuals in vulnerable groups). Infection from this pathogen ranges from symptom-free carriage, to non-bloody diarrhoea, haemorrhagic colitis, haemolytic uremic syndrome (HUS), thrombocytopenic purpura and death. Cattle are recognised as a primary reservoir of <em>E. coli</em> O157:H7 following several outbreaks of this pathogen which were linked to undercooked beef products and raw milk. In 1996, an outbreak of <em>E. coli</em> O157:H7 in central Scotland linked to intensive farming practices, including the recycling of animal protein in ruminant feed which was unchallenged over decades. The origin of the disease itself remains unknown. The infectious agent is distinctive for the high temperatures at which it remains viable. This contributed to the spread of the disease in Britain, where temperatures used during the rendering processes had been reduced. Another contributory factor was the feeding of infected protein supplements to very young calves.</td>
<td>A total of 501 cases and 21 deaths were linked to the Scottish outbreak. On the IoI, many small outbreaks linked to this pathogen have been reported but, to date, a large scale foodborne outbreak has not occurred. A large outbreak occurred in 2005 involving private houses and a Crèche in the midlands, where 18 individuals were affected,</td>
<td>In 1997, the Pennington Group investigated the circumstances of the Scottish outbreak and made a number of recommendations, all of which were accepted by the UK Government who made £19 million available to improve food hygiene standards in butchers' shops and other high-risk food premises. Institutions across the EU and on the IoI, including the FSAI and the FSA,</td>
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<td>1999</td>
<td>Dioxin</td>
<td>In January 1999, 50kg polychlorinated biphenyls (PCBs) contaminated with 1g dioxins were accidentally added to a stock of recycled fat used for the production of 500 tonnes animal feed in Belgium\textsuperscript{187}. This animal feed was then further distributed to chicken farms and initially led to abnormal laying hen mortality and decreasing egg hatchability\textsuperscript{188}. Consequent analyses indicated dioxin levels that exceeded the legal standards (for example those applying to chicken fat) by 1,500 times. By May, when all chicken and eggs were removed from the Belgian market place, it emerged that the broiler feed had been recycled into pig feed, thus also contaminating the pork meat industry.</td>
<td>The initial blocking of meat products in Belgium was soon followed by import bans of Belgian meat and egg products by other EU countries, backed up by the EU veterinary committee's decisions\textsuperscript{189}.</td>
<td>Several measures were taken in order to control the dioxin risk, including a ban on the use of recycled frying oils in animal feed and a tightening up of the controls surrounding feed manufacture\textsuperscript{190,191}.</td>
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<td>2002</td>
<td>Acrylamide</td>
<td>In April 2002, the Swedish National Food Concern has been expressed as</td>
<td>The food industry has responded to this</td>
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<td>2003</td>
<td>Sudan Red 1</td>
<td>In May 2003, Sudan Red 1 dye was detected by the French authorities in a product containing hot chilli. This dye has a number of industrial applications including shoe polish, but as a food additive it is prohibited worldwide, notable exceptions being some Asian and African</td>
<td>A substantial product recall ensued throughout the EU. The European Commission moved swiftly to prohibit the import of chilli spice and derivative products containing certain food</td>
<td>On 21st January 2004, a policy change was introduced; a prohibition was declared meaning that chilli products, including curry powder, can now only be imported into the EU if they are accompanied by the appropriate</td>
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<td>2008</td>
<td>Dioxin</td>
<td>Dioxin is a term used for a group of chemicals that are known to have similar toxic effects. These include toxicity to the immune system, carcinogenicity, effects on the skin and reproductive toxicity and adverse effects on the developing foetus. They are highly potent and can remain in the body for extended periods of time. In late 2008, high levels of dioxin and dioxin-like PCBs were detected in samples of Irish pork fat that were taken as part of the Irish National Monitoring Programme. The results showed levels that were up to two hundred times the legal limit for these compounds in pork meat. The source of the contamination was traced to a single feed production plant, where recycled food waste was used to produce animal feed in a process that involved drying dough using heat.</td>
<td>The FSAl, in co-operation with the DAFM, issued an alert recall for all Irish pork and bacon products on the 6th December 2008 and advised consumers, as a precautionary measure, not to consume Irish pork and bacon products, and to dispose of any purchased since the 1st of September 2008. A similar recall of these products was issued via RASFF in other EU countries, and to third countries as well, to which Irish pork and bacon products had been exported. The negative ramifications for the Irish pork</td>
<td>The Oireachtas Committee on Agriculture recommended that a full traceability of batches at slaughter should be introduced. In June 2011, Bord Bia commenced taking samples of pork and bacon products in retail outlets as part of the Identigen pig DNA testing programme which will be factored into its quality-assurance scheme.</td>
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### Emerging Food Safety Issues

