FSA SCIENCE: RETROSPECTIVE UPDATE AND PROSPECTIVE PRIORITIES

Report by Guy Poppy, Chief Scientific Adviser

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1 SUMMARY

1.1 In July the Board requested an update on science, evidence and information (collectively referred to in this paper as science). This paper outlines how our current work supports the Food Standards Agency (FSA) strategy, plus a forward look at prospective priorities, including new possibilities opened up by exciting recent scientific developments, including the microbiome and big data, and how FSA is taking advantage of these.

1.2 We will show how current and future work will be used to drive forward FSA's strategic priorities and how FSA is working to optimise how we choose, do and use science, recognising that this is the foundation for delivering food we can trust.

1.3 The Board is asked to:

- **agree** the trajectory of funding for the three categories of science (core business, investment and strategic) set out in paragraphs 19 – 21;
- **agree** that the Board should have an annual science prioritisation discussion.

2 ACHIEVING IMPACT FROM SCIENCE AND DATA

2.1 The FSA's Strategic Plan 2015-20 states that we will continue to develop, apply and openly communicate a robust evidence base to underpin our work to protect consumers' interests. Aligned with this is the pledge that:

> *We will use science, evidence and information both to tackle the challenges of today, and to identify and contribute to addressing emerging risks for the future.*

2.2 Therefore science, evidence and information are crucial to deliver the FSA's objectives, with data playing an integral and increasingly important part through new sources of information and insight. For the remainder of the paper, we will use the term 'science' to cover science, evidence and information.

Box 1: Definitions

Science: the intellectual and practical activity encompassing the systematic study of the structure and behaviour of the physical and natural world through observation and experiment.

Evidence: anything that can be presented in support of a particular view or assertion. Evidence can be weak or strong.

Data: Facts/figures about something in a raw form. Data can be analysed to gain information. Data are generated through many sources, including research, surveillance, emerging risks and intelligence.

2.3 We take an inclusive view of science, evidence and information, drawing on any and all disciplines and sources that can be useful - including the natural, physical and social sciences. This includes using types and sources of data and information that may not be 'scientific' in the traditional sense, but to which we can apply data science and structured analyses to provide useful insights and benefits, both for ourselves and for others.

2.4 As depicted in Figure 1, data lay the foundations that lead to impact. So it is crucial to ensure we have the right data feeding in to the process. Working in partnership with others and sharing data (both using data generated by

