

Science Council Working Group on Data Usage and Digital Technology

Final Report to the Food Standards Agency (FSA)

June 2020

This report was prepared and endorsed by the Science Council Working Group on Data Usage and Digital Technology (Working Group 4) June 2020.

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Interests Declaration:

In line with FSA guidance on managing interests of its scientific advisers, the [interests of Working Group members](#) were assessed to identify any potential conflicts.

Professor Patrick Wolfe is a Non-Executive Director of The Alan Turing Institute Charity (Charity no. 1162533). This role was considered during the commissioning of project FS301085: Road-mapping Uses of Advanced Analytics in the UK Food and Drink Sector, awarded to the Alan Turing Institute. The Science Council Secretariat and Council members agreed that Professor Wolfe's Non-Executive role did not present a conflict with respect to his involvement in Working Group 4 discussion of project FS301085.

No other interests were identified.

*Professor Laura Green, Professor Mark Woolhouse and Mr Mark Rolfe stood down from their Science Council advisory roles in March 2020, at the end their initial 3-year appointments, before the final preparation of this report. However, their input was considerable through much of the Working Group 4 activity and early discussion of proposed advice and recommendations.

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Executive Summary

The Science Council Working Group on Data Usage and Digital Technology (Working Group 4) has aimed to provide independent advice and assurance to the Food Standards Agency's (FSA) Board on how the FSA might be assured that it is and remains best equipped to understand the next phase of opportunities (and challenges) associated with the digitalisation of our food system.

Working Group 4 was formed in September 2018 and whilst final preparation of this report was undertaken during (and impacted by) the COVID-19 pandemic, the implications of COVID-19 are not directly covered within the scope of this report. However, there can be little doubt that concerns for the resilience of our food system during the pandemic have the potential to act as a paradigm shift in how many within this system approach digital platforms and data sharing. This in turn impacts the underpinning infrastructure of data capture (i.e. standards and quality) and data governance and trust, and the opportunities to apply advanced analytical techniques which come with this. Working Group 4 would both welcome and encourage future FSA updates on its response to this report, in order best to reflect on the true extent of COVID-19's impact on the dynamics of thought and pace of data usage for food safety and authenticity.

Whilst the presented recommendations provide Working Group 4's independent assessment of where/how the FSA can further strengthen its approach to data usage and data innovation, Working Group 4 is confident the Board can be assured that the FSA is already well informed and well positioned to respond to the opportunities and challenges that the increased digitalisation of our food system is likely to present in the next 2-5 years.

"Well informed and well positioned" highlights one of the key considerations associated with this review: the FSA's positioning as a leader of data innovation as opposed to an observer and advocate of it. Work commissioned with the Alan Turing Institute to aid Working Group 4's investigation provides some guidance on how 'readiness for operational adoption' in all things digital might be consistently assessed and articulated. There is a balance to be struck here between the adoption of approaches which are easily implemented, and the targeting of longer-term innovations which may take greater investment of FSA resources, but which could deliver significant transformational impact in the FSA's role as a 'central competent authority'. Wherever possible it would be beneficial to collaborate with others with respect to the latter, leveraging additional capability and capacity. Data innovations in general should not of course be heralded as solutions for every challenge or a means to replace decision making processes; indeed, it must be emphasized that transparency and explainability remain central to consumer trust in the 'advancement' of data-enabled decision making.

Working Group 4 has provided six high-level recommendations which seek to protect and encourage the FSA's strategic positioning on data and digital opportunities. These could perhaps be summarised as supporting the key areas of governance, capability and culture. It is however also fair to acknowledge, with the benefit of hindsight, that the Science Council has come to realise the original Working Group 4 terms of reference were perhaps more narrow than the full scope of the several far-reaching opportunities and challenges facing the FSA, and indeed the rest of Government.

Working Group 4's increased appreciation of this has pragmatically shifted the positioning of its final outputs, making them higher level and more strategic. For this reason, we are confident that Working Group 4's output—and an ongoing plan to revisit this output within the FSA—will be able to add significant value to the FSA in its mission.

The six Working Group 4 recommendations can be briefly summarised as follows:

Recommendation 1: Champion an integrated approach to data standards

Data standards are fundamental to our ability to operate in a connected data ecosystem. The FSA must continue to work with partners to actively influence standards where this is felt to be justifiable in relation to consumer interests.

Recommendation 2: Grow the FSA's technical leadership for data

The FSA's informed data leadership risks being too narrow, without mechanisms that offer sufficiently transparent challenge and assurance to enable the Board to derive confidence that external developments and strategic opportunities are considered in a consistent manner. Working Group 4 believes the FSA would benefit from the formation of an additional data advisory/governance structure in support of its assured data leadership.

Recommendation 3: Champion the principles of permissioned data access and open data where possible and explore options available to mandate improved data access where consumer interest is at stake

Data access is overwhelmingly recognised as the primary bottleneck and prerequisite for unlocking future opportunities in data innovation. The ability of the FSA to further access the wealth of food industry data and encouraging others to further exchange data on a permissioned basis, could be revolutionary to the safety and authenticity of our food system. There may however be instances where the anticipated value/benefits to consumers are such that legal options to gain mandated data access, should be further explored. A natural next step, should the FSA deem it appropriate, could well be to develop a concrete plan to determine how it can best champion the furtherance of permissioned data access and open data.

Recommendation 4: Whilst remaining responsive to rapidly emerging opportunities for innovation, the FSA would benefit from more consistent completion of the 'innovation cycle' and long-term monitoring of impact for data innovations

A 'mixed portfolio' of innovation efforts is required for the FSA to maximise its effectiveness in the data space. The FSA's 'proof of concepts' and 'sprints' have shown good 'promise' but the translation and transition into everyday operational use and monitoring the long-term success and impact of this could be improved.

Recommendation 5: Encourage the development of data capabilities and skills across the FSA staff base

Working Group 4 would encourage greater systematic development of data skills in the wider FSA staff base. It is important that staff can appreciate the implications and have the necessary capabilities to provide a baseline level of challenge to the data systems they are presented with, to make informed, evidence-based decisions. This is consistent with the principles of ensuring analytical explainability and FSA transparency.