<table>
<thead>
<tr>
<th>Year</th>
<th>Agent</th>
<th>Narrative</th>
<th>Consequences</th>
<th>Regulatory impacts</th>
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<tbody>
<tr>
<td>2010</td>
<td>Salmonella</td>
<td>The 2009 - 11 national general outbreak of <em>Salmonella</em> Typhimurium DT8 linked with the consumption of duck eggs was the largest food poisoning outbreak of salmonellosis recorded in recent years in Ireland&lt;sup&gt;202&lt;/sup&gt;.</td>
<td>The total number of cases was thirty five and roughly half of these were reported to have been admitted to hospital. Approximately 70 per cent of the cases were explained as resulting from consumption of duck eggs.</td>
<td>As a result of this outbreak, several control measures for the industry were introduced by DAFM, including a restriction on infected duck flocks, development of a code of practice for duck egg producers, and the introduction of legislation that</td>
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<tr>
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<tbody>
<tr>
<td>2011</td>
<td><em>E. coli</em> O104:H4</td>
<td>In May 2011, Germany reported an on-going outbreak of Shiga-toxin producing <em>Escherichia coli</em> (STEC), serotype O104:H4. By that July, over three thousand cases of diarrhoeal disease, including 17 deaths, associated with the German outbreak were reported worldwide, though overwhelmingly from the EU. In addition, almost eight hundred cases of haemolytic uraemic syndrome (HUS) have been associated with the outbreak, including 30 deaths. A second outbreak was recorded in France in June 2011 with 15 cases including 9 cases with HUS. The <em>E. coli</em> O104:H4 strains in both French and German outbreaks were common to both incidents strongly indicating a common source. A consignment of fenugreek seeds imported from Egypt was</td>
<td>from small backyard flocks or private farms(^2\text{03}).</td>
<td>establishes a legal basis for the control of salmonellosis in ducks and duck eggs(^2\text{04}). The measures provided include the preparation of a <em>Salmonella</em> control plan and the associated testing, sampling and registration arrangements.</td>
</tr>
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</table>

By October 2011, a total of 3,911 cases had been reported to the ECDC and WHO linked to the German and French outbreaks. These included 906 cases of HUS which led to 34 deaths\(^2\text{05}\). A further 17 deaths, due to diarrhoeal disease, were recorded. The ECDC and EFSA strongly recommend advising consumers not to grow sprouts for their own consumption and not to eat sprouts or sprouted seeds unless they have been cooked properly. This is in line with advice from the FSAI. GPs and clinicians were reminded to notify any potential cases promptly to Public Health. No cases of *E. coli* O104:H4 related illness associated with this outbreak were recorded in Ireland.
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<tbody>
<tr>
<td>2012</td>
<td>Food Fraud involving horsemeat</td>
<td>Implicated in both outbreaks, although <em>E. coli</em> O104:H4 was not isolated from any batches of the suspect seeds. However, this does not mean that the bacteria would not have been present in seeds and sprouted seeds. Hitherto, the preparation of seed sprouts for direct human consumption did not involve any bacterial decontamination measures.</td>
<td>Falls in the share price of certain companies implicated in this event from which they took some time to recover. Increased costs for regulators, retailers and the wider food industry due to the increased DNA testing regime. Concerns were expressed regarding possible breaches of religious and cultural norms. Both Jews and Muslims refrain from eating pig meat products while horsemeat is not traditionally eaten in Ireland or The horse meat scandal exposed flaws in European control systems on food safety. EU agriculture ministers agreed to a three-month programme of DNA testing of processed meat across the European Union in 2013. One of the more fundamental ramifications of the horsemeat event was the establishment of a review by the UK government of the integrity and assurance of food supply networks in the UK. The Interim Report was released in December 2013. Furthermore, adjustments were made to the Scottish Government’s Food Standards Scotland Bill to give officers</td>
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In late 2012, the FSAI reported the presence of horse meat in beef products with one burger sample containing 29% equine DNA relative to the beef DNA content. Of 27 beef burger products tested, 37% were positive for horse DNA, and 85% were positive for pig DNA. Of 31 beef meal products investigated, 21 were positive for pig DNA but all samples were negative for horse DNA. The 19 salami products tested negative for horse DNA. The contaminated beef products had been manufactured in meat plants in both Ireland and Britain. Traces of horse DNA were detected in batches of raw ingredients, including some imported from The Netherlands and Spain. By the start of 2013, investigations were EU-wide with...
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<tr>
<td></td>
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<td>manufacturers and traders in France, Belgium, Romania, Luxembourg, Italy, Switzerland, Poland and the Baltic States involved as well. From the outset, it was evident there was a complete lack of traceability concerning the horsemeat that was entering the food chain through so-called ‘beef’ products. This raised a concern with regard to possible human exposure to the veterinary drug phenylbutazone (known as ‘bute’) which is licenced for use as an analgesic in horses. However, current regulations stipulate that horses treated with bute cannot be used for human consumption. Investigations by the FSA showed that, in the small number of cases where bute had been used, the levels were such that the risk to human health was minimal. However, these were cases where the animal had a ‘horse passport’ that permitted its entry into the human food chain. This indicated that the passport system was not functioning properly. In addition to potential bute exposure, concerns were also expressed about the risks from equine infectious anemia spreading via contaminated horse meat from Eastern Europe.</td>
<td>Britain.</td>
<td>enforcement powers to seize food that breaches food standards or labelling rules and to make it compulsory to report non-compliance with food standards regulations, including food fraud.</td>
</tr>
</tbody>
</table>
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APPENDIX 3

