UPDATE ON WORKING GROUP 4; DATA USAGE AND DIGITAL TECHNOLOGY

Report by Professor Patrick Wolfe, Working Group 4 Chair

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Summary

1. This paper and associated discussion deliver on **Action June-19-8**: to update the Science Council on works commissioned for Phase Two of Working Group 4 and for the Council to consider what further information or activity is required for the Working Group to deliver its recommendations to the FSA.

2. Council members are asked to:
   - **Review** the commissioned Phase Two projects and progress made;
   - **Review** the Phase One synopsis (Paper SC 6-13C) for the afternoon workshop discussion;
   - **Consider and Agree** the approach and supplementary activity, if any, required to produce the Working Group 4 final report and recommendations to the provisional timetable outlined.

Discussion

3. To address the questions agreed in Working Group 4's Terms of Reference (Annex 1), a phased approach has been employed. Council members initially participated in a series of exploratory interviews to better understand the FSA's current data usage across several different business areas.

4. The Working Group Chair, Patrick Wolfe, agreed to summarise the key learnings from those interviews. This synopsis is delivered as paper SC 6-13C and will be reviewed in detail by Council members alongside the FSA Director of Openness, Data and Digital, Julie Pierce, in a workshop discussion.

5. The report highlights that FSA data usage and data innovation are in a good position but identifies three commonalities for consideration:

Aspirations, Culture and Skills: The pace of digital change, combined with new technical skills needs, mean that the FSA's current 'data culture' at the operational

level has pockets of excellence but capabilities can be further improved across the organisation. Council members are asked to consider how might the FSA move to a position of more consistent 'organisational excellence'?

Data Standards and Timeliness: The entire FSA-internal data life cycle, from planning and collection, to modelling and drawing conclusions, to standards, continuing availability of information, and quality assurance, is not yet uniformly strong across all aspects of the FSA's mission that could be enhanced by data.

Data Access and Trust: External efforts by the FSA at data sharing are helping to improve the sector as a whole; however, managing data access with external entities as well as the sheer volume of data in the food sector means that additional strategic planning and prioritisation is warranted.

6. The Working Group concluded from the Phase One process (Annex 1), that it should commission assistance for Phase Two (Annex 1), gaining supplementary capacity from those familiar with state-of-the-art methods for the required expert input. Two areas of focus were identified, consistent with the Working Group Terms of Reference and Phase One synopsis:

   I.   To explore a Sector specific 'Data Trust' system, enabling the effective exchange and exploitation of data;
   II. Provide the FSA with a state-if-the-art summary of the latest developments and issues in the application of advanced data analytics to food safety and authenticity data.

7. Projects were commissioned with the Internet of Food Things Network Plus[1] (Annex 2) and The Alan Turing Institute[2] (Annex 3) respectively.

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[1] https://www.foodchain.ac.uk/
[2] https://www.turing.ac.uk/

Data Trusts - FS301083

8. This project builds on the work of the Open Data Institute[3], to deliver a strategic 'roadmap' and several proof-of-value use cases for the creation of viable 'Data Trusts' in the Food and Drink Sector.

9. Data Trusts (essentially a repeatable framework of terms and mechanisms held together by community-based agreements for data sharing) would enable more efficient and effective data sharing amongst actors within the UK food supply chain, including the FSA as the central competent authority, supporting the FSA's remit to ensure food is safe and authentic, whilst respecting and securing Food Business Operator's commercial sensitivities.

10. Delay in contracting has impacted some early aspects of project outreach but the initiative is gathering significant interest, including from other Government Departments.

11. Three use cases are in development, with a piece working with a Port Health Authority in support of intelligence-led sampling regimes of imported products being initially prioritised.

12. The study team are also planning how best to convene relevant stakeholders and experts for the 'thematic roadmap' distillation of core considerations: governance modelling etc. The study team have secured the welcome engagement of a London-based international law firm in support of the 'Business Model Report' (Milestone 4), exploring the economic viability of Data Trust governance models.