Recommendation 6: Ensure the FSA is sufficiently equipped to attract, reward and retain internal skillsets, whilst continuing to endorse flexible means of providing data skills and capabilities for the FSA

The FSA has proved adept in utilising external support to deliver its data projects. However, it is important to acknowledge that data expertise attract a premium and, there is need to ensure the FSA is sufficiently equipped to access and maintain capabilities, both externally and internally where in-house capacity is believed necessary.

Working Group 4 is hopeful that the proposed recommendations will prove effective in supporting the FSA's efforts to grow its reach and influence as a modern, excellent and data enabled regulator, and to ensure consumer trust in the safety and authenticity of the UK food system.

It is of course reasonable to highlight that the issues surrounding data and its use are expansive, beyond the means or need of the FSA to address alone. Indeed, the Centre for Data Ethics and Innovation's recent AI Barometer report¹, highlights many of the same issues as 'common barriers' in realising harder to achieve benefits. Working Group 4 is optimistic that its recommendations should however support an integrated approach to shared opportunities for innovation at the convergence of our food and data ecosystems.



Professor Patrick Wolfe
Science Council Working Group 4 Chair



Professor Sandy Thomas
Science Council Chair

Introduction

Prior to the establishment of the Science Council Working Group on Data Usage and Digital Technology (Working Group 4), the Science Council recognised that use of data and digital technology is critical in the Food Standards Agency's (FSA) mission to keep food safe and what it says it is, and the Agency's ambition to achieve this goal, operating as an excellent, modern and forward-thinking regulator.

The Science Council [Working Group on Horizon Scanning](#) highlighted the unprecedented pace of technological development across many sectors. It concluded that whilst the food and drink sector as whole, is perhaps slower to embrace new technologies than others, the FSA must nevertheless remain attuned to both the 'art-of-the-possible' and step-changes in the sector's application of data systems, through its intelligence systems and access to data science capabilities.

The FSA operates at a critical focal point between other food system and health regulatory and enforcement partners, Food Business Operators (FBOs) and consumers, with opportunity to engage, exploit and enrich the data streams available to and from all of these. Data on its own has little intrinsic value until it is translated to information, knowledge and insight. Sharing with others often further increases its cumulative value, particularly when datasets can be combined. The ability of the FSA to harness the breadth of data available to it, led by an outcome-based approach represents an important opportunity to keep our food system safe, authentic and trusted. There are already several leading examples of FSA innovation and good practice in data applications such as the use of Distributed Ledger Technology (i.e. Blockchain) for more efficient and effective collection and communication of inspection results in abattoirs², and in making the majority of the FSA's data catalogue publicly available³.

The FSA has an important opportunity to acknowledge, consider and connect to wider data and digital transformation. The resources available to the FSA are of course limited, and it is imperative that it invests intelligently relative to its size, core remit and organisational needs. It has expressed cognizance to take stock of work going on elsewhere on 'grand challenges' of our data 'ecosystem', with an ambition to collaborate, influence and leverage others towards FSA interests. It would not be appropriate or possible for the FSA to drive digital transformation on its own, but it should remain strategically placed to take advantage of opportunities as they arise. Otherwise, it risks falling rapidly 'out of touch' as advanced data/digital capabilities continue to move from a competitive/strategic advantage to an essential asset.

The aim of this report from the Science Council is to provide independent advice and assurance to the FSA Board, to help the FSA better understand the next phase of data and digital opportunities and challenges, and inform the FSA's strategic response. This builds on the earlier advice and impact of the now closed General Advisory Committee on Science (GACS) on 'Data Exploitation' from 2014 (Annex 2), from which it was considered sufficient time had passed to warrant further independent review.

Working Group 4 was formally established in September 2018 under the Chairmanship of Professor Patrick Wolfe, with its [Terms of Reference](#) setting out four questions for consideration:

1. Over the next 2-5 years, what are likely to be the emerging data tools, techniques and technologies which could have the greatest impact on the FSA's mission?
2. Where and how could the FSA benefit from modifying its data collection processes? What are the expected benefits of any changes?
3. What are key implications for the FSA of advancements in open data, data sharing and how should the Agency go about leveraging them (including private/industry data)?
4. How can the FSA ensure that it adopts the right controls and governance around data?

Approach Taken by Working Group 4

To address these questions, Working Group 4 employed a two-phased approach:

Phase 1 Objectives:

- I. Consider the FSA's current use of technologies and data, understanding and identifying any obvious gaps or room for improvement;
- II. Identify the people or groups the FSA should be learning from and/or working with;
- III. Identify what additional inputs the Working Group requires (expertise/insight/commentary);
- IV. Consider if there is a need for the Working Group to commission advice or research to inform its work;
- V. Agree approach to Phase 2.

Working Group 4 participated in an initial series of exploratory interviews (Table 1) to better understand the FSA's current data usage across several FSA 'business areas' considered to be highly relevant. This was accompanied by discussion with the FSA Director of Openness, Data, Digital and Science and the FSA's Chief Scientific Adviser. The Working Group Chair used this to synthesise an initial summary of internal learning, that helped steer Phase 2 activity.

Business Areas Considered	Representatives Interviewed
Analytics and Social Science	Head of Analytics, Vanna Aldin, and Head of Social Science, Michelle Patel
Incidents Team	Senior Incidents Officer, Mohammed Din
National Food Crime Unit	Head of Intelligence, Giles Chapman
Regulatory Compliance Division	Head of Regulatory Compliance and Standards, Catriona Stewart, and Head of Delivery Support, Mark Davis
Regulating Our Future	Chief Information Officer, Leigh Sharpington
Field Operations	Head of Operational Delivery (Wales & West England), Glen Portman
Strategic Surveillance	Head of Data, Jesus Alvarez-Pinera,
FSA's Independent Data Fellow	Dr Anatol Wegner, University College London

Table 1: FSA business areas communicated with as part of the initial Phase 1 exploration of current FSA data usage and business area aspirations.

Phase 2 Objectives:

- I. Identify the emerging data tools, techniques and technologies of the next 2-5 years which could have the greatest impact on the FSA's mission;
- II. Consider the key implications for the FSA of advancements in open data, data sharing;
- III. Consider how the FSA can ensure that it adopts the right data governance and legal & regulatory frameworks for the use of data, including ethical use;
- IV. Advise on the options for the FSA to understand and respond better to the most significant issues;
- V. Consider how the FSA might appropriately support or encourage private sector or governmental adoption/adjustment thereof;
- VI. Consider how the FSA can assess and review its priorities.