Economic significance of Agri-Food sectors and associated food safety issues

‘Food Harvest 2020: A vision for Irish Agri-Food and fisheries’ lays out ambitious targets for increased production in the ROI Agri-Food industry by 2020. This divides the industry into ten sectorial areas, of which nine are relevant to the subject matter of this report. The economic significance of each sector and current food safety concerns are described as follows:

Table 4: Economic significance of Agri-Food sectors and associated food safety issues

<table>
<thead>
<tr>
<th>Sector</th>
<th>Economic significance</th>
<th>Food safety issues</th>
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<tbody>
<tr>
<td>Beef</td>
<td>In terms of live cattle trade and meat, this sector accounts for the largest share of gross agricultural output in ROI at 28.6 per cent. In NI, the beef and sheep meat sector accounts for the largest share of gross turnover in the food processing sector at 23 per cent. Somewhere in the order of 98 per cent of beef exports were destined for continental Europe, with the UK accounting for half of Ireland’s beef exports at 254,000 tonnes, with a value of the order of €685 million. In total in 2010, ROI exported circa 500,000 tonnes of beef worth €1,510 million and 340,000 cattle were exported live worth €150 million.</td>
<td>Control of microorganisms during food production stages is critical to protect the end product from contamination with pathogens. The legislation in place to ensure the safety of food products throughout the food chain in both NI and ROI is the hygiene legislation, commonly referred to as the ‘Hygiene Package’. Potential emerging issues are being addressed in the ProSafeBeef project. The researchers are looking into chemical contaminants, focusing on development of methods for detection of anti-parasitic drug residues agents in beef and are now applying these methods to assess the levels of the drug residues in beef in Europe and South America. These data, alongside other data on a wider range of veterinary drug and environmental residues, will be used to develop risk assessment models. The group has also been generating qualitative and quantitative data on key microbial pathogens in beef and on practices on the beef...</td>
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## Emerging Food Safety Issues