13. Further updates will be regularly delivered to the Working Group 4 Chair.

Advanced data Analytics - FS301085

14. The UK Food Sector generates a huge amount of data as a by-product of processes applied throughout the production lifecycle and supply chain, from sourcing to preparation and delivery to retail outlets. Such pools of data are set to expand (and potentially become more accessible) with for example, the growing deployment of 'Internet of Things' technologies in the food supply chain. Whilst this data has the potential to drive needed advances in processes for ensuring food

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[3] https://theodi.org/article/odi-data-trusts-report/

safety and authenticity, providing well applied on a question-driven basis, much of it remains under exploited. If it is to take and encourage full advantage of these data, the FSA needs to identify and articulate the risks and opportunities that advanced data analytical tools, including Artificial Intelligence (AI), represent to the UK Food and Drink Sector.

15. The study team has initiated the project by a series exploratory discussions with the FSA Openness Data and Digital Directorate, to establish the baseline of the FSA's current capability and thinking: what the FSA has trialled, what data analytics it is utilising in earnest and to provide a steer on any specific challenges that would be beneficial to consider during the review process.

16. The study team are now pursuing interviews with representatives of a range of identified external stakeholders: (a) the FSA Data Science team; (b) academics working on food safety research and in advanced data analytics; (c) representatives of FBOs; (d) representatives of technology and service providers; (e) professionals working for other bodies involved in food safety (Work Package 2). Fifteen interviews have been conducted so far. The Study team are also planning for the subsequent Delphi panel exercise (Work Package 3), to be ran in January.

17. The Working Group 4 Chair met with the study team in October and twice in December 2019, to discuss progress and will continue to receive regular updates.

18. One of the challenges of this piece is finding the right balance of technical specificity, whilst maintaining and providing an accessible discussion.

19. Whilst the Data Trusts project is intended to run until September 2020 to allow for use case piloting, both projects will provide a readout in March 2020 to support the Science Council in the formulation and delivery of its final report and recommendations in financial Q1 2020.

Conclusions:

20. Working Group 4's aim is to support the FSA be prepared for changes, challenges and opportunities that data and its use will bring in the in the next 5 years.

21. Given the acute pace of change in this space, the FSA's strategic planning and prioritisation in relation to data warrants regular review.

22. The FSA is a nexus point between other regulatory and enforcement partners, Food Business Operators and consumers, and the associated data streams of all three.

23. Data has no intrinsic value until it is translated to information, knowledge and insight. The ability of the FSA to harness the breadth of data available to it, led by an outcome-based approach represents significant value to our food system in keeping food safe, authentic and 'trusted'.

24. It is important that the FSA has the capability to acknowledge, consider and connect to wider data and digital transformation. Many of the issues raised around governance and ethics transcend food and are being tackled by others including as part of a National Data Strategy[4]. This external recognition must be balanced with the FSA's own capacity to respond to, and lead in the application data and digital approaches when the cost-benefit opportunity is clear. This balanced approach is consistent with the FSA being a responsible, modern, evidence-led regulator.

25. Council members are asked to consider and agree, subject to the delivery of Phase Two project outputs, what other information or activity would be required to deliver Working Group 4's final report and recommendations during April 2020?

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[4] https://www.gov.uk/guidance/national-data-strategy

Annex 1: Summary of Working 4 Questions and phased approach to its investigation, as laid out in the Working Group Terms of Reference

The WG will consider the following questions and provide a report setting out its analysis, conclusions and recommendations for the FSA;

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, including for its Regulating Our Future programme, and what value could these add?
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? This will be informed by a review of data governance and legal & regulatory frameworks for the use of data in decision making (including pre-disclosure and pre-disposition in relation to machine learning and artificial intelligence), and, associated with this, the ethical use of data.

To achieve this, Working Group 4 agreed a phased approach to its investigation:

Phase 1

I. Consider the FSA's current use of technologies and data, understanding and identifying any obvious gaps or room for improvement.
II. Identify who are 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, scope this work.
V. Agree approach to Phase 2

Phase 2

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

Annex 2: Developing 'Data Trusts' for the Food Supply Chain Work Specification

(FSA Project Reference: FS301083)

September 2019 - September 2020

Project Summary and Objectives

Introduction

The purpose of this Research & Development project is to deliver a strategic 'roadmap' and Proof-of-Value (PoV) for the creation of viable 'Data Trusts' in the Food and Drink Sector. There is not yet a universally agreed definition of what a Data Trust is, but it is essentially: "a repeatable framework of terms and mechanisms held together by community-based data sharing agreements".

Data Trusts would enable more efficient and effective data sharing amongst actors within the UK food supply chain, including competent authorities, supporting the Food Standards Agency's (FSA) remit to ensure food is safe and authentic, whilst respecting and securing Food Business Operator's (FBOs) commercial sensitivities.