Reflecting insights derived from Phase 1 and the objectives above, Working Group 4 commissioned research in two key areas, with the support of resources from the FSA's Strategic Evidence Fund (SEF):

1. Road-mapping Uses of Advanced Analytics in the UK Food and Drink Sector Project FS301085, commissioned with [The Alan Turing Institute](#).
2. Developing 'Data Trusts' for the Food Supply Chain Project FS301083, commissioned with the [Internet of Food Things Network Plus](#) (IoFT).

These projects were used to inform Working Group 4's response to Phase 2 objectives and supported formulation of its final advice and recommendations by providing supplementary sector-specific expertise. Putting emphasis on these external projects

was not without risk, including challenging the timeliness of the delivery of the Working Group 4 report. However, this was assessed to be the best path forward considering insights from Phase 1, and the fact that the Group's remit was sufficiently technical to require additional expertise beyond that available to the FSA and Science Council.

Phase 1 Summary- Lessons from FSA 'Discovery' Interviews

Phase 1 affirmed that there is much to commend with the FSA's existing approach to data usage and innovation. Nevertheless, three key themes encompassing a range of issues and questions were consistently highlighted by FSA staff (Table 1):

Aspirations, Culture and Skills

There are pockets of excellence across the FSA, and strong aspirational goals from FSA leadership, but the "data culture" at the operational level is variable: innovation and modernisation are sometimes met by cultural barriers.

Meanwhile, the pace of advancement in the data/digital space is relentless. The FSA will not be able, nor does it necessarily need to demonstrate either thought leadership or undertake technical demonstration of 'novel' applications unless it believes the opportunity presented is sufficiently 'mature'. Rather, the FSA should acknowledge and consider the work undertaken elsewhere in the "digital landscape", including that referenced in Annex 1.

Working Group 4's leading challenges to the FSA and considerations under the theme of aspirations, culture and skills include:

- Having the sight/structures in place to ensure that it can consider external developments and strategic opportunities in a consistent way.
- Ensuring sufficient 'opportunity', including resource allocation, for staff to develop or access novel approaches in data usage and digital technology that address 'user needs'. The critical user for applications can of course vary, for example this may be enforcement partners or consumers directly. Collaborative user experience design is an important component of the FSA's skills and capacity needs.
- Improving communication between FSA subject matter (business area) experts and data scientists to ensure work focusses on necessary, well-defined problems and that shared expectations are clearly articulated, potentially mitigating the impact of for example, effort underestimation or competing priorities once work is initiated.
- Ensuring a sustainable capability and capacity model, which could involve a blend of third-party service providers (existing FSA partners include IBM, Cognizant and Epimorphics) and in-house expertise; considering a maturity assessment of the specialist skills available in the FSA.

Data Standards and Timeliness

Maintaining the 'correct' data standards enables better linkage and use of data from different sources. However, whilst the FSA may advocate a standard where there is justifiable need for one, it is not fully within the FSA's gift to 'police' a standard. In

further support of this consideration, Working Group 4 welcomed the FSA's Chief Scientific Adviser's Science Report on Data Standards⁴, published in April 2019, for the clarity in which the principles of "adoption, consensus and ownership" as different circumstances suggest, are articulated.

'Quality' data i.e. that which is complete and accurate, and the ability to link a broad range of signals is mission critical for example to the National Food Crime Unit (NFCU), as is the 'timeliness' of availabilityⁱ, particularly as business areas across the FSA are being asked to do more in light of EU Exit.

Digitising a data collection and/or enforcing a data standard for an ineffective or poor-quality dataset does not make it automatically better or more useful. In each instance, the specific outcome which needs to be achieved should be used to drive what is asked for/collected and how (and how additional assurance of this might be gained). In an UK governmental context, this includes ensuring that professional standards for data collection, analysis and publication and for analytics i.e. that of both the Data Ethics Framework⁵ and the so called "Green Book"⁶ are sufficiently considered in the design phase before any new collection is created.

Working Group 4 supports the role of the FSA's IT Management Board in assuring any new data collection meets its intended purpose, and avoids unnecessary duplication although, it was noted that at the completion of the design phase or following a preliminary collection phase, it is crucial that the correct validation checks are in place for further operational assurance.

Data Access and Trust

The FSA's "Open by default" data transparency, making approximately 70% of all datasets available within its data catalogue², is a significant asset.

The volume of data in the food sector is enormous. From the Working Group's discussions, its leading questions with respect to data access and trust are:

- How can the FSA 'open-up' consistent access with and between others for mutual benefit?
- What are the key questions and answers the FSA would seek to address through access to external data sources?
- What are the leverage options available and where should efforts be prioritised?
- How do we assure competitive interests are safeguarded but equally utilise data to drive system competition, allowing more informed consumer choices and trust?

Particularly in relation to discussing access to FBO data, it is important to be clear that the aim is to incentivise improvement to food safety, system trust and resilience, and not necessarily to unduly penalise those who participate when data has been voluntarily shared. The FSA must be mindful of the 'mature' enforcement options available when issues are identified under such terms.

ⁱ The meaning of 'timely' is, of course, dependent on the use being made of the data and the time window available for associated action.

Working Group 4 members also highlighted the future of the General Data Protection Regulation (GDPR) post EU-Exit as 'UK GDPR'^{7, 8, 9}. The FSA should be aware of how any future adequacy decisions on restricted data transfers may influence or impact global research collaborations and trade, and how this may in turn influence its evidence base though no substantive comment or recommendation is possible at this time. This will however be a space that it is advisable for FSA to continue to watch closely, as impacts and ramifications of UK GDPR for the legalities of data transfer and algorithmic explainability become gradually clearer through case law.

Phase 2 Summary- Response to Outputs from Commissioned Work

Two pieces of supplementary work were commissioned as part of Phase 2:

Road-mapping Uses of Advanced Analytics in the UK Food and Drink Sector (FSA Project Reference: FS301085)

The use of advanced data analytical methods, commonly if not always accurately thought of as machine learning and artificial intelligence, is in line with FSA aspirations to be more proactive and preventative in its situational awareness and risk analysis. The ability to access increasing amounts of data, providing it is of sufficient 'quality', provides opportunity to explore the use of such tools, be this supervised learning (where a 'training dataset' is required and used as reference) or unsupervised learning (where the approach is capable of discovering hitherto unknown patterns in data).