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<thead>
<tr>
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<tr>
<td>Dairy</td>
<td>The IoI exports about 80 per cent of all dairy production. Over the last two decades, the island has become one of the world’s leading producers of infant nutritional products with the presence in Ireland of leading infant nutrition companies, and accounts for 15 per cent of the global supply of infant formula. Exports of Irish dairy products and ingredients were valued in the order of €2.29 billion. In 2010, total ROI milk output amounted to 5,582 million litres with an estimated value of €1,536 million. From January to August 2011, there was 4,139 million litres of milk produced in ROI.</td>
<td>The introduction of pasteurisation of milk in the 1950s eliminated tuberculosis, the major food safety risk, from this food. In terms of potential emerging food safety issues, the FSAI advised the cessation of the sale of raw milk on the grounds of Public Health protection, and the Minister for Agriculture has decided to ban the sale as soon as possible. However, raw milk may be used for cheese making, with proper regulations and continued surveillance in place.</td>
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<tr>
<td>Pigmeat</td>
<td>Pork production systems on the IoI are primarily comprised of a small number of specialist producers operating large-scale units. Free range and outdoor production is minimal, while organic pork is very much a niche market. There were approximately two million pigs (410,450 and 1.59 million pigs in NI and ROI, respectively) in 2010. During 2010, the ROI exported 134,000 tonnes (product weight) worth approximately €317 million. The UK market in pig meat accounts for around half of total exports in volume terms, and given the relative value of exports, around two thirds of</td>
<td>Possible food safety threats include Mycobacterium hyosynoviae and Mycobacterium hyorhinis which, while not being new to the industry, are detected more frequently due to improved laboratory techniques. They may also be more present clinically today due to the elimination of other bacterial and viral agents. Also the misuse of veterinary medicines.</td>
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<td></td>
<td>total value. Continental EU markets accounted for 38,000 tonnes of product with an estimated value of €65 million. In 2009, the value of pigmeat exports from NI was almost £113m with product exported throughout Europe and further afield. Approximately 2,000 people are employed on pig farms or in businesses directly associated with pig production.</td>
<td>Possible food safety threats include misuse of veterinary medicines.</td>
</tr>
<tr>
<td>Sheep</td>
<td>Sheep meat production in Ireland remains largely a traditional farming activity involving small holdings. In 2010, the ROI exported 36,500 tonnes of sheep meat worth €170 million. The French market accounted for 50 per cent of Irish sheep meat exports, with shipments there estimated to be 18,500 tonnes with a value of €95 million.</td>
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<tr>
<td>Poultry</td>
<td>The Poultry Industry is characterised by vertical integration, with large companies integrating several stages of the supply chain such as breeding, hatchery, feed production, rearing, primary processing, further processing and distribution within their company or under close contract systems. There are a number of key players, with six companies representing in excess of 90 per cent of all domestic broiler production on the Iol. At farm gate, the poultry industry on Iol is worth an estimated €121 (£105)</td>
<td>MS aim to meet control targets for certain zoonoses at primary production level and, where necessary, other stages of the food chain. Statutory Rules (SR 2008 No. 63) lays out the National Control Plan for the control of Salmonella in Poultry in NI. NCPs for controlling breeding flocks and table egg layers are in place in RoI since 2007 and 2008 respectively, under SI 706 of 2006 and SI 247 of 2008, which mandate the sampling type and frequency and obliges the reporting of serovars of public health significance,</td>
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### Emerging Food Safety Issues

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<tr>
<td>Horticulture and Cereals</td>
<td>The value of the edible horticulture and cereals exports from ROI was approximately €200 million in 2010. Cereal production on the IoI continues to decrease overall with a concomitant increase in cereal imports.</td>
<td>Possible food safety threats include alterations to fungal biology due to climate change causing increased occurrence of current mycotoxins or new mycotoxin species.</td>
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<tr>
<td>Seafood</td>
<td>Irish Seafood is worth more than €700 million per annum. Exports of Irish seafood for 2010 are estimated at €365 million, representing about 50 per cent of total Irish seafood sales. An estimated 75 per cent of Irish seafood exports are sold in EU markets. Markets outside of the EU are also of vital importance. The Irish seafood industry generates an estimated 11,600 jobs.</td>
<td>Possible food safety threats include alterations to plankton biology due to climate change causing increased occurrence of phycotoxins or new phycotoxins species. Also new technologies and food production techniques may present emerging food safety control challenges.</td>
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<tr>
<td>Organic</td>
<td>The annual value to the domestic market is approximately €100 million with some 1,500 operators engaged in production. Unlike many sectors of horticulture, organic production is particularly suited to small-scale production. The target for this sector is an increase in organic land use to five per cent from the current level of just over one per cent.</td>
<td>Possible food safety threats include increased threat from existing or new pathogens due to climate change or market developments, especially given the ethos of sector.</td>
</tr>
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APPENDIX 4

The UK Virtual Veterinary Surveillance Network.