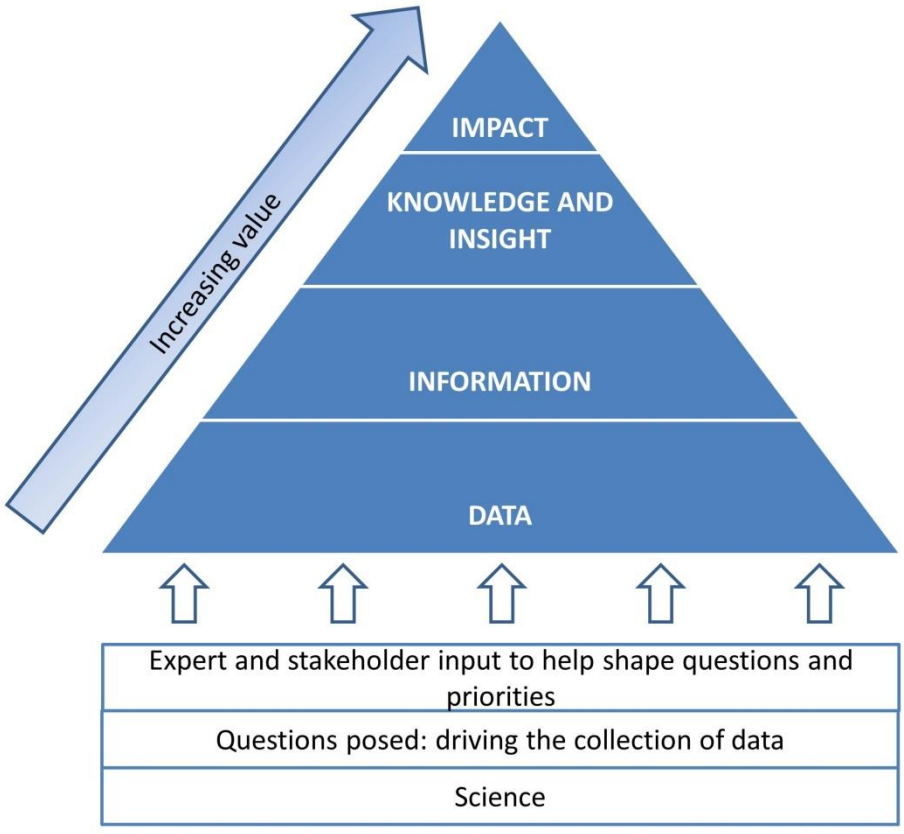


Figure 1. The data pyramid

others, and making our own data openly available for others to use) are important to maximise resource. Data are analysed by scientists to provide information, and a process of adding context, expert advice and engagement with others extracts knowledge and insight from this information. The insights drawn are used to direct action, which in turn leads to impact - including protection of consumers.

2.5 The process described above is the foundation of the FSA's new approach to surveillance (FSA/16/11/05). In addition, this approach generates sources of potential signals for assessment using the risky foods framework and this may identify further evidence needs (FSA/16/11/07).

3 CURRENT PROGRAMME

3.1 We have a broad programme of science that supports priorities across the FSA. This includes work undertaken internally by FSA scientists (such as those in the Analytics and Risk Assessment Units), work done by our Advisory Committees, and work that we commission externally.

3.2 One of the driving principles for the Regulating Our Future programme is that all available sources of evidence should be taken into consideration. The programme has support from the Analytics Unit, and a research fellow from