Aims

The project aims to reinforce the strategic goal of the FSA, supporting the interests of consumers by ensuring that: "food is safe, what it says it is, and that consumers have access to an affordable healthy diet, and can make informed choices about what they eat, now and in the future". The FSA recognises the significant contributions data and digital systems have within this, presenting a mature data strategy, consistent with its 'Regulating Our Future' programme, aimed at creating a regulatory system that is modern, risk-based, proportionate, robust and resilient. For the UK to be a strong, credible and potentially increasingly independent player in the global food system, it must continue to assess and maximise to opportunities data and digital systems and methodologies present.

In further support of this, the FSA's independent advisory Science Council established a Working Group on Data Usage and Digital Technology (WG4). As per the WG4 Terms of Reference, it has undergone a Phase One 'Discovery Phase' to consider the FSA's current use of data and digital technology. For Phase two, the Science Council wish to commission assistance gaining further access to deep technical specialists, with both the capability and capacity to understand the latest opportunities and challenges in data sharing and to consider how these may impact our food system.

The FSA's and Science Council approach to this is through an open, collaborative approach and proactive co-production of solutions, and not simply relying on responsive regulatory authority to satisfy only immediate regulatory obligations. The FSA aims to work with partner agencies across the world on global food safety challenges.

Therefore, the aims of this project are to support the FSA's strategic aims by:
- supporting the interests of consumers
- co-producing solutions in conjunction with stakeholders

- enabling collaboration with relevant international bodies

Objectives:

The **Project Mission** is to: "design and build a viable Data Trust system to enable the effective exchange and exploitation of data to facilitate effective food safety and an authentic and compliant food system based around the requirements of a small number of representative use cases."

The project consists of two phases with their own subset of objectives:

Objective	Description	Delivery
Obj. 1	**Thematic Roadmap** -This consists of processes to develop the key areas required to deliver a viable data trust system for food. The roadmap will be expanded and developed to describe and define the pipeline process. The key areas include: -Scope and scale: ongoing engagement with stakeholders will enable consideration, co-creation/co-production of plans and solutions for individual need cases, of varying size and complexity, within the food system -Social, Technical, and Economic/Legal approaches will be developed to contextualise study. -The evolving roadmap will be central to informing Science Council WG4, in support of its recommendation formulation.	Phase A Deliverable 1: Initial readout of Roadmap, with the reports from the Tech, Social, and Legal activity strands. Delivery: submission to Science Council Working Group 4 January 2020.
Obj. 2	**Proof-of-Value Delivery** -Our technical partners will apply rapid prototyping/lean approaches to implement a viable system for the initial use cases. -up to five use cases* are being considered to take forward for initial build of prototype systems: 1. Meat supply chain: with FBOs and regulatory bodies 2. Fine wine imports with HMRC and Australian food authorities 3. Cocoa supply chain: with growers in Colombia, commodity tracking, and product producers in the UK 4. 'Fast products', e.g. Lettuce for salads and sandwiches 5. 'Direct to consumer goods': regulating systems without consumer facing premises.	Phase A Deliverable 2: Data trust solutions for first use cases i.e. working prototypes. Delivery: March 2020 Phase A Deliverable 3: Review of Phase A design and build activity, together with updated plans for Phase B. Delivery: March 2020

	* This list will be reviewed and revised as appropriate.	
Progress review/break-point		
Obj. 3	**Refinement and further use case build** The completed data trust use cases from Phase A will be integrated into a meta-system that facilitates the management of these solutions and simplifies the process of implementing new use cases.	Phase B Deliverable 4: Meta-system review and build. Delivery: July 2020
Obj. 4	**Final reporting**	Phase B Deliverable 5: Evaluation and lessons learnt from overall project and proposed actions for the future. Delivery: September 2020
Common to all objectives	**Dissemination and engagement** - Working Groups - Workshops - Reports - Booklets, videos - Social media	Deliverable 6: Dissemination and engagement (ongoing)

Motivation and Potential Impact

The **Project Vision** is to deliver: "An economically viable, scalable, technologically coherent food Data Trust system to facilitate securely managed data for greater food safety, authenticity and compliance within a competitive food chain."