Fig 2: UK Virtual Veterinary Surveillance Network

Taken from Defra: a review of the implementation of the Veterinary Surveillance Strategy[15].
APPENDIX 5

Major foodborne pathogens on the IoI

Table 5: Foodborne pathogens currently responsible for the majority of cases of foodborne illness on the island of Ireland

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Description</th>
<th>Exposure</th>
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<tbody>
<tr>
<td>Campylobacter spp.</td>
<td><em>Campylobacter</em> is the most commonly reported cause of bacterial foodborne infection on the IoI. The illness is characterised by severe diarrhoea and abdominal pain, and symptoms may subside after a number of days or may persist for weeks. Rarely, more severe sequelae may develop such as reactive arthritis, Reiter’s syndrome, or HUS, and approximately one in every 1,000 cases leads to a severe neurological disorder called Guillain-Barré Syndrome. An all-island case control study entitled ‘Risk factors for sporadic <em>Campylobacter</em> infection’, suggested that consumption of chicken, lettuce and food from takeaways, accounts for the majority of <em>Campylobacter</em> infections on the IoI. A 2008 EFSA survey of <em>Campylobacter</em> infection in the EU MS returned prevalence rates of 83 per cent and 98 per cent for contamination of broiler batches and broiler carcasses in ROI, respectively. A 2010 survey in the ROI found that 13 per cent of external surface packaging on chicken products and 11 per cent of retail display cabinets were contaminated with <em>campylobacter</em>. The same survey returned prevalence rates of 75 per cent and 86 per cent respectively, for contamination of broiler batches and broiler carcasses in the UK.</td>
<td></td>
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<tr>
<td>Salmonella spp.</td>
<td><em>Salmonella</em> is a major cause of bacterial enteric illness in humans worldwide. Salmonellosis presents as an acute clinical illness with sudden onset of headache, abdominal pain, diarrhoea, nausea. Fever is almost always present. Dehydration, especially amongst vulnerable populations, may be severe. <em>Salmonella</em> was the second most commonly reported cause of bacterial foodborne infection on the IoI in 2009 and 2010 (Table 1). The principal risk factor for human infection is consumption of undercooked contaminated foods of animal origin, such as pig meat, poultry, milk, eggs or beef, with pig meat being particularly important in an IoI context. However, all foods, including</td>
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<tbody>
<tr>
<td><strong>Verocytotoxigenic</strong> <em>Escherichia coli</em> (VTEC)</td>
<td>live naturally in the intestinal tracts of humans and other animals. <em>Salmonella</em> are usually passed to humans by eating foods directly or indirectly contaminated with animal faeces.</td>
<td>vegetables are susceptible to cross-contamination. It must be stated that not all salmonellosis is foodborne and direct animal-human contact is likely to make some contribution to case numbers.</td>
</tr>
</tbody>
</table>

VTEC, in particular serogroup O157, remains a highly significant zoonotic threat to public health. However, more recently, other non-O157 VTEC serogroups (O111, O26, O103 and O145) have emerged and have been associated with severe illness in humans. The clinical manifestations of infection range from symptom-free to diarrhoea, bloody diarrhoea, HUS, thrombocytopenic purpura and death\(^{180,181}\). Although VTEC is associated with relatively few human infections in comparison with other foodborne pathogens (such as *Campylobacter* and *Salmonella*) on the Iol, it poses particular concerns related to its very low infective dose (which may be as low as 10 colony forming units), and the severity of the resultant disease. Cattle are recognised as a primary reservoir of VTEC, following several outbreaks of VTEC O157 which were epidemiologically linked to undercooked beef products and raw milk\(^{225,226}\). VTEC can be transmitted to humans In the ROI in 2010, non-O157 serogroups made up over 40 per cent of VTEC notifications. Ireland and the UK have some of highest reported rates of infection in Europe\(^{220}\). In the ROI, exposure to untreated drinking water from private wells has been identified as an important risk factor for VTEC infection, as has person-to-person spread in childcare facilities. In May 2011, Germany reported a large outbreak of HUS and bloody diarrhoea caused by a Shiga-toxin producing *E. coli* serotype, O104 associated with the consumption of fresh produce\(^{221,222,223,224}\). Almost 4,000 people were affected with 51 deaths. A joint risk-assessment by EFSA/ECDC linked the German outbreak and a HUS outbreak in France\(^{59}\). Fenugreek seeds sourced in Egypt were implicated in both outbreaks, but no definite link was established\(^{225,226}\). |
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<tr>
<td><em>Listeria monocytogenes</em></td>
<td><em>Listeria monocytogenes</em> is the infectious agent responsible for human listeriosis which is one of the most serious foodborne bacterial infections. The morbidity and mortality of listeriosis is very high, with notified cases invariably reported as being hospitalised.</td>
<td>In England and Wales in 2009, there were 214 reported cases of human listeriosis (crude incident rate 54/100,000)(^{218}). An increase in the reported incidence of listeriosis in ROI in 2007 was not attributed to an outbreak, but to a general increase in incidence among pregnant women whose first language was not English, possibly reflecting an increase in the immigrant population in Ireland and their different cultural or food preferences(^{219,220}). Later, in 2010, 10 listeriosis cases were reported in the ROI with two confirmed cases in NI(^{230,231}). The foods most often associated with <em>Listeria monocytogenes</em> infection are ready-to-eat refrigerated and processed foods such as pre- prepared cooked and chilled meals, soft cheeses, cold cuts of meat, pâtés and smoked fish(^{232}). Failure of consumers to adhere to the “Use-by-dates” of these types of foods increases the risk of contaminated foods being consumed(^{233,234}).</td>
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by means of contaminated food and water, from person to person, and through contact with animals.
APPENDIX 6