A study team from the Alan Turing Institute, the UK's National Institute for Data Science and Artificial Intelligence, was asked to consider the different tools/approaches in development, any evidence for their application in the food sector now or likely in the near future (2-5 years), and to further consider the legal or ethical challenges if such tools are used to drive decision making.

The Turing team's Final Report¹⁰ highlights the continuously developing/evolving opportunities to deploy data analytics for enhanced user 'dashboards', horizon scanning tools (consistent with Science Council Working Group 3 recommendations¹¹), intelligence driven inspections, aid the detection and prevention of food crime and in the mitigation of food related incidents.

Both the Turing study team and Working Group 4 were encouraged by the progress the FSA has made in its data 'sprints'ⁱⁱ and 'proof of concepts' in the areas above already¹². Indeed, the pace is such that further advancements have been made with respect to the development of Type 1-3 tools (as defined by the Turing Report), since that team first undertook their assessment. However, explainability^{iii, 13} remains the

ⁱⁱ A 'Data Sprint' is time-bound activity for application development

ⁱⁱⁱ Explainability is the capacity of a machine learning model to make its behaviour transparent or understandable to its users. This is a key requirement if data analytics tools are to be trusted by their users and in an FSA context, consumers, as aids in decision-making tasks.

critical barrier for the 'most advanced' Type 4 tools. These are unlikely to be deployable within the next 2-5 years in an FSA context due to a lack of readily accessible articulation of how an output was produced.

Whilst explainability was undoubtedly the primary factor in the Turing Report's assessment of the 'readiness for adoption' of the various approaches available or in development, other factors may impact the overall assessment (Box 1). These broadly capture an indication of the strategic opportunity presented and the technical capability to develop/apply a tool to the FSA's context, giving an overall indication of prospects for success in operationalising. Of course, both the Turing team and Working Group 4 nevertheless recognise irrespective of any initial 'readiness' assessment, a degree of experimentation is required to identify the best performing approach to the FSA's specific needs.

Box 1: Factors influencing the readiness for operational adoption of advanced analytics in an FSA context, as identified by the commissioned Turing Report. This approach combines scoring of the ‘opportunity’ with the availability analytical approaches to support operational prioritisation.

- 1. Strategic Value:** address food safety or authenticity risks that are important to the FSA as a food system regulator and are: (a) currently a known gap; or (b) predicted to change within next 2-5 years; (c) have high impact as measured by (i) severityⁱ and/or (ii) scale;
- 2. Dataset Availability:** (a) official, open, good quality; or (b) official or proprietary, negotiable access, good quality; (c) harvestable, requiring little cleaning;
- 3. Ethical and Legal Compliance:** uses methods and development processes that can demonstrate compliance with the recently published ATI ethical framework, i.e., (a) process and (b) outcome transparency, including explainability;
- 4. Opportunity Score:** a summary of factors 1-3 reflecting potential benefits, e.g. (a) bringing enhancements to existing practice, including improving robustness, enabling more timely interventions and/or reducing costs; or (b) establish a new practice and competencies;
- 5. Method Availability:** maturity of methods as evidenced by demonstrated practical value in similar applications and supported by high quality software tools;
- 6. FSA PoC or Sprint Projects:** well-defined use case, satisfactory results in terms of performance and so qualify as potential minimum viable product;
- 7. Generalisability:** have potential to be applied to other use cases with minimal additional effort.
- 8. Analytics score:** a summary of factors 5-7, reflecting operational readiness of the method(s);
- 9. Overall:** a summary of opportunity and analytics scores.

Developing ‘Data Trusts’ for the Food Supply Chain (FSA Project Reference FS301083)

As acknowledged by the Turing project, data availability or accessibility drives opportunities to enhance our situational awareness and explore the use of advanced data analytical methods. However, data costs. It costs to collect, store and analyse. These cost and who bears them will of course vary but as such, must be weighed carefully against the ‘need’ for any data collection. Nevertheless, our food system

collects a vast amount of data, of which the greater availability i.e. accessibility of some would be in consumer’s interest.

Food sector data is often spread across multiple actors and may lack adoption of common standards^{iv}, and whilst the sharing of data may be in the regulators or consumer interests, it may challenge the competitive interests of independent and competing FBOs or other associated organisations.

The challenge here then is how should entities collaborate to make information that protects consumer interests accessible in a way that is safe, legally valid and demonstrably beneficial?

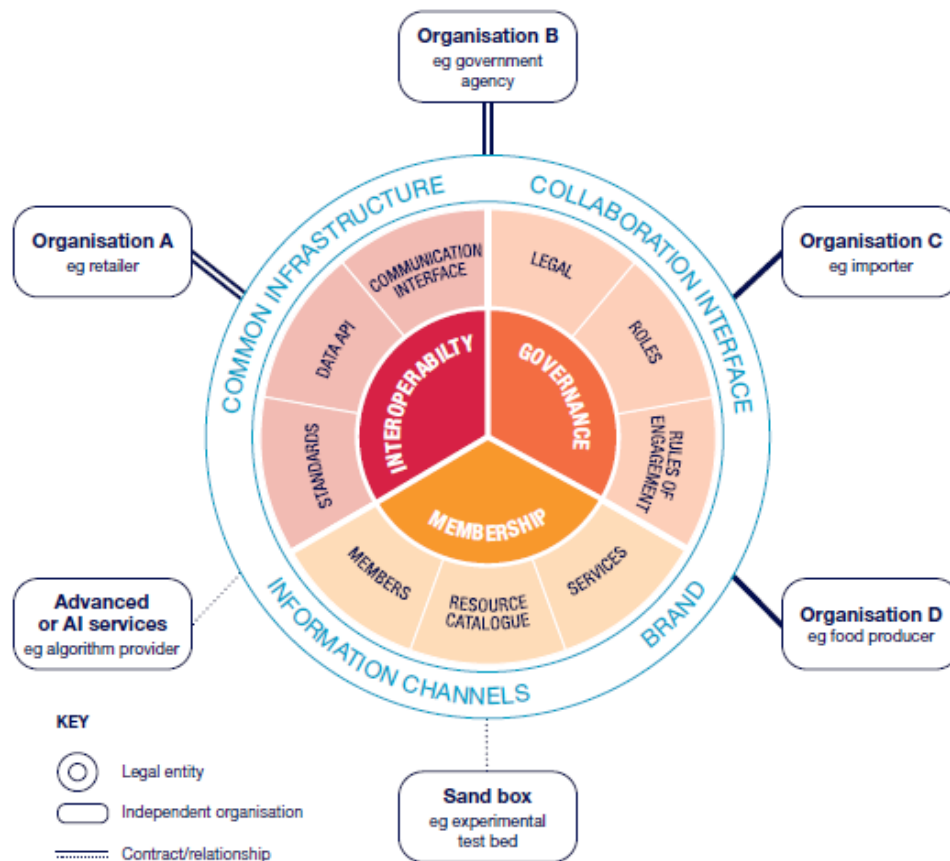


Figure 1: Key concepts of a collaboration framework as in development by the commissioned ‘Data Trusts’ project with the IoFT.