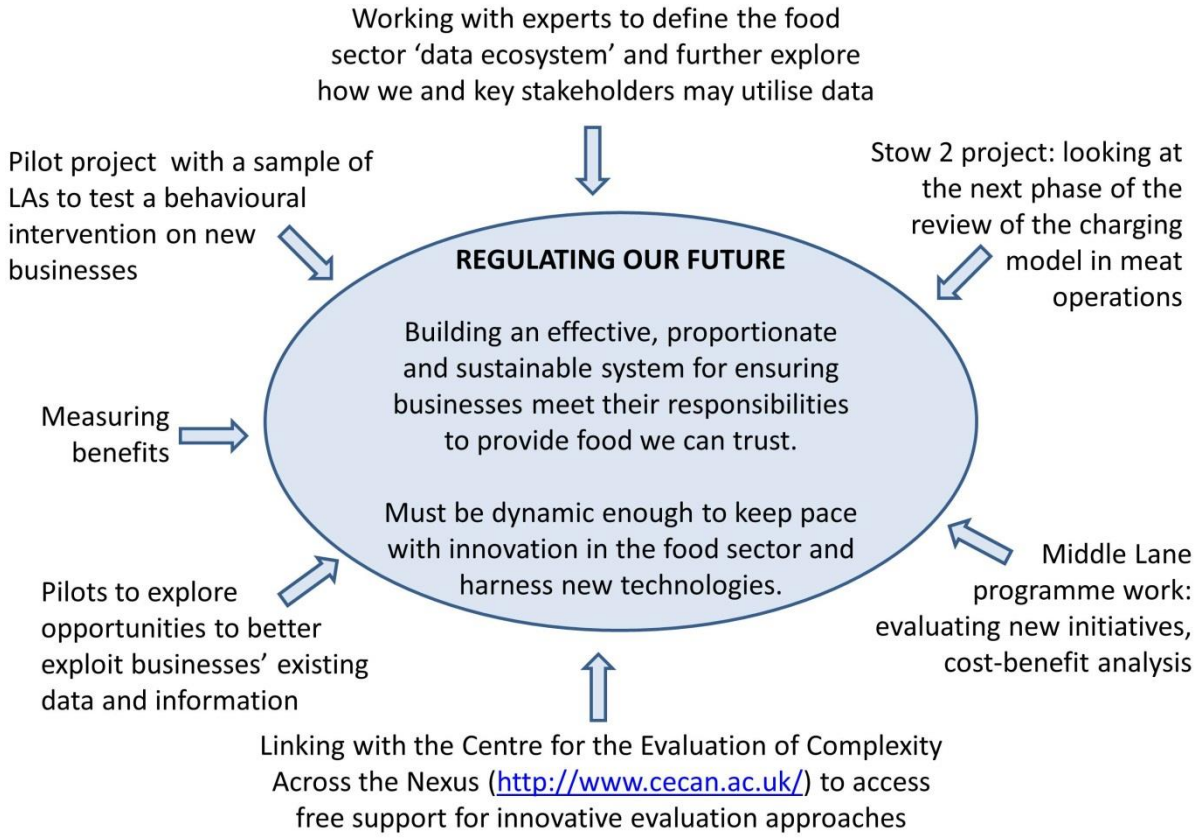


Figure 2. Science supporting Regulating Our Future

the London School of Economics has been secured to provide dedicated analytical support for a new regulation model to reduce reliance on Local Authority enforcement activities. Several research projects have been proposed to build the evidence base. Some of the ways in which science and data are supporting the programme are indicated in Figure 2.

3.3 Further examples of our current work and the impact it is having are given in Annex 1.

3.4 The science we do broadly falls into three categories:

CORE BUSINESS	INVESTMENT		STRATEGIC
Now: (retrospective, responding, reacting)	Changing: (preparing, evolving, improving)		The future: (predicting, breakthroughs, partnerships, trials)
Carrying out statutory, contractual and process driven science	*Understanding risks to consumers (and their associated impact)*	*FSA Strategic Plan & Corporate Priorities*	*Strategic Evidence Programme*

3.5 Although quality and impact of each of the areas of science above needs to be assessed in different ways, they can all contribute to work across the FSA. Taking Regulating Our Future as an example:

- **Core business** provides information that the current regulations and other interventions are based on.
- **Investment science** will explore how best to develop and update the regulations.
- **Strategic science** will allow us to take into consideration possible changes in the future, so that the new regulations will stand the test of time.

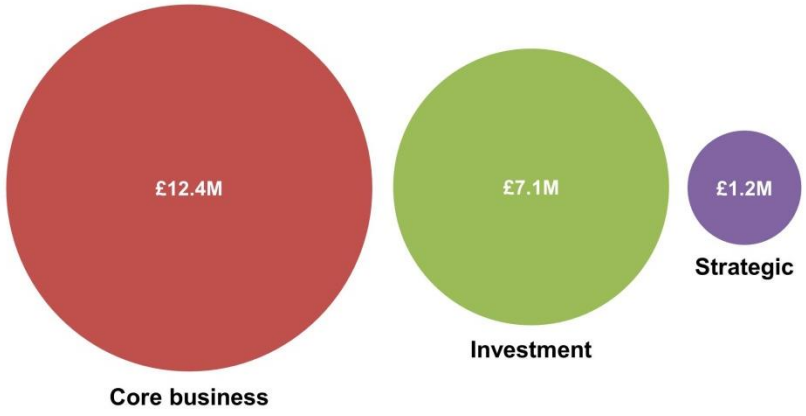


Figure 3. Spend on each of the three categories of science (2015-16)

3.6 In the last financial year, 2015-16, the FSA spent £20.7M on externally commissioned science work. Over half of this (£12.4M) was spent on core business. Approximately one third (£7.1M) was spent on investment science, while the remainder (£1.2M) was spent on strategic science. See Figure 3. Graphs showing the spend broken down by other categories can be found in Annex 2.

4 CURRENT AND FUTURE PRIORITIES

4.1 Science is prioritised along with all other FSA activity through the Investment Board. This common prioritisation approach has helped to ensure that science is connected across the FSA and that all science investment is clearly linked to FSA objectives and integrated with other activities.

4.2 In addition, there are quality checks as proposals progress through their lifecycle, which together provide quality assurance for any science work funded by the FSA. A recent review has found that the system is sound, but has identified areas where these checks can be further strengthened.

4.3 As part of the Science, Evidence and Information (SEI) programme, for each of the three areas of science, we are asking:

- how do we **'choose'** what we are going to do?
- how do we **'do'** it?
- how do we **'use'** and **'get impact from'** it?

This work will put us in a stronger position to assess whether financial and staff resource is being put in the right place. Further information on the Science, Evidence and Information programme can be found in Annex 3.

4.4 We would like to take this opportunity to highlight some of the strategic science priorities. This is a relatively new area for the FSA, and is focussed on looking to the future and creating partnerships. The aims of our strategic science are to help inform future strategies and to build resilience, as well as to harness exciting new technology. Much of the work is about innovations in the use of data and technology, to support new and better ways of gaining information and assurance in the food system. This work is focussed on three themes: evolving issues, enabling/disruptive technologies and partnerships. Examples can be found in Box 2.