Responsibility for food control activities on the Iol

Northern Ireland

- Local Authorities in NI are responsible for enforcing official food safety controls in the majority of food factories including approved cold stores, wholesale and distribution establishments, meat products plants, stand-alone meat preparation plants, as well as at retail and food catering levels.

- DARD Veterinary Service – Veterinary Public Health Unit is responsible for the delivery of official controls in slaughterhouses on behalf of the FSA. DARD QAB Milk Section enforces food hygiene legislation on behalf of the FSA in milk production units and approved liquid milk premises. In addition to the registration of milk production holdings, food businesses processing milk and dairy products require approval under the hygiene package. DARD QAB also inspects milk pasteurisation plants.

- Similarly, QAB Egg Marketing Inspectorate (EMI) acts on behalf of the FSA in respect of enforcement of food hygiene legislation at egg production units and packing stations in NI. DARD is responsible for imports from third countries of products of animal origin at Border Inspection Posts (BIPs).

- In NI, the FSA is responsible for monitoring, designation and classification of shellfish harvesting areas in accordance with Community legislation on food hygiene. Local Authorities are responsible for all other official controls including fish hygiene matters during harvesting, processing, wholesale, distribution, at retail and catering levels, and for the importation of shellfish and fish.

- Local Authorities in NI are responsible for enforcing official food safety controls in all foods of non-animal origin and for all other parts of the food chain including at import from outside EU.

Republic of Ireland

- In ROI, the FSAi is responsible for the implementation and enforcement of food legislation. It carries out this enforcement function through service contracts with 36 official agencies, and the Food Safety Authority of Ireland Act, 1998, provides the legislative basis for this. All of the official laboratories under service contract involved in food control achieved accreditation to ISO 17025 in 2010. The official agencies working under service contract agreement in 2010 were:
  - The Health Service Executive
  - DAFM
  - The Sea-Fisheries Protection Authority
  - 31 local authorities
  - The National Standards Authority of Ireland
  - The Marine Institute.
In ROI, DAFM is responsible for food control activities in high throughput slaughterhouses and meat processing, wholesale and distribution establishments. However, the Local Authority Veterinary Service is responsible for controls in slaughterhouses with a low throughput.

In ROI, official controls during primary production at dairy production holdings supplying raw milk for liquid milk processing is performed by the Dairy Inspectorate and the Veterinary Inspectorate of the DAFM on behalf of the FSAI. This includes the approval of premises and performing inspections and audits.

The HSE is responsible for official controls on products of animal origin at retail level and in the food service sector through the Environmental Health Service (EHS).

DAFM is responsible for imports from third countries of products of animal origin at BIPs.

In ROI, the Sea Fisheries Protection Authority (SFPA) is responsible for official controls on fish and shellfish from primary production, through harvesting, processing, wholesale and distribution, with the HSE having this responsibility in retail and catering operations. The SFPA is jointly responsible with DAFM for official controls on imports from third countries of fish and shellfish.

In ROI, The HSE is responsible for official controls on food products of non-animal origin at import, manufacturing, processing, wholesale, distribution and retail level.
8 References


3. Details of safefood-funded research projects, including those specific to surveillance, can be reviewed on www.safefood.eu/en/Professional/Research/


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