Project FS301083: Developing ‘Data Trusts’ for the Food Supply Chain, in collaboration with the IoFT seeks to provide a blueprint and build a minimal viable ‘digital collaboration framework’ for food safety which builds on research from the Open Data Institute¹⁴ and recognises already leading industry practice of for example the Food Industry Intelligence Network (fiin) (Annex 1)¹⁵.

^{iv} e.g. a common format or structure for data, aiding interoperability

This work unpacks the layers of segmentation (Figure 1) necessary to construct, incentivise and govern a viable, scalable and technologically coherent collaborative agreement framework and apply this to several use cases.

Given the practical design and build element of this research project, it has an extended deadline, and is due to report to the FSA in December 2020, though interim reporting and project thematic discussion has helped Working Group 4 to formulate its recommendations.

Working Group 4 Advice and Recommendations to the Food Standards Agency

As with the Science Council's previous Working Group activity, the advice and recommendations in this report aim to inform the FSA's strategic direction whilst allowing the FSA flexibility in its interpretation, response and delivery.

The recommendations reflect the original Working Group 4 objectives, lessons learnt from Phase 1 interviews and Phase 2 commissioned work to date. Working Group 4 also emphasises the relevance of advice previously provided by other Science Council Working Groups, particularly that of the [Working Group on Capability and Assurance](#).

All five of the issues that that Working Group addressed have some application here and Working Group 4 encourages further review of that guidance.

Recommendation 1: Champion an integrated approach to data standards

(Theme- Data Standards and Timeliness)

The FSA produces, collects and draws on a range of datasets relevant to its mission. There can be several challenges in this respect, particularly in relation to 'historic' collections, but Working Group 4 has welcomed the work underway at the FSA with respect to data standards: in identifying and understanding gaps, and in working with others to adopt or establish standards as most appropriate.

Data 'wrangling' i.e. dataset preparation, organisation, integration is a common problem which can absorb significant resources associated with any data project/application. Data standards are part of the conversation on data quality, presenting an agreed way of doing things, mitigating some need for data wrangling. However, data standards do not necessarily guarantee the completeness and accuracy of a dataset, which is still reliant on the source of input i.e. standards support quality and trust, but they do not assure it.

Nevertheless, data standards are fundamental to our ability to operate in a connected data ecosystem, though it is not necessarily fully within the FSA's gift to define a standard, depending on the issue. The FSA must continue to work with partners like for example GS¹⁶ and BSI¹⁷, and others, to actively influence data standards where this is felt to be justifiable in relation to consumer interests.

Recommendation 2: Grow the FSA's technical leadership for data

(Theme- Aspirations, Culture and Skills)

Whilst the sponsorship of the FSA's Board and Executive in recognising the opportunities data and digital opportunities can afford in delivering the FSA's mission is a significant asset, the Agency's informed senior data leadership at present risks being too narrow. Working Group 4 consider the FSA's data leadership overly reliant on the Director of Openness, Data, Digital and Science, without mechanisms that offer sufficiently transparent challenge, assurance and potentially resilience, to ensure the FSA has the sight/structures in place which enable the Board to derive confidence that external developments and strategic opportunities are considered in a consistent manner.

Recognising the existence of the Strategic Surveillance Steering Committee, Working Group 4 believes the FSA would benefit from the formation of an additional data advisory/governance structure in support of its assured data leadership. This was also flagged in Recommendation 8 of the 2014 GACS report (Annex 2). Six years on, Working Group 4 has concluded that this recommendation is critically important and deserves serious consideration by the FSA.

Recommendation 3: Champion the principles of permissioned data access and open data where possible and explore options available to mandate improved data access where consumer interest is at stake.

(Theme- Data Access and Trust)

Data access is overwhelmingly recognised as the primary bottleneck and prerequisite for unlocking future opportunities in data innovation. This is of course in no way unique to the food sector. The demonstration of value to the data's owner, as well as the wider user community, whilst maintaining individual interests and mutual trust is extremely challenging. Nevertheless, the ability to further access the wealth of food industry data, could be revolutionary to the safety and authenticity of our food system, fiin of course a pertinent example of permissioned data sharing/access.

There are also some positive indications of perhaps improving availability of open datasets, such the recent publication of a purchasing dataset from Tesco¹⁸. However, recognising that such open publication is unlikely to be thought suitable in many instances, the ongoing project commissioned with IoFT to explore 'Data Trusts' hopes to address privacy issues and perhaps improve the timeliness of data exchanges, broadening the discussion of a viable framework for permissioned data exchanges in the food sector, through membership agreements.

There are however instances where the anticipated value/benefits to consumers, particularly in relation to the work of the NFCU, is such that legal options to gain improved (mandated) data access for the FSA, should be further explored. The FSA must of course be willing to accept greater responsibility and accountability for such data and actions taken in response to it, should such levers be employed. Equally, where permissioned or open data access has been provided to regulators, it is crucial to maintain a mature approach to any identified enforcement needs.

A natural next step, should the FSA deem it appropriate, could well be to develop a concrete plan to determine how the FSA can best champion the furtherance of permissioned data access and open data.