This project represents an innovative opportunity for the FSA to further demonstrate its respected position within UK Government for the application of data and digital technologies, providing community motivation and thought leadership. It represents a strong opportunity to collaborate with industry, academia and other government departments on an area of shared value and benefit, and has attracted significant interest from external parties during scoping. The project has been endorsed by the FSA's independent advisory Science Council WG4, as it aims to advise and help prepare the FSA for future data working environments and opportunities.

This project specifically supports development of the Science Council's Working Group's recommendations against three of the original questions set in their 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, including for its Regulating Our Future programme, and value these could add?
2. What are key implications for the FSA of advancement in open data, data sharing and how should the Agency go about leveraging them (including private/industry data)?
3. How can the FSA ensure that it adopts the right controls and governance around data?

Utility

The utility of the project is encapsulated in the specific PoV approach whereby the initial individual use case-driven solutions should all be viable technical solutions that meet the need of the partners (Deliverable 2). Furthermore, the aim is to deliver an economically viable system that is financially sustainable whilst meeting the needs of stakeholders beyond the lifetime of the funded project: the meta-system or underlying models can be used within other specific contexts and so better inform other needs or sectors (Deliverables 4 &5). This project will also help demonstrate FSA 'trustworthiness' as a competent regulator.

Feasibility

The project plan has been structured to maximise the feasibility of delivery. Specifically, the three pillars of technical, social and economic elements (objective 1) will ensure that the system meets all three sets of needs in terms of serving the stakeholder community with a technically operational system that is also economically viable from a business perspective. It is intended to delve deeper from the leading work of the Open Data Institute[5] (ODI), providing sector-specific translation and consideration of the challenges and competing views within the UK's complex food system, through a collaborative approach, learning from current best practice such as that exhibited by the Food Industry Intelligence Network (FIIN) as appropriate.

IoFT are a contributing partner the FSA's Blockchain project for the collection and communication of inspection results within the meat supply chain. IoFT and the FSA share the view that to make best use of some of the new innovative approaches such as blockchain and artificial intelligence, we need to better incentivise and support a data 'ecosystem' that enables ethical data sharing, adoption of standards and transparency on how data is being used, and by whom. The IoFT leadership team has access to the necessary competence and skills to deliver as per the detailed approach. It is shortly to publish reports on digital collaboration and the application of Digital Ledger Technologies in the food chain.

Timeliness

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[5] https://theodi.org/article/odi-data-trusts-report/

The concept of secure data sharing across the supply chain has become very topical for a range of scenarios from food distribution cooperatives to competitor organisations seeking to benefit from best practice (non-competitive) lessons learned from otherwise isolated, privately held data. The timing for this project is opportune to build upon such interest and collaborative research initiatives like the FSA Blockchain pilots.

There is some International activity in this space, however delivering this still ground-breaking work presents an opportunity for the FSA and the UK to remain in vanguard, or alternatively risk of falling behind. Global trade makes food a priority and thus there is a strong case for a scalable data trust model.
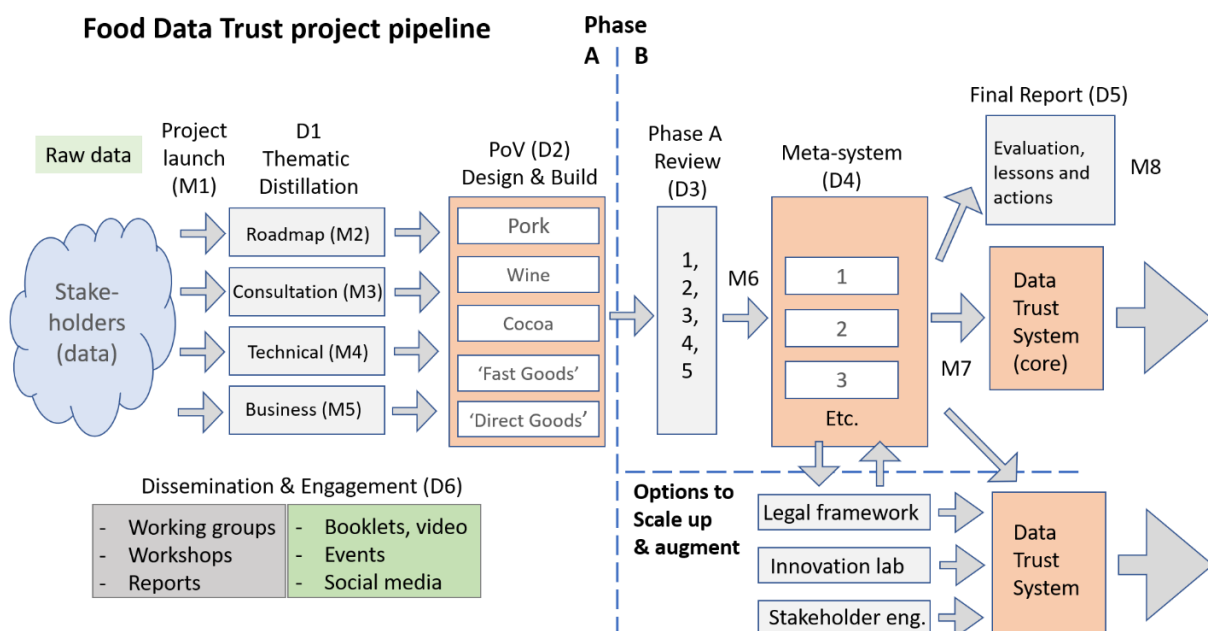
Description of Approach