5 DISCUSSION – FUTURE TRAJECTORY

5.1 It is important to reflect on the proportion of FSA's total departmental resource spent on externally commissioned science, how this is changing year-on-year, and compare this to other government departments. Figure 4 gives an approximate indication.[1]

[1] The figures are derived from ONS data on Westminster spend on science and engineering by calendar year as a percentage of published departmental net operating costs for the financial year. It should be noted that the ONS data are not equivalent to the data presented in figure 3 and paragraph 14. Those figures are higher as they include spend on wider science that does not meet the ONS definition.

Box 2: Examples of strategic science

The Internet of Things and food safety

FSA recently undertook a project in collaboration with IT as a Utility Network+, a community of researchers, practitioners and policy-makers interested in collaborative activity relating to IT utilities. This project looked at how cutting-edge technology and the Internet of Things (networks of physical devices that can transfer data between each other without requiring human intervention) could impact food safety. The project consisted of an academic literature review, four individual projects and a series of workshops. Overall, the work identified potential for the Internet of Things to improve security across the food system. Several recommendations came out of this work, including the need to review the implications the use made of the data generated, and the requirement for data sharing infrastructure.

'Big data' Fellowship

FSA is funding a research fellow in Data Science and Food at University College London's Big Data Institute. This is the first significant investment in data science across any governmental body. The fellowship will focus on developing new analytics methods for tracking and characterising foodborne illnesses, but it also links the FSA into the larger UCL Big Data research initiative. https://www.food.gov.uk/news-updates/news/2016/15494/fsa-pushes-big-data-reserach-to-the-top-of-the-agenda

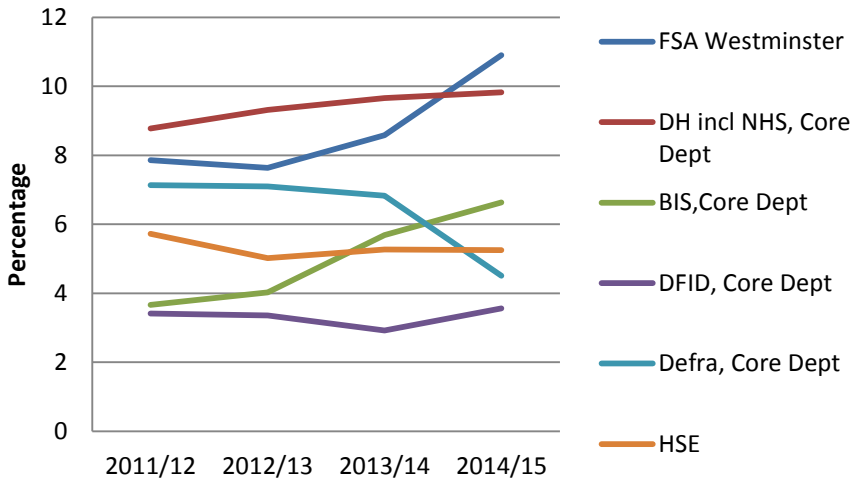
Quadram Institute Fellowship

The Quadram Institute is an exciting new interdisciplinary research institute, with £75 million funding from the Biotechnology and Biological Sciences Research Council. Two focus areas for this new Institute are gut health and the microbiome, and food safety and genomics of foodborne pathogens – both of which are of great relevance to the FSA. To tap into this, the FSA will be co-funding a research fellow at the Quadram Institute. The appointed fellow will develop a programme of work to exploit cutting edge technology and data sources to investigate, for example, the gut microbiome, relationships between 'normal' gut bacteria and pathogens, pathogen virulence and molecular epidemiology. Importantly, the fellow will form a solid link between the FSA and the Quadram Institute, strengthening our partnership and allowing us to leverage maximum benefit to consumers from this well-funded Institute.