Recommendation 4: Whilst remaining responsive to rapidly emerging opportunities for innovation, the FSA would benefit from more consistent completion of the ‘innovation cycle’ and long-term monitoring of impact for data innovations

(Theme- Data Standards and Timeliness)

A ‘mixed portfolio’ of innovation efforts is required for the FSA to maximise its effectiveness in the data space. The FSA’s ‘proof of concepts’ and ‘sprints’ have produced many examples showing promise. However, the translation and transition of these outputs into everyday operational use and monitoring their long-term success and impact could be improved. This is not to suggest that it is expected that every sprint would be fully operationalised: data science and particularly the application of advanced analytics is hypothesis-led, and a degree of experimentation is required to find an approach most effect for FSA needs. There are also reputational advantages of being close to the ‘cutting edge’ of strategic innovation, but the consistency at which the FSA considers the utilisation of its resources and future justification of those based on longer-term transformation could be more clearly evidenced. Signifying the operationalisation of a ‘tool’ alone is not enough to assert its impact on the delivery of FSA activities and further increasing the visibility of applications may help engage others enthusiastic to support our areas of research interest target efforts and better build on what’s come before. However, Working Group 4 appreciates there may be risks with this i.e. perhaps creating opportunity to more easily circumvent surveillance, and the challenge posed by further developmental, maintenance and engagement resourcing, and the likely limits to the FSA’s responsibility for customisation of published services (i.e. what can and perhaps should be undertaken by others rather than using FSA resources), as each new application is made available.

In this context, articulation of the decision of what *not* to prioritise based on an ongoing ‘readiness’ assessment, such as that developed by the Turing project team (Box 1) is also valuable to evidence. This approach may help to identify opportunities for additional collaboration, influence and leverage, where innovative R&D, using our food system as a complex model, may take greater precedence over near-term and more strictly user-focused internal application development.

Recommendation 5: Encourage the development of data capabilities and skills across the FSA staff base

(Theme- Aspirations, Culture and Skills)

Despite some suggestion that recognition/realisation of the potential benefits that data approaches offer is increasing, there is need for greater, systematic development of data skills in the wider FSA staff base, hand-in-hand with growth of FSA’s technical data leadership (Recommendation 2).

As acknowledged by the IoFT team, not all of us will have to become fully fledged data scientists. However, it is reasonable to expect that many will need greater awareness of the opportunities and risk associated with data-driven systems.

All FSA staff are expected to maintain and develop training in relation to their roles and for personal development. Supporting the development of improved data awareness and capabilities could be targeted towards the needs of specific roles, though other opportunities may be more ‘generic’. Working Group 4 would encourage

at least one day per annum to be specifically designated to improve data handling skillsets, for each member of staff. It is important that staff can appreciate the implications and have the necessary capabilities to provide a baseline level of challenge to the data systems they are presented with, to make informed, evidence-based decisions, in all areas of FSA delivery. This is consistent with for example, the principle of ensuring explainability.

This step of course is not sufficient in itself for any significant shift in capabilities. Nevertheless, it reinforces a positive cultural message, supports intelligent and creative 'provider and user' relationships at all levels, and can be monitored in delivery. These improved provider and user relationship will further support staff to access and help develop novel approaches that address their business area needs.

Working Group 4 would encourage the FSA's response to consider what central or other appropriate governmental training resources are available or could be leveraged for implementation.

Recommendation 6: Ensure the FSA is sufficiently equipped to attract, reward and retain internal skillsets, whilst continuing to endorse flexible means of providing data skills and capabilities for the FSA

(Theme- Aspirations, Culture and Skills)

The FSA has proved adept in utilising external support to deliver its data projects. However, it is important to acknowledge that data expertise attracts a premium and, there is need to ensure the FSA is sufficiently equipped to access and maintain capabilities, both externally and internally where in-house capacity is believed necessary.

A critical mass of internal skills, and potentially, access to computing power is required to implement activity effectively, and this will likely become more significant as advanced data tools 'become the norm'. It is also important to recognise the diversity of skill types that this might include. Effective data project management is likely a distinct function to the 'deep technical specialist'. However, brokerage between user need and technical delivery can be just as critical in achieving overall impact.

The 'mixed economy' procurement strategy currently employed is appropriate. Nevertheless, Working Group 4 wishes to highlight ongoing consideration of whether the FSA has enough internal vs. external/*ad hoc* capacity and capability, and how this compares to that of other comparable regulators. The resources available to the FSA are of course limited, and it is imperative that it invests intelligently relative to its size, core remit and business needs. The FSA might reasonably wish to contemplate different scenarios in terms of the skills required, and potentially look to promote shared opportunities presented by, for example, a government Spending Review¹⁹, other resources made available by activities highlighted in Annex 1, or by further encouraging coordinated recognition of the government data science 'profession'.

Conclusions

Since the establishment of Working Group 4 in September 2018, the FSA and its efforts in relation to the application of data and digital technologies for improved food safety and authenticity, have not remained static. Much has been achieved/developed since that time, as captured in the most recent Annual Surveillance Report to the Board January 2020¹¹ (which acts as a proxy for the Board's strategic discussion of data and analytics), but also recognising the FSA's forward look from its 'Regulating Our Future' Programme to 'Achieving Business Compliance'^{20,21,22}.

Working Group 4 is confident that its advice and recommendations remain relevant and do not conflict with these ambitions, helping the FSA to 'do more', in a joined-up manner, and will make material impact to consumers with the insights and capability gained. This comes irrespective of the acknowledgement that the original Working Group 4 terms of reference were perhaps narrower than the full scope of the several far-reaching opportunities and challenges facing the FSA, and indeed the rest of Government.

Putting this report in the context of the FSA's current operations, the FSA's situational awareness and risk analysis systems undoubtedly will be challenged by the UK's imminent exit from the European Union, with clear opportunity for data systems to augment our capability and capacity. There may also perhaps be opportunities to be realised from the 'shock' COVID-19 has caused to our food system.

Working Group 4 would have welcomed the opportunity to further consider the support FSA data systems are providing to the ongoing national COVID-19 response and associated horizon scanning²³. However, the 'need' here was not felt sufficient to further delay delivery of the Working Group 4 report. Nevertheless, if there are gains to be derived from COVID-19, it has been in highlighting the vulnerability of our global food system and in presenting a window of opportunity to transform it. An opportunity which clearly has not been missed by the FSA²⁴, and perhaps how will also emerge from the shortly expected National Food Strategy²⁵, as an opportunity to build system trust. In this context much of the discussion of data sharing and data standards for improved situational awareness is requiring less of a 'hard sell'. Indeed, the ambitions of the new Joint Biosecurity Centre²⁶ may present collaborative opportunities or transferable tools and lessons for the FSA amongst other UK food system regulators.

Reflecting on the original four questions posed in the Working Group 4 terms of reference:

1. Over the next 2-5 years, what are likely to be the emerging data tools, techniques and technologies which could have the greatest impact on the FSA's mission?