Figure 1: Food data trust project pipeline
The project pipeline illustrates the key activities and the associated deliverables and milestones for the project.

The description of the approach here provides an overview of intensions however, the project will need to remain flexible/responsive to information/challenges encountered through both phases of the investigation. This will be achieved through iterative and close discussion between the IoFT and FSA project management teams.

Objective 1: Thematic Roadmap
Deliverable 1: Thematic distillation
(Delivery: January 2020)

Description:
Initial readout of the roadmap coupled with the reports from the three key areas: social, technical and economic/legal.

Tasks for D1:

Milestone 1- Project Launch

Milestone 2- Roadmap

Expansion of food system specific guidelines and principles for data trust system to both inform Science Council WG4 activity. The report will also feature detailed guidelines for the further PoV design and build work in phase B. This will include plans for the core (i.e. costed work and the scale-up options which IoFT and partner stakeholders may wish to present for consideration). Tasks to contextualize the roadmap include:

I. Defining 'Data Trust': As there is not yet an agreed definition of the data trust concept. Project will need to identify and examine existing definitions and current thinking, and refine this through further research, workshops and other inclusive activities to ensure we are articulating the system appropriately.

II. Scoping: What is the extent of 'community' activity, what is known/accessible internationally, which players are required for an initial build. How to balance the FSA's food safety interest/remit and scaling system interest where food safety data may become just one data 'feature' of a Trust system (keeping in mind for the project to be attractive, interoperable with others and impactful).

Milestone 3 - Stakeholder Consultation

Connect stakeholders, explore key issues and canvass perspectives through interviews and workshops. IoFT have a wealth of experience in convening assemblies as part of its delivery model. Stakeholders will be briefed, informed and led-through facilitated processes to contribute effectively.

Milestone 4 - Technology Report

Researching the current range of standards and regulations relating to the food and drink production supply chain, digital collaboration, and related cyber security. We will identify which existing bodies are involved, such as BSI, and work with them to understand what needs to be done or challenges to address. The aim is to minimise the technical standards, and certainly the need for new standards required. The Technology Report will include consideration of:

I. Secure and resilient systems

II. Service development and service provision scalability

Milestone 5 - Business Model Report (Milestone 4)

Address the legal and regulatory issues that underpin the project and enable the creation of an economically viable data trust system. Legal experts will be consulted in a professional capacity to advise and draft the necessary agreements to assemble the components of a trust framework. Current thinking is that legal trust structures are inappropriate in the context of data, food or otherwise. The legal work conducted within

the ODI project has "recommended that further work is carried out to identify the right corporate structures for data trusts, including ones that might operate internationally".

It will also consider the interdependence and independence necessary between service developers, providers and governance. Define new business models needed to establish a robust and resilient governance framework for the data trust system. The task will identify which existing roles should be involved in a governance structure, and which new roles might be needed. The goal is to create a socially representative and economically viable/literate model. This task will work through these challenges with appropriate expertise.

Objective 2: Proof-of-Value Delivery
Deliverable 2: Design and build of initial PoV use cases
(Delivery: March 2020)

Description:
Develop data trust prototype solutions for the initial use cases identified. These will be reviewed and revised as appropriate: it is not necessarily anticipated that all use cases will reach the same degree of maturity during Phase A.