5.2 Based on ONS data, the indication is that FSA's spend on externally commissioned science compares well with other departments and has been increasing a little in recent years, although the provisional figures for 2015 show a decrease in spend to around 6.5% for FSA (we do not have the 2015

Figure 4: Current price research spend as percentage of net operating cost

(Note that the figures are only approximate indications as it is comparing research spend for a calendar year with net operating cost for a financial year)



The data for Figure 4 are derived from ONS data on science and engineering research spend as compared with the net operating cost data from published departmental annual reports and accounts. See footnote 1.

figures for the other departments). While the ONS data provides a useful comparison across departments and over a period of time, the actual FSA spend on science and evidence is higher. This is because ONS data only captures around a third of activity that we count as science. Given the importance of science and evidence to our work we suggest that we should continue to invest in science at around 15– 20% of FSA's budget. Work under the SEI programme is focussing on ensuring that we maximise value from our investment and that we develop suitable measures to capture the benefits and impacts of our investment in science. This also includes work to develop specific key performance indicators (KPIs) for the three categories of science to reflect that the impact of each is different.

5.3 We also need to consider whether we are spending in the right proportion between the three categories of science - core business, investment and strategic. We propose (or expect) that the proportion we spend on core business should reduce over time, through better use of our and other's data and continuing improvement in our prioritisation processes and approach. What we spend on investment should grow relative to the core spend. Spend on strategic science provides for future resilience and allows us to make breakthroughs that could lead to step changes in consumer protection, but there is a level of risk with strategic science as it will not always succeed. We therefore propose that investment in strategic science should grow, but at a cautious rate commensurate with our view on horizon scanning activity.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 This paper highlights the wide variety of science work that FSA is involved in, and in particular explores how we are harnessing the exciting possibilities offered by new, disruptive science such as the microbiome and big data. We

will continue to engage widely, including reaching people working in areas not obviously related to food to see if we can adapt different thinking.

6.2 We are currently working through the implications of leaving the EU for FSA's science and that of the UK more generally. We will return to the Board with a discussion specifically on this issue in January 2017.

6.3 The Board is asked to:

- **agree** the trajectory of funding for the three categories of science (core business, investment and strategic) as set out in paragraphs 3.4 – 3.6;
- **agree** that the Board should have an annual science prioritisation discussion.

ANNEX 1

Examples of current work and its impact

(1) COT work on the diet of infants and young children

The Scientific Advisory Committee on Nutrition (SACN) is undertaking a review of the scientific evidence that underpins the Government's advice on the diets of infants and young children (from birth to age 5 years). The Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) was asked to contribute to this work by reviewing the risks of toxicity from chemicals in the infant diet and the available evidence on the maternal and infant diet and the risk of developing food allergy or auto-immune disease. The COT advice also informs FSA policy in these areas.

In response to previous recommendations of the COT, particularly with respect to infant foods, the FSA had recently commissioned a number of surveys on the presence of various chemicals in food, working across policy and science teams to use in house expertise to plan and tailor these studies to suit FSA requirements. Results from these food surveys were used, together with consumption information from the Diet and Nutrition Survey for Infants and Young Children (DNSIYC) and the National Diet and Nutrition Survey (NDNS), for the estimation of dietary exposure to chemicals including environmental chemical contaminants (e.g. polybrominated diphenyl ethers, hexabromocyclododecanes and polybrominated biphenyls), metals (lead, aluminium and arsenic), and some that are generated as a result of processing of food (e.g. acrylamide). The COT considered the exposure assessments together with information on toxicity when assessing the risks of these chemicals.

As part of this work, the COT also reviewed a number of FSA-funded literature searches, carried out by Imperial College London looking at aspects of the maternal and infant diet and the development of allergic and autoimmune disease. The COT's views have been published and will feed into the SACN review on the diets of infants and young children. A sub-group has now been set up to consider the risks and benefits for early and/or late introduction of a range of allergenic foods. This sub-group consists of members from COT and SACN with an independent Chair with extensive experience of risk benefit assessment.

(2) The impact of the analysis and use of evidence - Campylobacter

To tackle the high number of people affected by Campylobacter – which affects almost 280,000 people a year – the Food Standards Agency made the bold decision to produce a survey to measure the levels of the bacterium in chicken on sale in UK supermarkets. Results of the survey were then published, quarter by quarter, retailer by retailer. The initiative helped raise awareness of Campylobacter from 19% to 35% over the year. Retailers (M&S, Morrisons, Waitrose, the Co-op, Aldi) were also spurred on to launch major awareness campaigns and reduction initiatives at various points in the year.