Working Group 4 has come to better appreciate that for the most part, the appropriate answer to this question appears to lie one level higher, in assurance of the decision making process linked to the 'readiness for adoption' (Box 1) and crucially the 'explainability' of a given approach.

There is of course a balance to maintain here between consistently pursuing easily implementable applications, which may be misconstrued as the implied advice, and targeting innovations that may take greater resources, but which could deliver

significant transformational impact. However, wherever possible it is beneficial to collaborate with others in respect to the latter.

This 'mixed portfolio' is likely to be the most effective way to provide the long-term support of our horizon scanning capabilities, attract others to FSA areas of research interest and secure maintenance of effective food safety regulation as business models, operations and trade change.

2. Where and how could the FSA benefit from modifying its data collection processes? What are the expected benefits of any changes?

The FSA has shared positive evidence of existing processes. No new FSA data collections are made unless the 'business value' can be clearly demonstrated, whilst there is also evidence that the FSA is looking to 'do things better' with respect to modifying existing collections. For example, changes are being made to the Food and You Survey²⁷ (taking on board the advice and recommendations of the Advisory Committee for Social Science²⁸) and to how the FSA collects and makes available information on Local Authority performance²⁹. This latter example on Local Authority performance closely links to discussion of data standards and associated accessibility of data. Working Group 4 identified little cause for substantive changes to current thinking. However, as per Recommendation 1, Working Group 4 wishes to reiterate the significance of this work, so as not to lose sight of such efforts nor the continued promotion and feedback on pertinent standards with stakeholders.

3. What are key implications for the FSA of advancements in open data, data sharing and how should the Agency go about leveraging them (including private/industry data)?

The ability to access quality data, based on a defined 'need' and demonstratable benefit to consumers, has the potential to be transformative to the FSA's vision of a safe, authentic food system. However, existing cross-sector evidence demonstrates there is no 'silver bullet' with respect 'trusted' data access and sharing. Commissioning the 'Data Trusts' project with IoFT represents Working Group 4's contribution to this challenge and we look forward to receiving their full report in due course, and the FSA's consideration of any subsequent actions/activity which are felt warranted following this.

Working Group 4 would however like to further understand (and potentially support) available options to mandate greater data access in instances where there is thought to be an immediate risk to consumer interests in food safety.

4. How can the FSA ensure that it adopts the right controls and governance around data?

Governance is an expansive issue but the FSA's integrated approach, working with others and taking advantage of the thought leadership and resources invested elsewhere, for example by the groups or in the activities in Annex 1 has, and will continue to help the FSA derive confidence in its applications, and their associated controls and governance. Most of Working Group 4's recommendations have relevance in this context but the FSA's approach to data standards (Recommendation 1) and its approach to capability, capacity and resourcing (Recommendations 2,5 & 6) can be further emphasised in supporting effect governance decisions.

Ultimately, the question of where the FSA wants to position itself as a data enabled organisation will of course warrant continued, regular review by the FSA Board, supported by an appropriate resourcing strategy.

Whilst the presented recommendations provide an independent assessment of where/how the FSA can further strengthen its approach to data usage and data innovation, Working Group 4 is confident the Board can be assured the FSA is already well informed and well positioned to respond to the challenges and opportunities the increased digitalisation of our food system will present in the next 2-5 years.

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Annex 1- Bodies or activity that should contribute to an FSA data and digital ‘watchlist’, and that may also present collaborative opportunities within which to promote FSA interests

Name	High-Level Introduction	Links
Data Advisory Board and Data Leaders Network	The Data Advisory Board is the senior public sector board responsible for driving the better use of data in government. It is accountable for example, for the NDS (as below). The Data Leaders Network supports the Data Advisory Board by acting as a delivery arm and advisory council on data initiatives and strategy discussed by the Board. The FSA participates in the Data Leaders Network but not the Data Advisory Board. The secretariat for both sits within the Department for Digital, Culture, Media & Sports (DCMS).	https://www.gov.uk/government/groups/data-advisory-board-and-data-leaders-network
National Data Strategy (NDS)	Developed and delivered by DCMS, the NDS aims to drive a collective vision that will support the UK to build a world-leading data economy. The NDS will also provide coherence and impetus to the wide range of data-led work across government.	https://www.gov.uk/guidance/national-data-strategy
AI Sector Deal	The 2017 Industrial Strategy White Paper identified AI and data as 1 one of the 4 Grand Challenges in which the UK has opportunity to display global leadership. The AI Sector Deal incorporates a broad range of government action in response to this and the more detailed AI Review ‘Growing the AI Industry in the UK’ ³⁰ , including support of other activity captured in Annex 1. The opportunities it has created include a £20m GovTech Fund, which helps connect and support tech businesses to provide the government with innovative solutions for more efficient public services.	https://www.gov.uk/government/publications/artificial-intelligence-sector-deal/ai-sector-deal
All Parliamentary Group on Data Analytics (APGDA)	Established in 2016, the APGDA connects Parliament with business, academia and civil society to promote better policy making on big data and data analytics.	https://www.policyconnect.org.uk/appgda/home
Office for National Statistics (ONS)	The UK’s largest independent producer of official statistics and the recognised national statistical institute of the UK. The ONS Data Science Campus aims to understand the newest generation of tools and technologies that can be used to exploit the ONS’s rich data sources. ONS also offer a range of training services.	https://www.ons.gov.uk/