Tasks for D2:
1. The aim is to build a system that progressively accommodates a series of evermore complex use cases. We will start with the recent FSA blockchain pilots and then unpack further use cases to implement within the emergent system.
    I.   Meat supply chain: with Food Business Organisations (FBO) and regulatory bodies
         - Builds on preliminary blockchain prototype
         - Regulatory structures in place
         - Food businesses engaged
    II. Wine imports with HMRC and Australian food authorities
         - Specific use case in place with suppliers and logistics
         - Monitoring technologies identified
    III. Cocoa supply chain: with growers in Colombia, commodity tracking, and product producers in the UK
         - Cocoa growers identified and already involved in a research project with IoFT
         - Monitoring technologies identified and in place
         - Other related research groups identified
         - UK food business partner identified
    IV. Fast products, e.g. lettuce for salads and sandwiches
         - Multiple growers/suppliers identified
         - Monitoring technologies identified
         - Existing research to build upon
    V.   'Direct to consumer goods'
         - Challenging area
         - More research needed
         - Partner engagement to be developed

Phase A to Phase B Transition

Completion of the Roadmap (D1) and initial PoV delivery (D2) represents a project review point. These will be accompanied by Deliverable 3: review of Phase A design and build activity, together with updated plans for Phase B (March 2020). Dependant on delivery, future need case identification, and engagement of others in system the FSA will review current and proposed deliverables and decide on whether and how to proceed regarding Phase B.

Objective 3: Refinement and further use case build

Deliverable 4: Meta-system

(Delivery: July 2020)

Description:

The completed data trust use cases from Phase A will be integrated into a meta system that facilitates the management of these solutions and simplifies the process of implementing new use cases.

Tasks for D4:

   I.   Review progress with previous use cases, guidance from Science Council, and input from other stakeholders.
   II. Testing and impact assessment. There will be an ongoing structured bench-marking process to review and refine the impact of this work. This will ensure that the appropriate bodies, organizations and individuals are at least kept informed, and where applicable, involved.
   III. Design, build, and review cycle continues for use cases
   IV. Design, build and review cycle begins for meta-system. This is a Data Trust system that facilitates the management of the various established use cases and simplifies the creation of new use cases.

Objective 4: Final Reporting

Deliverable 5: Final Reporting

(Delivery: September 2020)

Description:

Evaluation and lessons learnt from overall project and proposed actions for the future.

Cross-Objective deliverables

Deliverable 6: Dissemination and Engagement

(Delivery: ongoing throughout project)

Description:

A body of academic research will be orchestrated to underpin the design and development activities of the project.

Working groups will be convened and supported. Facilitated research activity will be directed towards relevant topics and themes and the ensuing results will be written up and published appropriately. Knowledge exchange between the research groups and the development

teams will be orchestrated periodically throughout the lifetime of the project. Dissemination and engagement will be organised to achieve the following sub-tasks and activities:

I. Stakeholder engagement to be expanded
II. Raise awareness of the work of the project
III. Engage with related activity - far and wide
IV. Communicate preliminary findings once known

Specific sub-tasks and milestones to include:

I. Project launch event (Milestone 1)
II. Project showcase/preliminary findings (Milestone 6)
III. Meta-system promotion (Milestone 7)
IV. Dissemination of final project outputs and outcomes (Milestone 8)

Project Timeline

Task	Month												
	Phase A							Review Point	Phase B				
	Sept	Oct	Nov	Dec	Jan	Feb	Mar		Apr	Jun	Jul	Aug	Sept
Deliverable 1: Roadmap	■	■	■	■	■								
Deliverable 2: Initial PoV Build		■	■	■	■	■	■						
Deliverable 3: Phase A Review						■	■						
Deliverable 4: Metasystem Build									■	■	■	■	
Deliverable 5: Final Reporting											■	■	■
Deliverable 6: Dissemination & Engagement	■	■	■	■	■	■	■		■	■	■	■	■

Deliverables & Milestones*

Deliverable/Milestone	Details	Target Date
Milestone 1	Project launch	Sept 2019
Milestone 2	Roadmap development	Dec 2020
Milestone 3	Stakeholder consultation	Dec 2020
Milestone 4	Technology report	Dec 2020