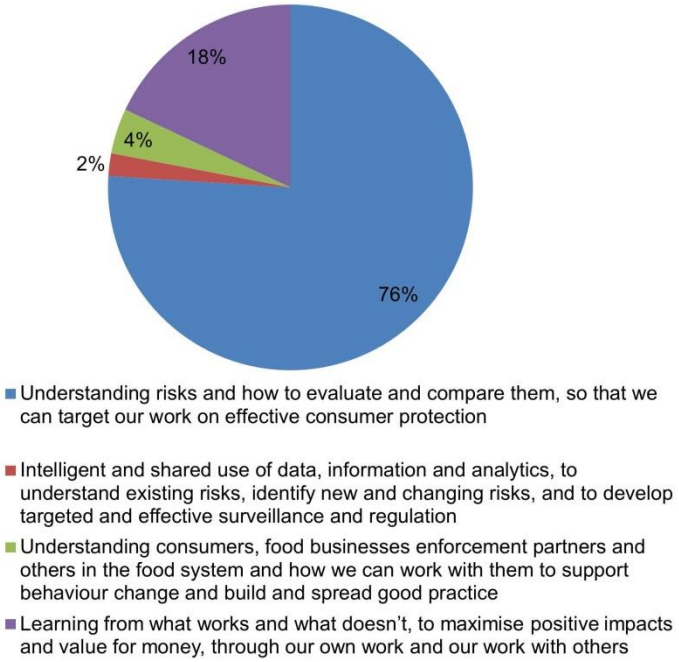
(3) Example of in-house chemical risk assessment work - potassium

Potassium replacements for sodium salts may have a role in reducing sodium intake in the population. However, individuals who are less able to excrete potassium may be at risk of adverse cardiac effects from the build-up of potassium in the blood. A joint working group of the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) and the Scientific Advisory Committee on Nutrition (SACN) is performing a risk-benefit analysis of the use of potassium-based sodium replacers in foods, with particular consideration of the effects in vulnerable groups. To inform the discussion of this working group, FSA experts in exposure assessment and statistics have modelled the potassium intakes by UK consumers for consideration by toxicologists of the potential health impact of increased intake. This involved analysing data from the National Diet and Nutrition Survey (NDNS) to estimate potassium intake arising from different scenarios that simulated replacement of different proportions of the dietary sodium with potassium in the foods that are the main contributors to salt (sodium) in the diet.

ANNEX 2

Breakdown of spend on externally commissioned science work

By theme of the Science, Evidence and Information strategy:



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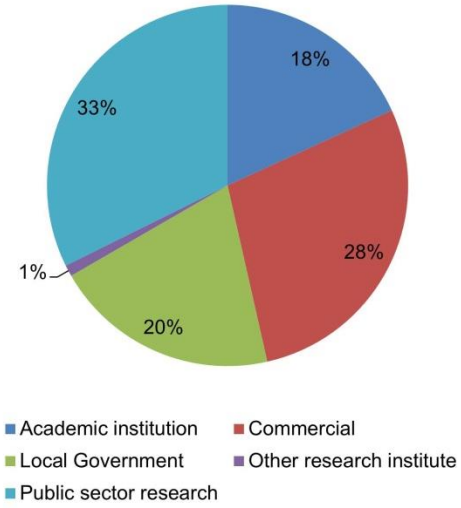

ANNEX 3

Science Evidence and Information programme

Background

The SEI Programme is a series of business improvement projects that are fundamentally about achieving a function that is value for money, focusses on outcomes and maximising impact. It is designed to create an environment which better enables us to achieve the vision set out in the SEI Strategy.
The Executive Management Team has agreed the following outcomes for the SEI Programme:

a) Our science work is integrated across the organisation and contributes to the tactical and strategic goals throughout.
b) We effectively prioritise the science we commission in line with a wider corporate approach.
c) Science work and its value is visible and understood by EMT and the wider organisation.
d) Science we commission has a measurable impact, realises benefits and demonstrates a return on investment.
e) We leverage maximum value from science conducted outside the organisation before commissioning internal science.
f) We understand the professional capabilities we need to achieve our objectives and recruit or develop them.

The Projects within our SEI Programme

How do we **'choose'** our science?