Government Digital Service (GDS)	Part of the Cabinet Office, the GDS provides standards and best practice guidance for consistent, coherent, high-quality digital services. It helps build and support common governmental platforms, services, components and tools for digital transformation.	https://www.gov.uk/government/organisations/government-digital-service
The Centre for Data Ethics and Innovation (CDEI)	The CDEI is an independent advisory body set up and tasked by the UK Government to investigate and advise on how we maximise the benefits of data-driven technologies.	https://www.gov.uk/government/groups/centre-for-data-ethics-and-innovation-cdei
Open Data Institute (ODI)	The ODI aims to work with others to build an open, trustworthy data ecosystem, where people can make better decisions using data and manage any harmful impacts. Their work on 'Data Trusts' was seminal to the direction and development of FSA project FS301083.	https://theodi.org/
The Alan Turing Institute	The Alan Turing Institute is the National Institute for data science and artificial intelligence and aims to be a leader in the public conversation on data and to advance research, applying it to real-world problems. Their recent work on AI ethics and safety in the public safety ³¹ is of note.	https://www.turing.ac.uk/
The Food Industry Intelligence Network (fiin)	fiin is a food industry 'safe haven' to collect, collate, analyse and disseminate information and intelligence, enabling a collaborative and targeted approach to supply chain assurance, protecting the interests of consumers. fiin membership is drawn from a cross-section of the food industry.	https://www.fiin.co.uk/
UK Research & Innovation (UKRI)	UKRI coordinates a range of activities of interest, and for potential leverage. Highlights include administering the Industrial Strategy Challenge Fund and Strategic Priorities Fund programmes such as: AI and Data Science for Science, Engineering, Health and Government. UKRI is also supporting 16 Centres for Doctoral Training in Artificial Intelligence, that aspires to train 1000 PhD students to exploit the potential of AI to transform the way we work and live. Hopefully some of these may be steered towards food system challenges and FSA priorities.	https://www.ukri.org/

Annex 2- Summary of Recommendations from the 2014 General Advisory Committee on Science Working Group on Data Exploitation

1. The FSA should develop and promote use of an inventory of data sources (including information on data quality, provenance and ownership - has it been used before, was it useful or not, was it used appropriately?).
2. The FSA should undertake a programme of projects to explore the potential for data exploitation in specific areas of its work. Priority pilot projects should offer maximum potential and impact and alignment with the FSA's strategic priorities. The WG has identified a list of applications indicative of the type of approach the FSA could take (including indicative data sources, tools and methods).
3. The FSA should consider ethical issues at the outset of every project and keep these under regular review throughout the project lifecycle, including implication for consent, publication and possible future uses of data; and potential to de-anonymise data when linking independent data sets.
4. The FSA should develop best practice principles and guidelines for working with diverse data sets to manage governance issues relating to implementation of data exploitation projects. This should cover: understanding and assuring quality; limitations of data and their use; ethical issues; economics/resources; legal issues; technical issues; skills and capacity. The aim of these should be to allow the FSA to achieve a balance between the potential benefits of better data exploitation and any attendant risks.
5. The FSA should review its current policies and procedures in light of recommendations 3 and 4, to ensure they properly reflect the issues surrounding the further development of data exploitation and the FSA's strategic data goals; including:
 - FSA procedures for commissioning research on humans and/or human tissue and on animals and/or animal tissue;
 - FSA policy for release of underpinning data;
 - implications of the regulations relating to data protection and freedom of information as the FSA collects and exploits more data, including external data.
6. The FSA should develop an 'intelligent customer' capacity in FSA, so FSA can identify needs and opportunities and frame and address questions in an informed, robust way. This should include maintaining and developing links to external expertise, including ongoing engagement with the ITaaU Network³².
7. The FSA should maintain an active awareness of and engagement with the data landscape, in the form of a 'watching brief' on developments locally and internationally.

8. The FSA should develop its senior level strategic leadership for data exploitation in the FSA in order to: provide strategic and cross-cutting oversight and direction for existing and new data projects; develop the FSA's priorities in relation to better exploitation of internal and external data; and lead the development and embedding of good practice and governance for data exploitation, drawing on external resources and expertise as appropriate. Specifically, the FSA should appoint:
 - a data champion (such as the Chief Scientific Advisor or Director of Science, Evidence and Research);
 - an external programme advisor or other expert advisory structure to help develop and steer the programme.

References

- ¹ [CDEI AI Barometer Report](#)
- ² [FSA news article on first use of Blockchain in slaughterhouses](#)
- ³ [FSA Open Data Catalog](#)
- ⁴ [FSA Chief Scientific Adviser's Science Report on Data Standards](#)
- ⁵ [UK Government's Data Ethics Framework](#)
- ⁶ [HM Treasury Guidance on Appraisal and Evaluation in Central Government \(The Green Book\)](#)
- ⁷ [GDPR Overview for Researchers by UKRI](#)
- ⁸ [Information Commissioner's Office Guidance on Data Protection at the End of the Transition Period](#)
- ⁹ [Information Commissioner's Office Guide to the General Data Protection Regulation](#)
- ¹⁰ [Final Report to the FSA from The Alan Turing Institute on the Application of Advanced Data Analytics for Food Safety and Authenticity](#)
- ¹¹ [Science Council Working Group 3 Report on Horizon Scanning](#)
- ¹² [FSA Board Paper 20-01-05 – Annual Surveillance Report](#)
- ¹³ Leslie, D. (2019). Understanding artificial intelligence ethics and safety. A guide for the responsible design and implementation of AI systems in the public sector. The Alan Turing Institute. <https://doi.org/10.5281/zenodo.3240529>
- ¹⁴ [ODI Data Trusts Report](#)
- ¹⁵ [Food Industry Intelligence Network](#)
- ¹⁶ [GS1 Standards](#)
- ¹⁷ [BSI Standards](#)
- ¹⁸ Aiello, L.M., Quercia, D., Schifanella, R. *et al.* Tesco Grocery 1.0, a large-scale dataset of grocery purchases in London. *Sci Data* **7**, 57 (2020). <https://doi.org/10.1038/s41597-020-0397-7>
- ¹⁹ [HM Treasury Guidance on a Comprehensive Spending Review 2020](#)
- ²⁰ [FSA Board Paper 20-03-18 – Achieving Business Compliance](#)
- ²¹ [FSA Board Paper 20-01-07 – Modernising Regulation](#)
- ²² [FSA Board Paper 20-06-12 – COVID-19 Business Prioritisation](#)
- ²³ [FSA Board Paper 20-06-04 – FSA Response to COVID-19](#)
- ²⁴ [FSA news article – Westminster Forum Address](#)

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- 25 [National Food Strategy](#)
- 26 [Introductory article on the Joint Biosecurity Centre](#)
- 27 [FSA news article on Food and You 2](#)
- 28 [ACSS Review of Food and You](#)
- 29 [FSA Board Paper 19-09-18 Local Authority](#)
- 30 [Growing the Artificial Intelligence Industry in the UK, an independent review from Professor Dame Wendy Hall and Jerome Pesenti](#)
- 31 [Alan Turing Institute Report: Understanding Artificial Intelligence Ethics and Safety](#)
- 32 [IT as a Utility Network +](#)