Milestone 5	Business model report	Dec 2020
Deliverable 1	**Roadmap readout**	**Jan 2020**
Deliverable 2	**Proof-of-Value use case build**	**March 2020**
Deliverable 3	**Phase A review and update on Phase B design**	**March 2020**
Milestone 6	Project showcase/preliminary findings	March 2020
Deliverable 4	**Meta-system build**	**July 2020**
Milestone 7	Meta-system promotion	August 2020
Deliverable 5	**Final reporting**	**September 2020**
Deliverable 6	**Dissemination & Engagement**	**Ongoing**
Milestone 8	Dissemination of final project outputs and outcomes	September 2020

Milestones may be further supplemented following discussion between IoFT and FSA project managers

Annex 3: Road-Mapping Uses of Advanced Analytics in the UK Food and Drink Sector Work Specification (FSA Project reference: FS301085)

September 2019 - March 2020

Project Summary and Objectives

Introduction
The availability of data and advancement of data usage influences the Food Standards Agency's (FSA's) ability to carry out its mission: to ensure food is safe and authentic.

The FSA's independent Science Council established a Working Group on Data Usage and Digital Technology (WG4) to support the FSA's desire to better understand the 'art-of-the-possible' within the next phase of data advancements, recognising future opportunities and challenges, and to have sufficient knowledge of them both to consider their direct application and to ensure positive food system governance as an excellent, modern and accountable regulator.

As per the Working Group Terms of Reference (ToRs), WG4 has undergone a Phase One 'Discovery Phase' to consider the FSA's current use of data and digital technology. Recognising how quickly the data sphere continues to evolve, the Science Council wished to commission assistance in Phase Two, gaining further access to deep technical specialists familiar with state-of-the-art advanced data analytical methods, with sufficient capacity to consider how these may impact our food system.

As the national institute for data science and artificial intelligence, a collaborative hub for 13 UK partner universities, with an international network of more than 300 Fellows, The Alan Turing Institute is well placed as a partner through which the FSA can access a significant proportion of cutting-edge national capability.

Objectives:
The UK Food Sector generates a huge amount of data as a by-product of processes applied throughout the production lifecycle and supply chain, from sourcing to preparation and delivery to retail outlets. Such pools of data are set to expand (and potentially become more accessible) with for example, the growing deployment of 'Internet of Things' technologies in the food supply chain. At present, while this data has the potential to drive needed advances in processes for ensuring food safety and authenticity, much of it remains under exploited. If it is to to take full advantage of this data, the FSA needs to identify and articulate the risks and opportunities that advanced data analytical tools, including Artificial Intelligence (AI), represent to the UK Food and Drink Sector.

The project **objective** is: "*to provide the FSA with a state-of-the-art summary of the latest developments and issues in the application of advanced data analytics to food safety and authenticity data.*"

The projects findings will be used to support the FSA in achieving its goals: strategic prioritisation and translation of risks and opportunities, as it seeks to understand what steps a competent regulator should be taking to advance its understanding and capabilities, for improved system trust. Barriers and enablers to the adoption of advanced data analytics by the Food Sector, will be considered from the perspective of both private sector Food Business Operator (FBOs) needs, and public-sector use and governance by the FSA as a food system regulator. Based on this, project investigators will deliver a 'thought leadership' report summarising key recommendations for the Food Sector's use of advanced data analytics, from which the FSA can review/consider its further needs.

Motivation and Potential Impact
The FSA is clear on both the potential and importance of embedding data and technology as a route to better regulation. It believes that modern, digital solutions are vital in providing a level playing field for businesses, as well as enabling it to target risks more effectively. The FSA aspires to be more proactive/preventative/predictive, rather than simply responsive.

The FSA is well recognised within UK government, and across the globe among food regulatory bodies, for its pilots in the use of Distributed Ledger Technology and within our surveillance programme. The FSA employs an agile way of working, defining a business question, evolving to a technical solution through quick iteration of prototypes.

The motivation for this project is that the Science Council wish to help the FSA maintain its position among the 'vanguard' of competent authorities, with the support of an up-to-date summary of the next phase of advanced data analytical developments, and what is on the near horizon: the 'art-of-the-possible'.

As the UK prepares to leave the EU, our food system and the FSA will experience greater scrutiny and pressure. This review project is timely in demonstrating and supporting community motivation and leadership and long-term has the potential to influence and impact improved food safety and UK food system trust both domestically and to trading partners.

The Alan Turing Institute has the necessary collaborative networks and skills to make this project feasible and deliver it as per the detailed study approach. The Alan Turing Institute has the cognitive capacity to consider the impacts of applying advanced data analytical approaches to a system as complex as our food system, and can draw on a wealth of experience of working with UK Government partners.