The Science Pipeline: We have examined how we currently identify what goes on our Delivery Plan for both investment and strategic science and how it gets there. We want to ensure that we commission science that is driven by our strategic outcomes and corporate priorities combining a 'top down' direction with 'bottom up' ideas. We need to ensure that we are making full use of the internal and external expertise that we have available to us in working out what our evidence gaps are and work collaboratively to fill them. We want to ensure that where possible, we are making use of, and taking opportunities presented by, what others are doing before we invest in commissioning something new. We're also looking at the flow of strategic science and how we improve that by designing an approach that has more structure and intent.

How do we **'do'** our science?

Quality: Once we have agreed to invest, we want to get the best possible return on that investment, and part of getting that return is that we control our investment and deliver effectively. We are looking at our quality and assurance processes again to ensure that not only are they robust, but that they are embedded.

Tools and Processes: We also know that our delivery monitoring and controls have become complex over time and are not really driving improved delivery, and at worst, may be adding burden and delay. We are looking closely at these processes to ensure that they are effective and add value.

Science Skills: We are continuing with work on our Science Skills Strategy to identify the skills that we require versus the skills that we have so that we can fill the gaps to create a more capable workforce. This extends beyond our immediate employees and will look at how we take advantage of the range of expertise available to us, and how we create new networks and partnerships.

How do we **'use'** and **'get impact from'** our science?

Planning and Prioritisation (working with our Finance and Portfolio Team): Science alone does not deliver benefit. It is when the evidence and data is used to drive action or decisions that benefit realisation is unlocked. We are working on our methods for ensuring that our work provides the right evidence that can then be applied through policy, operational or informative interventions that will ultimately lead to benefit for the consumer. This means being clearer at the start of developing proposals for science investment about what we will use the science for, ensuring that it is applied as planned, and further maximising its value through sharing it with others. We are shifting our thinking from science, evidence and information as being isolated products, to them being critical pieces of a much bigger picture.

For investment science, we will ensure that all activity is part of wider programmes that have clear and measurable outcomes and clear accountability for achieving those outcomes.

We need to determine where we should be focussing our resource to have the greatest impact and we will particularly look at how we have organised our work around 'Understanding risks to consumers (and associated impact)' so that we start to develop an all-encompassing picture that allows us to form more solid opinions about where our priorities should be.

Value for Money, KPIs & Benefits: Finally, one of our priority projects is to put in place performance monitoring using key performance indicators so that we are better able to make effective and timely decisions about how we use our resources and not only can we establish targets for improvements, but we also know when we are doing enough. Our approach here is that there are different ways to measure the performance of the three different types of science. Strategic science is about understanding the level of risk that we are prepared to tolerate when investing in more speculative activity that may or may not pay off, and identifying indicators that would point us to stop investing, or to continue. For investment science we will be looking at performance at a programme level and whether a programme is on track to deliver its predicted benefits. For core science, we will be looking at performance in terms of resource and cost put in, versus quality and value of what is delivered.

<u>What will we deliver between now and April 2017?</u>

We will have created an improved environment for planning, delivering and understanding the value of our work on which we can continue to build. We plan to close the programme around April 2017. At that point we will hand over a plan of activity for continued improvement and will expect to have achieved the following:

- Strategic science:
    - A new and sustainable approach to generate a flow of innovative opportunities for investment supported by a clear process for selecting and taking investments forward (and knowing when to stop).

- Investment science:
    - A portfolio of science projects that are aligned to strategic programmes of work and contribute clearly to the delivery of the programme outcomes.
    - Science activity that is planned and prioritised collaboratively with the wider organisation as part of joined up planning and prioritisation exercises.
    - Improvements in the delivery and monitoring of the work to reduce non value added administrative burden and reduce complexity or process.

- Core science:
    - A clear, reportable, understanding of what our routine work is and how it is performing so that we can continuously challenge whether we need to continue with it, and if we do, an Improvement Plan for how it can be done better, cheaper, and/or faster.

- For all areas of science:
    - New reporting that is transparent about how we are spending our money and allocating our people resources across the three areas of science, and how those investments are performing.
    - Compliance with our Open Data policy.
    - A revised Quality Framework with action to embed it.
    - Better integration of our various Scientific Advisory Councils (through the ongoing implementation of the SAC Triennial Review recommendations).
    - An approved Science Skills Strategy and completed skills gap analysis.
    - Influenced the continued work around understanding the risks to consumers so that we may better target our resources.