Delivery of the final project report will be used to inform Science Council WG4 recommendations and may help advise the FSA data leads where they might wish to consider investing further resource, impacting the FSA in its mission by allowing it to make smarter, more timely decisions or interventions in support of a safe, authentic, trusted food system.

Description of Approach
The description of the approach here provides an overview of intensions however, the project will need to remain a degree of flexibility, to be responsive to information encountered throughout its lifecycle. The project team will liaise with the FSA and Science Council closely through iterative discussion throughout the delivery process.

The ability to access increasing amounts of data, providing it is of sufficient quality, provides the opportunity to explore the use of advanced data analytical methods. There are several sub-themes that will need to be unpacked for the analytical methodologies considered within the bounds of this project. This includes:

- technical standards for use;
- governance and assurance including how users assure reliability or express confidence;
- legal and ethical regulatory considerations including algorithm transparency;
- user accessibility including data handling and social acceptance;
- current practices of FBOs and international regulators, lessons from these and/or other sectors.

The project will last six months, consisting of four inter-related work packages.

The project will be initiated by exploratory discussions with the FSA to better understand and establish the baseline of its current capability and thinking: what it has trialled, what data analytics it is utilising in earnest and steer on any specific challenges that would be beneficial to consider during the review process.

This will be supplemented by **Work Package 1**: a literature review on what is currently reported on the application of advanced data analytics to meet food safety and authenticity challenges and, as possible, how sub-themes such as governance and ethics were addressed within these.

Both preliminary FSA discussions and the WP1 literature review, will help the study team identify key informants for a series of more detailed semi-structured interviews (**Work Package 2**) and Delphi panel (**Work Package 3**). Stakeholders are anticipated to include FBOs, Alan Turing Institute Fellows and representatives of other relevant data community stakeholders, such as the Open Data Institute (ODI). Additional participants will be identified using a snowball approach.

A full list of questions will be drawn up accordingly but will likely include: strengths and suitability of different advanced data analytics methods; tools and skills requirements and their provision; organizational and regulatory needs for data collection, curation, sharing and processing, in line with the necessary component sub-themes identified. The interviews will be analysed to refine and contextualise understanding of the key issues associated with each theme.

The Delphi panel aims to establish consensus on recommendations for the methodologies identified and a way forward for the associated thematic challenges. The Delphi panel is a well-established method for targeted consultations with deep specialists. Panel members take part in iterative rounds of deliberation, beginning with an initial questionnaire, which can be open-ended or more structured. Responses are synthesised and returned to panellists for a final round of evaluation. The method is designed to elicit the breadth of views that exist amongst informed respondents about a subject and consequently to maximise the anticipation of developments.

Finally, key findings from the project will be synthesised into a 'thought leadership' report (**Work Package 4**) on the applications of advanced data analytics to ensure food safety and authenticity. The report will cover a range of areas, including: expected impacts from the use of advanced analytical methods in the Food Sector in the next 5-10 years; the projected growth in applications of advanced data analytics; where and how they can deliver the most impact; key recommendations for the Sector's use of advanced data analytics in the context of its operation within a "multi-dimensional landscape", and what these may mean to the delivery of the FSA's remit.

Milestones & Deliverables

Work Package	Details	Period (Months)	Deliverables
WP 1	Review of research literature on the application of advanced data analytics to food safety and authenticity challenges, and lessons learnt from other sectors.	1-2	Review of advanced analytics and their application to food safety and decision support; framing and compiling of issues and questions to be pursued in WP2 and WP3; identification of key informants for interviews and Delphi panel.
WP 2	Semi-structured interviews with key informants identified in WP1 on: 1) food safety and authenticity challenges; 2) applications of advanced data analytics to address these challenges.	2-4	Summary of themes and issues from interviews
WP 3	Forecasting food safety and authenticity risks (short term medium term and long term), using the Delphi methodology.	3-5	Delphi panel report
WP 4	Preparation of thought leadership report. Presentation of findings to FSA Scientific Council. Subject to feedback, preparation of a proposal for a follow-on project.	4-6	-Draft thought leadership report delivered month 5. -Final thought leadership report delivered month M6

Project Timeline

Milestone	Month					
	1	2	3	4	5	6
WP1: Literature review						
WP2: Interviews with key informants						
WP3: Delphi panel						
WP4: Thought Leadership Report					Draft	Final